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PHARMACEUTICAL RESEARCH IN ASIA: A BIBLIOMETRIC STUDY

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Abstract-
The goal of the this study is to examine and evaluate research article of pharmaceutical research in Asia during the period 2018 to 2022 which is indexed in web of science. For that a total 486 research article was analyses using bibliometric approach through different parameters like type of document, authorship pattern, and year-wise distribution of articles, relative growth rate and doubling time growth rate, most productive country, author and affiliations. the study found that The highest number of contributions, 126 (25.93%), were published in 2021, during a five-year period, its relative growth rates and doubling time is increased, mean of relative growth is 0.37 and mean of doubling time is 0.42, most of the publication published as journal article with 370 (76.13%), The average number of authors per paper is 12.89, with a productivity of 0.078 per author, seven author collaboration contribute more 49 (10.08%), Kroon, E and Phanuphak, N shared first place with 14 (2.88%) articles each, University of London contributed the most articles, with 37 (7.61%), followed by Monash University in second place with 26 (5.35%), USA is the most productive country with 163 (33.54%) contribution , 'COVID-19' is highly used keyword, 'Molecules' is most productive Journal of articles.

Keywords: Pharmaceutical, Bibliometric, Asia, Medical, Medicine, Research

1. Introduction

Since ancient times, pharmaceutical have been utilized to treat disease. Plants and herbal treatments for a range of illnesses and injuries were used in the early days of medicine. The lengthy and challenging process of proving a compound's safety and effectiveness and getting it from the lab into the hands of patients in need has grown into a very large-scale worldwide industry today. The quality of life and life expectancy of many patients have improved in part due to pharmaceuticals. Medicines can treat diseases, lessen their symptoms, postpone their development, and stop problems from developing. Pharmaceutical firms are constantly working to develop novel new medications that will help patients live longer and healthier lives. Pharmacies constantly create, produce, market, and distribute these treatments throughout the globe. Medical professionals and researchers are always exploring for innovative or improved methods of treating sickness or illness. If they find something that might be useful, it won't be used widely until years of meticulous testing have been carried out.

Medical research is connected to a medicine becoming accessible to doctors and patients through research trials. Clinical trials, medication trials, and drug studies are other names for research investigations.

Every person in society has a basic need for health. The pharmaceutical industry has worked to ensure efficient drug production over the years, which aids in patient therapy, treatment, and life-prevention. The pharmacy industry has advanced in developing medications & treatments that enhance quality of life in response to the rising number of health conditions on a global scale. For this reason, pharma has become incredibly significant in human culture. If we analyze the past several years' worth of information, we can see that the industry has been effective in identifying the main causes of a number of serious diseases. Because of this, the annual death rate from heart conditions that are life-threatening has decreased significantly. And there have been numerous studies of this kind that have improved access to medical care for those with severe diseases. This is the main justification for why various nations are currently economically involved in the production of pharmaceuticals and medicines. In fact, the manufacture of pharmaceutical products in India can advance the country's economic growth. As India is known as the "Pharmacy of the world," its performance is correlated with that of the nation. Due to India's low price - high output rate, nations like the USA, Europe, etc. have either invested in such profitable programs or have set up production units there. The performance, productivity, and advancement of healthcare systems can be affected by contagious infections like the coronavirus pandemic. As a result, society as a whole is impacted more significantly. In these situations, the pharmaceutical industry plays a critical role in delivering medicines and other essential supplies that can help avoid or resolve the problem. (Cironpharma, 2020).

Bibliometric measurement and statistical methods have been used to examine and analyses the pharmaceutical research presented here. Research in the area of library and information science has a primary focus on bibliometrics. It makes use of quantitative analysis and statistics to describe trends in publishing within a certain topic or body of literature. Research impact, often known as bibliometrics, is a quantitative approach of citation and content analysis for academic journals, books, and researchers. By counting the number of times a certain work is referenced in other sources, the quantitative influence of a given publication is evaluated. Inferentially, you can determine the impact that a particular piece of academic writing has on the rest of the field. Bibliometrics must always be supported by in-depth peer review and a compelling case for the impact in a statement of purpose. Statistical sampling is the foundation of bibliometrics. It is predicated on some presumptions. Any appraisal must take these assumptions into consideration.

2. Review of Literature

Khaparde, Vaishali (2013), evaluated the department of chemistry's publications (Dr. Babasaheb Ambedkar Marathwada University, Aurangabad) from 1975 to 2012. Examined all 774 of the 144 journals' research papers and noted a consistent rise in the number of publications between 1975 and 2012, the majority of which had four authors, the majority of which were research papers published in journals of heterocyclic chemistry, and the productivity of faculty in large numbers of the 259 papers published.

Vanita P. Nimale, Vaishali Khaparde and Fawaz Abdullah Alhamd (2015), examined research articles from the International Journal of Information Management from the years 2003 to 2013 that cover acknowledgements. The number of articles with acknowledgements was 123 out of 538 (22.86%). The acknowledgements that are published in this publication are undergoing further analyses to determine the average number of acknowledgements per paper, their frequency of occurrence, their categories, and their most highly acknowledged contributors. In the findings, acknowledgements for peer interactive communication (PIC) are the greatest (28.28%), followed by those for financial help (22.36%), and those for clerical support are the lowest (1.31%).

Hakan Ozkose, Cevriye Gencer (2017), analyzed and identified total, 20497 Management Information System (MIS) publications from the Web of Science Core Collection that were published from 1980 to 2015. City University of Hong Kong provided funding for 292 studies, whereas Izak Benbasat published 66 articles that were relevant to the discipline of MIS. University of Arizona provided funding for 258 studies. According to Andrew B. Whinston (64), 16404 publications with multiple authors account for 80% of all articles, which gives credence to this theory. The United States of America had a big impact on the MIS field. 9545 (46.5%) of the 20497 articles were caused by it. The terms "study" (8319), "method" (7662), "algorithm" (5673), "research" (4342), and "technique" were the most frequently used in the field of MIS (4179).

In-Seon Lee (2020), examined the 4595 original documents that were retrieved from web of science, and reviews of those documents showed that the overall number of publications has increased over the past 20 years. The United States, China, and South Korea produced the most articles in this field, respectively. The three main categories of studies identified by a network analysis based on the co-occurrence of keywords are clinical studies, pain management studies, and mechanism research.

Yuqi Guo et.al (2020), evaluated the research on artificial intelligence (AI) that was done in the healthcare field. 1473 publications out of the 5235 hits were used in the analyses. Since 1995, the output of publications has increased by 17.02% yearly on average, while the growth rate of research papers has increased significantly, reaching 45.15% from 2014 to 2019. Diabetes, Alzheimer's disease, heart failure, cancer, and depression are the main health issues studied in AI research. The three technologies with the most influence on healthcare are convolutional neural networks, artificial neural networks, and support vector machines. Research hotspots in 2019 included tumour markers, convolutional neural networks, and nucleosides.

Raza, Muhammad Saleem (2021), observed that the trend of publications on carbon footprint has increased after 2002 and is also increasing in recent years. As the topic is extensively studied in many fields, including environmental sciences, engineering, materials sciences, earth and planetary sciences, chemical engineering, and energy, Peer-reviewed journal articles made up the majority of the 97% of publications. The authors, M. Aresta, T. P. Lin, and A. K. Persily, produced the most articles on the subject of carbon footprint. The National Institute of Standards and Technology, Lawrence Berkeley National Laboratory, and Tianjin University are the primary sources of funding for research on the carbon footprint of buildings. But only 3% of all articles on the carbon footprint of buildings are from National Taiwan University, George Mason University, and Universita degli Studi di Bari. Due to the fact that China and the USA account for the majority of the world's carbon footprint, these two countries also contribute the most to research on carbon footprint, followed by South Korea, the UK, Japan, Italy, Germany, Taiwan, etc. The majority of these publications were written in English.

3. Objectives of Study

The present study aim is Bibliometric study of publications in Pharmaceutical research in Asia which is indexed in web of science database during the period 2018 to 2022. Following are the specific objectives of this study:

1. To study the Year- Wise Distribution of Articles.
2. To examine the Relative Growth Rate (RT) and Doubling Time (DT) of Articles
3. To study the Authors Productivity year-wise.
4. To analyze the Authorship Pattern.
5. To check the Most Productive Author, Institution and Country of the Articles
6. To find out the Most Productive Journal of Articles.
7. To examine the Document Type- Wise Distribution of Articles
8. To find out the Prolific Keywords in Articles.

4. Methodology:

The present study data retrieved from the Clarivate analytics Web of Science database on the topic Pharmaceutical Research in Asia, which is span over the period from 2018 to 2022. A total of 486 research articles was downloaded and collected with bibliographic information with various parameters like year- wise distribution, type of document, most productive authors, institutions, countries etc. Additionally, it was analyzed using Microsoft-excel along with Bibexcel and Vosviewer statistical and mapping visualization bibliometric software tools.

5. Analysis of Data

Pharmaceutical Research in Asia from the years 2018 to 2022 was analyzed using a total of 486 research articles, 5022 authors, 2342 affiliations, and 128 countries. Brief assessments of the accompanying tables, figures, and graphs show the main findings of this study.

5.1 Year- Wise Distribution of Articles

Table No. 1 Year- Wise Distribution of Articles

Publication Years	Frequency	Percentage
2018	75	15.43
2019	92	18.93
2020	89	18.31
2021	126	25.93
2022	104	21.40
Total	**486**	**100.00**

Figure No. 1 Year- Wise Distribution of Articles

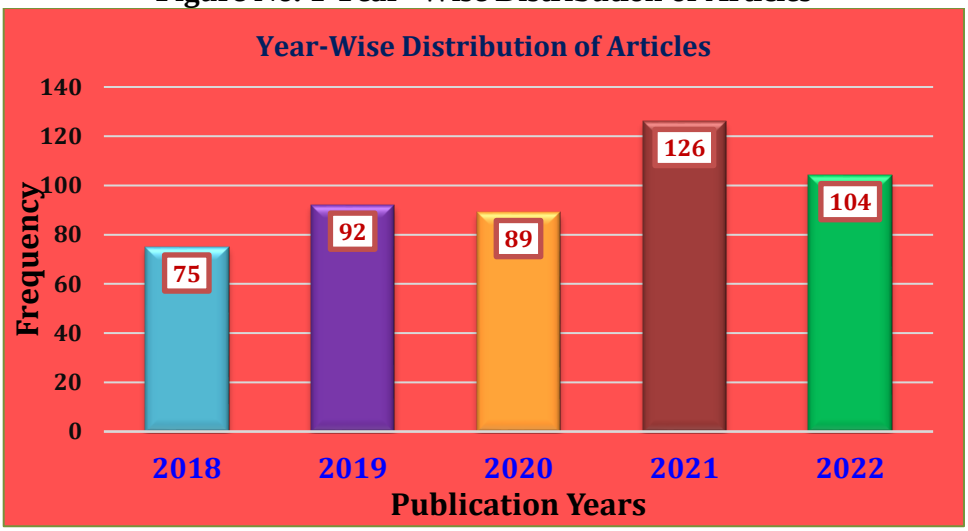


Table No. 1 and Figure No. 1 show the year-wise distribution of articles in "Pharmaceutical Research in Asia" collected from Web of Science from 2018 to 2022. The highest number of contributions, 126 (25.93%), were published in 2021, while the lowest number of research contributions, 75 (15.43%), were published in 2012. In 2022, the second-highest number of research contributions, 104 (21.40%), were published. It reflects the increase in publication from 2018 to 2021, with a slight decrease in 2022.

Relative Growth Rate (RGR) and Doubling Time (DT) of Publication

Table No. 2 Relative Growth Rate (RGR) and Doubling Time (DT) of Publication

Publication Years	Frequency	Cumulative Frequency	W1	W2	RGR	Mean [R(A)]	DT (A)	Mean DT (A)
2018	75	75		4.32				
2019	92	167	4.32	5.12	0.80		0.87	

2020	89	256	5.12	5.55	0.43	**0.37**	1.62	**1.42**
2021	126	382	5.55	5.95	0.40		1.73	
2022	104	486	5.95	6.19	0.24		2.88	

Figure No. 2 Relative Growth Rate (RGR) and Doubling Time (DT) of Publication

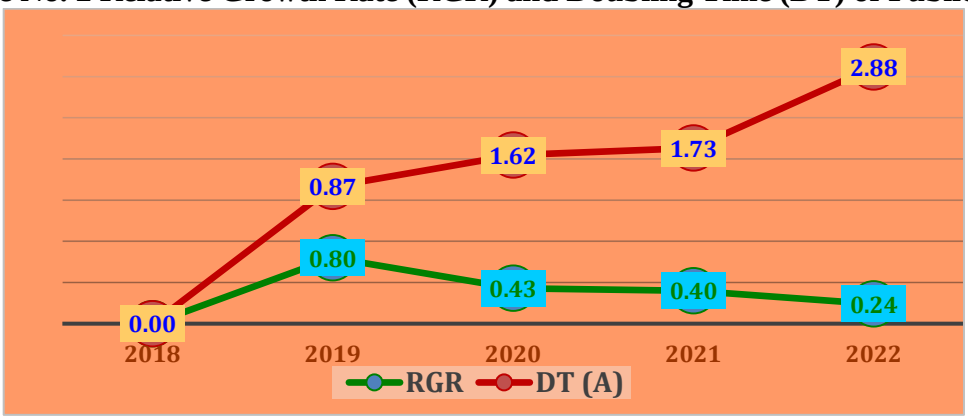


Table No. 2 and Figure No. 2 shows that during a five-year period, its relative growth rates decreased from 2019 (0.80) to 2022 (0.24) and that this period's mean relative growth rate is 0.37. The doubling time increased from 0.87 in 2019 to 2.88 in 2022. The highest doubling time is 2.88 in the year 2022 and the mean doubling time during a five-year period is 1.42. As a result, the relevant Doubling Time increased as the rate of growth of publication decreased.

5.3 Productivity of Authors

Table No. 3 Authors Productivity

Sr. No.	Year	Total No. Articles	Total No. Authors	AAPP*	Productivity Per Author
1	2018	75	874	11.65	0.086
2	2019	92	1573	17.10	0.058
3	2020	89	1167	13.11	0.076
4	2021	126	1378	10.94	0.091
5	2022	104	1271	12.22	0.082
	Total	**486**	**6263**	**12.89**	**0.078**

Notes: *Average Authors per Paper (AAPP) = Number of authors/Number of papers. Productivity per author = Number of papers/Number of authors

Table No. 3 reveals the productivity of authors from 2018 to 2022. The average number of authors per paper is 12.89, with a productivity of 0.078 per author. The year with the highest author productivity 126 (10.94%) was 2021. In 2018, the author productivity was at its lowest 75 (11.65%).

5.4 Authorship Pattern of Articles

Table No. 4 Authorship Pattern of Articles

			Year				
Authors	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**	**Percentage**
Single Authors	1	0	1	2	3	7	1.44
Two Authors	5	3	1	4	3	16	3.29
Three Authors	2	6	9	6	4	27	5.56
Four Authors	8	4	7	12	10	41	8.44
Five Authors	5	10	6	12	8	41	8.44
Six Authors	7	7	6	12	9	41	8.44
Seven Authors	6	6	8	15	14	49	10.08

More than Seven Authors	41	56	51	63	53	264	54.32
Total	**75**	**92**	**89**	**126**	**104**	**486**	**100.00**

Table 4 reveals the Authorship Pattern of articles published from 2018 to 2022. Seven Authors had the highest number of articles published, with 49 (10.08%). The collaboration of Six Authors, Five Authors, and Four Authors is followed by 41 (8.44%) each. Single Authors have the fewest number of publications 7 (1.44%). So, its reveals 479 (98.56%) contribution of multi-authors.

5.5 Most Productive Author of Articles

Table No.5 Most Productive Authors

S.No.	Authors	Article	Percentage
1	Kroon E	14	2.88
2	Phanuphak N	14	2.88
3	Ananworanich J	11	2.26
4	Reiss P	10	2.06
5	Ryom L	10	2.06
6	De Wit S	9	1.85
7	Mocroft A	9	1.85
8	Pinyakorn S	9	1.85
9	Sacdalan C	9	1.85
10	De Souza M	8	1.65
11	Hatleberg CI	8	1.65
12	Monforte AD	8	1.65
13	Phanuphak P	8	1.65
14	Phillips A	8	1.65
15	Robb ML	8	1.65
16	Bonnet F	7	1.44
17	Chan KG	7	1.44
18	El-sadr W	7	1.44
19	Goh BH	7	1.44
20	Hayashi Y	7	1.44
21	Law M	7	1.44
22	Onuki Y	7	1.44
23	Sabin C	7	1.44
24	Sato K	7	1.44
25	Weber R	7	1.44

Figure No. 3 Most Productive Authors

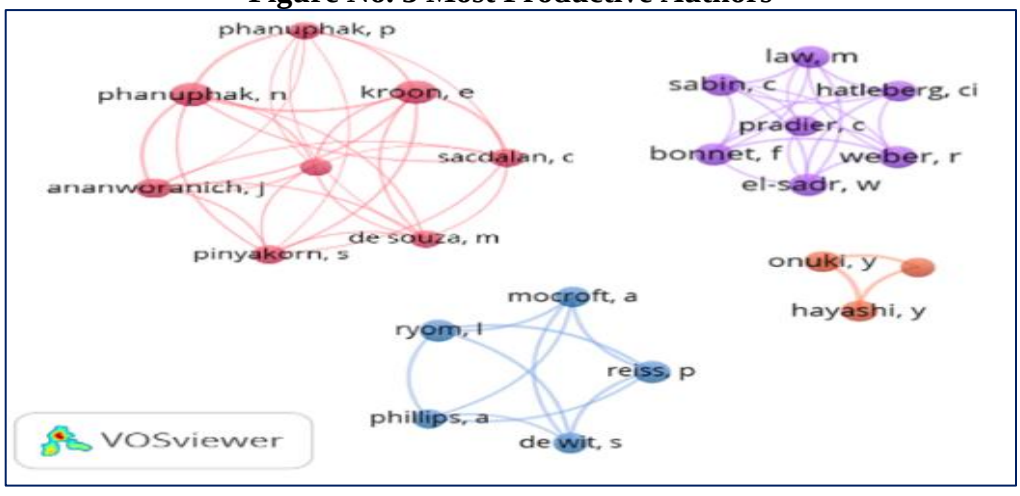


Table No.5 and Figure No.3 show the top 25 most productive authors from the research publication of pharmaceuticals research in Asia from 2018 to 2022. From the 486 research articles, a total of 5022

authors were examined. Kroon, E and Phanuphak, N shared first place with 14 (2.88%) articles each. This is followed by Ananworanich, J in second place with 11 (2.26%) articles, Reiss, P and Ryom, L in third place with 10 (2.06%).

5.6 Most Productive Institutes of articles

Table No.6 Most Productive Institutes

S.No.	Affiliations	Articles	Percentage
1	University of London	37	7.61
2	Monash University	26	5.35
3	University College London	25	5.14
4	National University of Singapore	24	4.94
5	University of Amsterdam	24	4.94
6	University of New South Wales Sydney	22	4.53
7	Udice French Research Universities	21	4.32
8	Asia University Taiwan	20	4.12
9	Harvard University	19	3.91
10	University of Tokyo	19	3.91
11	China Medical University Taiwan	16	3.29
12	Takeda Pharmaceutical Company Ltd	16	3.29
13	University Malaya	16	3.29
14	University of Copenhagen	16	3.29
15	Institut National De La Sante Et De La Recherche Medicale Inserm	15	3.09
16	National Cancer Center Japan	15	3.09
17	University of California System	15	3.09
18	University of Melbourne	15	3.09
19	Chulalongkorn University	14	2.88
20	Harvard Medical School	14	2.88
21	Seoul National University Snu	14	2.88
22	United States Department Of Defense	14	2.88
23	China Medical University Hospital Taiwan	13	2.67
24	Chinese Academy Of Sciences	13	2.67
25	Henry M Jackson Foundation For The Advancement Of Military Medicine Inc	13	2.67
26	Kirby Institute	13	2.67
27	Mahidol University	13	2.67
28	University of Queensland	13	2.67
29	Walter Reed Army Institute Of Research Wrair	13	2.67
30	Kindai University Kinki University	12	2.47
31	Monash University Sunway	12	2.47
32	National Taiwan University	12	2.47
33	United States Army	12	2.47
34	University of Oxford	12	2.47
35	University of Sydney	12	2.47

Table No. 6 lists the 35 most productive institutions out of the 2342 institutions that were examined from the 486 articles of pharmaceutical research in Asia during the Year 2018 to 2022. It should be noted that "University of London" contributed the most articles, with 37 (7.61%), followed by Monash University in second place with 26 (5.35%), and University College London in third place with 25 (5.14%).

5.7 Most Productive Countries of Article

Table No. 7 Most Productive Countries of Article

S.No.	Country Name	Article	Percentage
1	USA	163	33.54
2	Peoples R China	138	28.40
3	Japan	126	25.93
4	England	76	15.64
5	Australia	68	13.99
6	Thailand	63	12.96
7	South Korea	62	12.76
8	Malaysia	56	11.52
9	India	54	11.11
10	Taiwan	50	10.29
11	Canada	49	10.08
12	Netherlands	46	9.47
13	Germany	45	9.26
14	Italy	44	9.05
15	Singapore	42	8.64
16	Switzerland	38	7.82
17	France	37	7.61
18	Belgium	29	5.97
19	Pakistan	27	5.56
20	Brazil	23	4.73
21	Spain	23	4.73
22	Bangladesh	19	3.91
23	Scotland	19	3.91
24	Denmark	18	3.70
25	Iran	18	3.70
26	Sweden	18	3.70
27	Indonesia	17	3.50
28	Poland	17	3.50
29	Philippines	16	3.29
30	Chile	15	3.09
31	Saudi Arabia	15	3.09
32	Vietnam	14	2.88
33	Israel	13	2.67
34	South Africa	13	2.67
35	Turkey	13	2.67

Figure No. 4 Most Productive Countries of Article

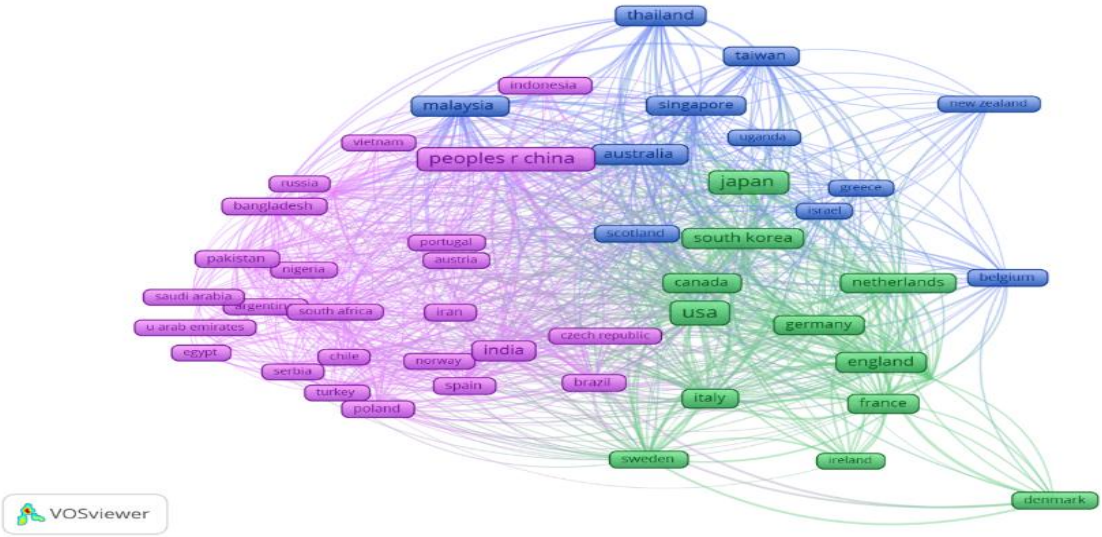


Table 7 and Figure 4 show the most productive 35 countries of articles. It was observed that 486 research articles of pharmaceutical research in Asia were contributed by 128 countries studied. The USA contributed the most research publications 163 (33.54%), followed by Peoples Republic of China 138 (28.40%) and Japan 126 (25.93%).

5.8 Most Productive Journal of articles

Table No.8 Productive Journal of articles

S.No.	Publication Name	Articles	Percentage
1	Molecules	13	2.67
2	Chemical Pharmaceutical Bulletin	11	2.26
3	Scientific Reports	10	2.06
4	Biological Pharmaceutical Bulletin	9	1.85
5	Plos One	9	1.85
6	Frontiers In Pharmacology	8	1.65
7	Annals of Oncology	6	1.23
8	Asia Pacific Journal of Clinical Oncology	5	1.03
9	BMJ Global Health	5	1.03
10	Clinical Infectious Diseases	5	1.03
11	Cochrane Database of Systematic Reviews	5	1.03
12	International Journal of Environmental Research And Public Health	5	1.03
13	Pharmaceutical Biology	5	1.03
14	Plants Basel	5	1.03
15	Science of The Total Environment	5	1.03
16	Sustainability	5	1.03
17	American Journal of Pharmaceutical Education	4	0.82
18	Applied Sciences Basel	4	0.82
19	BMC Public Health	4	0.82
20	Foods	4	0.82
21	Gastric Cancer	4	0.82
22	Indian Journal of Pharmaceutical Education And Research	4	0.82
23	Journal of Ethnopharmacology	4	0.82
24	Journal of The International Aids Society	4	0.82
25	Twenty one Journals with three articles each (21x3)	63	12.96
26	Thirty Five Journals with two articles each (35x2)	70	14.40
27	210 Journals with one article each (210x1)	210	43.21
	Total	**486**	**100.00**

Figure No. 5 Productive Journal of articles

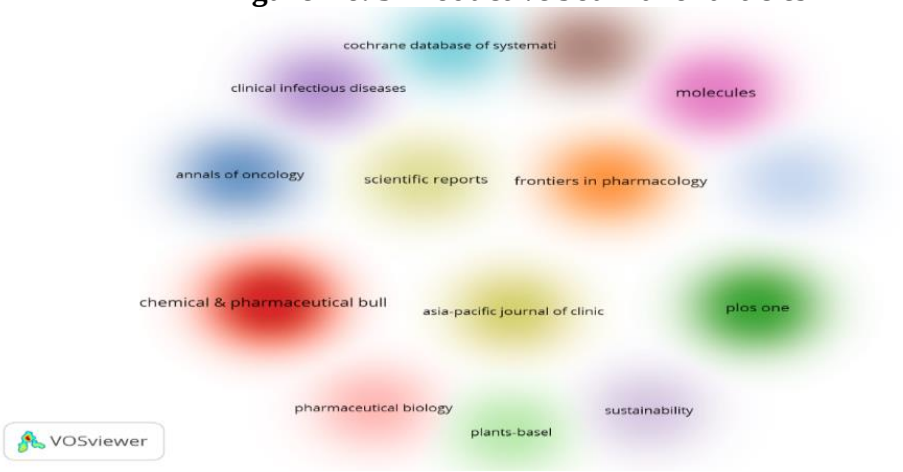


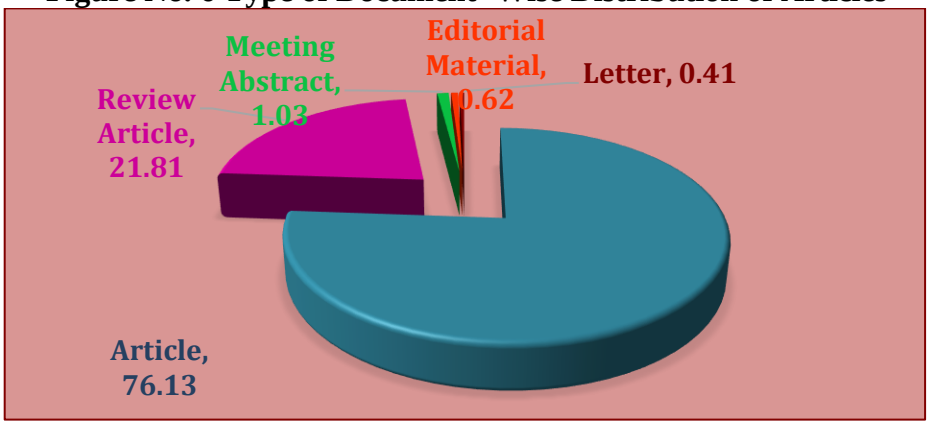
Table No.8 and Figure No.5 depict the most productive journals of articles, with article distribution by journal. It can be seen that Molecules published the most articles 13 (2.67%). This is followed by 11 (2.26%) articles published in Chemical Pharmaceutical Bulletin and 10 (2.06%) articles published in Scientific Reports.

5.9 Type of Document- Wise Distribution of Articles

Table No.9 Type of Document- Wise Distribution of Articles

S.No.	Document Types	Articles	Percentage
1	Article	370	76.13
2	Review Article	106	21.81
3	Meeting Abstract	5	1.03
4	Editorial Material	3	0.62
5	Letter	2	0.41
	Total	**486**	**100.00**

Figure No. 6 Type of Document- Wise Distribution of Articles



As shown in Table No. 9 and Figure No. 6, the majority of publications were published as journal articles, with 370 (76.13%) and review articles, with 106 (21.81%), respectively. Published in a relatively small amount of other forms.

5.10 Most – Prolific Keyword of Articles

Table No.9 Most Prolific Keyword of Articles

S.No.	Keywords	Frequency	Percentage
1	COVID-19	23	4.73
2	Asia	15	3.09
3	HIV	10	2.06
4	Epidemiology	9	1.85
5	antioxidant	8	1.65
6	cardiovascular disease	6	1.23
7	efficacy	6	1.23
8	Meta-analysis	6	1.23
9	biological activities	5	1.03
10	Essential oil	5	1.03
11	natural product	5	1.03
12	vaccine	5	1.03
13	Pharmaceuticals	5	1.03
14	antiretroviral therapy	5	1.03
15	Safety	5	1.03
16	Japan	5	1.03
17	systematic review	5	1.03
18	flavonoids	4	0.82
19	Pharmacy	4	0.82
20	Chemotherapy	4	0.82

Figure No. 7 Top- Most Prolific Keyword of Articles

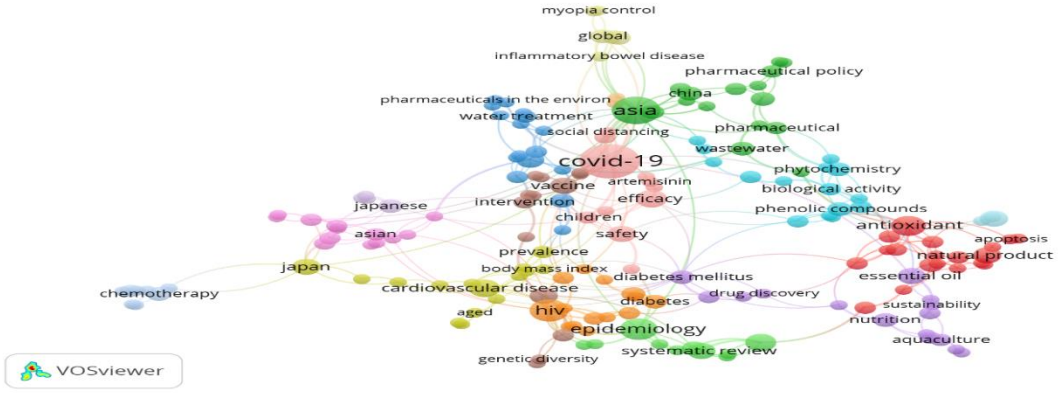


Table No. 10 and Figure No. 7 Shown the twenty most prolific keywords of articles. It was discovered that 486 publications include 501 keywords. COVID-19 was the keyword that was used the most, appearing 23 times (4.73%). Asia is the second-most-frequently used keyword, with 15 results (3.09%). HIV is the third most often used keyword, appearing 10 (2.06%) times, followed by epidemiology, which is used 9 (1.85%) times.

6. Key Findings

The key findings and outcomes of 486 research article of pharmaceutical research in Asia during the period 2018 to 2022 it is found that the highest number of contributions, 126 (25.93%), were published in 202, relative growth rates decreased from 2019 (0.80) to 2022 (0.24) and mean relative growth rate is 0.37. The doubling time increased from 0.87 in 2019 to 2.88 in 2022 and the mean doubling time during a five-year period is 1.42, The average number of authors per paper is 12.89, with a productivity of 0.078 per author. The highest author productivity of year was 2021, Kroon, E and Phanuphak, N shared first place with 14 (2.88%) articles each, University of London" contributed the most articles, with 37 (7.61%), The USA contributed the most research publications 163 (33.54%), followed by Peoples Republic of China 138 (28.40%), Journal Molecules published the most articles 13 (2.67%), the majority of publications were published as journal articles, with 370 (76.13%), COVID-19 was the keyword that was used the most, appearing 23 times (4.73%) followed with second most use keyword Asia 15 (3.09%)

7. Conclusion

The pharmaceutical sector is expanding rapidly these days as it is essential to human life to produce and distribute the best medications in order to treat various disorders. Asian countries work in the pharmaceutical industry and do more research as a result, along with other countries, because pharmaceutical firms are constantly looking for inventive new therapies that will help individuals live healthier lives. Pharmaceutical corporations constantly create, produce, market, and distribute these treatments all over the world. This bibliometric study research is beneficial to medical researchers as well as other researchers, scientists, and professionals from all sectors who are always conducting new, cutting-edge research in pharmacy and medicine around the worldwide.

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