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Ferdias, Pandri and Ahmar, Ansari Saleh, "Forecasting of the COVID-19 Epidemic: A Scientometric Analysis" (2021). *Library Philosophy and Practice (e-journal)*. 5415.

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Forecasting of the COVID-19 Epidemic: A Scientometric Analysis

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Abstract

This study presented a scientometric analysis of scientific publications with discussions of forecasting and COVID-19. The data of this study were obtained from the Scopus database using the keywords: (*TITLE-ABS-KEY (forecast) AND TITLE-ABS-KEY (covid)*) and the data were taken on March 26, 2021. This study was a scientometric study. The data were subsequently analyzed using the VosViewer and Bibliometrix R Package. The results showed that “COVID-19” was the keyword most frequently used by researchers, followed by “forecasting” and “human”. Authors who discussed the topic of forecasting COVID-19 come from 83 different countries/regions, with the most articles sent by authors from the USA.

Keywords: COVID-19; forecasting; scientometric.

1. Introduction

COVID-19 is a pandemic occurring worldwide and has become a major problem in the world. COVID-19 was first detected in Wuhan, China at the end of 2019. Based on the data of Worldometer website, there were 127,749,785 confirmed cases, 2,795,604 deaths and 102,934,981 recovered cases from the COVID-19 pandemic as of March 29, 2021, 00:59 GMT.

COVID-19 has been widely affecting every aspect of human life. The spread of COVID-19 pandemic has not only contributed to a profound effect on the health sector, but has also affected various aspects: economic, social, industrial, education and other aspects. By October 2020, tens of millions of people could be pushed into extreme poverty, while the number of people who were malnourished could increase to 132 million by year’s end, from a current number estimated at nearly 690 million [1]. In addition, it has also greatly affected the global economy and financial markets; a significant decline in income will also definitely affect the increase in unemployment, disruption of the transportation, service and manufacturing industries. The COVID-19 outbreak is unlikely to disappear any time soon, so proactive international action is highly needed to save lives and also protect economic prosperity [2][3].

COVID-19 also has an impact on education; The results of the study conducted by Omang & Angioha showed that there was a significant negative effect of COVID-19 on the education development of secondary school students in Cross River State, Nigeria, because the implementation of the learning process could not be implemented due to the absence of facilities and infrastructure to support the implementation of learning during the period of Lockdown [4]. Furthermore, Atuahene, Kong, & Bentum-Micah explained that COVID-19 has caused school

closures for a long time and would certainly have an effect on the learning process and learning outcome [5].

An accurate forecast of the evolution of new confirmed cases and an analysis of the number of deaths and cures enables the more effective management in regards to the global impact of COVID-19 [6]. To further determine the profile and forecasting mapping of COVID-19, it is necessary to apply a bibliometric study. Borgman stated that “bibliometrics is the application of mathematics and statistical methods to books and other media of communication” [7].

2. Methods

This study was a scientometric study. The data in this study were further analyzed using VosViewer and Bibliometrix R Package. VosViewer and Bibliometrix R Package were considered capable of contributing many advantages over other analysis software. VosViewer and Bibliometrix R Package use a text mining function to identify relevant word phrases for mapping and a clustering approach to examine network data co-citation and co-occurrence [8] [9]. In addition, they are able of providing many advantages in terms of visualization over other software [10].

The data from this study were obtained from the Scopus database using the keywords: (*TITLE-ABS-KEY (forecast) AND TITLE-ABS-KEY (covid)*). The data were taken on March 26, 2021.

3. Result and Discussion

3.1. Document type of publication

From the results of data search on Scopus, 746 documents were successfully obtained consisting of: 245 documents for 2021, 500 documents for 2020, and 1 document for 2019. Of the 746 documents obtained, these documents were divided into 9 types of documents, namely: article, conference paper, review, data paper, note, book chapter, conference review, letter, and short survey. The details are presented in table 1.

Table 1. Document type of publication

Document type	No. of Documents	Percentage
Article	613	82.17
Conference paper	84	11.26
Review	22	2.95
Data paper	7	0.94
Note	6	0.80
Book chapter	5	0.67
Conference review	3	0.40

Document type	No. of Documents	Percentage
Letter	3	0.40
Short survey	3	0.40
Total	746	100.00

From table 1, it can be found that as many as 82.17% or 613 documents types of article publication had the highest number compared to other types of published documents. This was followed by document type “Conference Paper” of 11.26% or 84 documents, document type “Review” of 2.95% or 22 documents and the number of remaining types divided into various types of other published documents. This shows that during the COVID-19 pandemic, researchers tend to publish their study results by choosing the document type of articles published in various Scopus journals. This determination is caused by a pandemic condition which resulted in limited human mobilization, so publications in the form of an article is the type of publication that is most likely to be carried out.

3.2. Trend topics

During the COVID-19 pandemic, publications were more dominant in 2020. It can be seen in the table that as many as 520 topics about COVID-19 were followed by the topic of Forecasting which was amounted to 435 topics. This shows that publications on forecasting COVID-19 data are the most dominating topics to be published. Meanwhile, in 2021 the topic of the Forecasting Method is considered to be a topic that tends to be published by researchers. This indicates the high enthusiasm of researchers in predicting when the COVID-19 pandemic will be over.



Fig. 1. Trend topics

Table 2. Trend topics on year

Topics	Frequency	Year
COVID-19	520	2020
Forecasting	435	2020
Human	353	2020
Pandemic	221	2020
Coronavirus Infection	190	2020
Forecasting Method	22	2021
Compartmental Model	14	2021
Auto-Regressive Integrated Moving Average	13	2021
Modeling	13	2021
Carbon Dioxide	11	2021
City	11	2021
Epidemiological Monitoring	11	2021
Numerical Model	11	2021

3.3. *Top 10 most productive country*

From Table 3, it can be seen that the most productive countries producing publications on forecasting COVID-19 were the United States with 134 publications, followed by India with 104 publications, then China with 88 publications, England with 59 publications, Italy with 53 publications, Russia as many as 39 publications, Spain with 38 publications, Germany with 35 publications, Saudi Arabia with 31 publications and finally Brazil with 23 publications. This shows that the major countries of the world are very concerned in conducting study on forecasting COVID-19.

Table 3. Top 10 most productive country

Country/territory	No. of Documents
United States	134
India	104

Country/territory	No. of Documents
China	88
United Kingdom	59
Italy	53
Russian Federation	39
Spain	38
Germany	35
Saudi Arabia	31
Brazil	23

3.4. Top 10 most productive authors name and h-index

Table 4 presents the Top 10 productive authors who discussed the topic of Forecasting and COVID-19. From Table 4, it can be seen that the majority of authors had a high h-index of publication and only 2 authors had an h-index < 10.

Table 4. Top 10 most Productive Authors Name and h-index

Author Name	No. of Documents	h-index
Chowell, G.	5	47
Ramasamy, K.	4	3
Salisu, A.A.	4	17
Aragon, D.C.	3	10
Bouri, E.	3	31
Darapaneni, N.	3	0
Ewees, A.A.	3	20
Fan, H.	3	10
Gandomi, A.H.	3	58
Kumar, R.	3	17

3.5. *Top 10 subject area of publication*

From table 5, it can be found that the subjects of health publications became the main subjects involved in most studies. This was caused by the COVID-19 pandemic which is closely related to human health. Then followed by the subject of mathematical publications, where most researchers carried out the modeling process of the growth of COVID-19 patient data. This model is expected to help the government in making policies for handling the COVID-19 pandemic. Furthermore, the subject of computer science publications, where researchers developed artificial intelligence (AI) in detecting COVID-19 in humans. The next subject is engineering, where researchers continued to create COVID-19 detection tools with computer science assistance. Another important subject is the subject of economic publications. The economic sector is recognized as the sector most affected by the COVID-19 pandemic, so researchers also tended to conduct analysis (study) on the global economy.

Table 5. Top 10 subject area of publication

Subject area	No. of Documents
Medicine	194
Mathematics	162
Computer Science	157
Engineering	104
Economics, Econometrics, and Finance	100
Physics and Astronomy	81
Biochemistry, Genetics, and Molecular Biology	74
Social Sciences	74
Environmental Science	65
Business, Management, and Accounting	58

3.6. *Forecasting methods or models used in this study*

Based on the data obtained based on Scopus data, several methods and/or forecasting models used by researchers in forecasting COVID-19 are presented in table 6.

Table 6. Forecasting Methods/Models for COVID-19

Methods/Model	DOI
Artificial Neural Network (ANN)	10.1016/j.aej.2020.09.037 [11]
Autoregressive integrated moving average (ARIMA)	10.1016/j.asoc.2020.106932 [12]
	10.1016/j.asoc.2021.107161 [13]
	10.1016/j.bspc.2021.102494 [14]
	10.1016/j.psep.2020.10.048 [15]
	10.1016/j.techfore.2021.120637 [16]
	10.1088/1742-6596/1751/1/012027 [17]
	10.32604/cmc.2020.011937 [18]
AWBO-DGGM(1,1) models	10.1016/j.energy.2021.119952 [19]
Bayesian inference	10.1016/j.jeconom.2020.08.010 [20]
	10.1155/2021/8847116 [21]
Bayesian vector autoregressive (BVAR)	10.1590/0037-8682-0762-2020 [22]
BSTS	10.1016/j.bspc.2021.102494 [14]
ELM network	10.1016/j.bspc.2021.102494 [14]
Exponential smoothing state space model (ETS)	10.1016/j.asoc.2020.106932 [12]
Extended WKDE	10.1038/s42003-021-01677-2 [23]
Holt's models	10.1590/0037-8682-0762-2020 [22]
Holt-Winter	10.1016/j.bspc.2021.102494 [14]
Hybrid	10.1016/j.bspc.2021.102494 [14]
IMSGM(1,1)	10.1016/j.apenergy.2020.116339 [24]
LSTM	10.1007/978-981-16-0010-4_11 [25]
	10.1016/j.isatra.2020.12.057 [26]
	10.1016/j.psep.2020.10.048 [15]
ML-based prediction	10.1088/1742-6596/1767/1/012006 [27]
MLP	10.1016/j.bspc.2021.102494 [14]
Multiple linear regression with call data (MLR_T)	10.1016/j.asoc.2020.106932 [12]
Multiple linear regression without call data (MLR_W)	10.1016/j.asoc.2020.106932 [12]
Multi-Task Gaussian Process (MTGP)	10.1007/s10489-020-01889-9 [28]

Methods/Model	DOI
regression model	
NNETAR	10.1016/j.bspc.2021.102494 [14] 10.30630/joiv.5.1.372 [29]
Nonlinear Autoregressive Artificial Neural Networks (NARANN)	10.1016/j.psep.2020.10.048 [15]
Prophet	10.1016/j.asoc.2020.106932 [12] 10.1016/j.bspc.2021.102494 [14] 10.32604/cmc.2021.014918 [30] 10.1109/ICICT50816.2021.9358564 [31]
PSOSMA-ANFIS	10.1016/j.envres.2020.110607 [32]
Seasonal Autoregressive integrated moving average (ARIMA)	10.1016/j.asoc.2021.107161 [13]
Seasonal Naive	10.1016/j.asoc.2020.106932 [12]
Sequential quadratic programming (SQP)	10.1016/j.asoc.2021.107289 [33]
Singular Spectrum Analysis Model	10.1088/1742-6596/1722/1/012092 [34]
SIR model	10.1038/s41467-021-21776-2 [35]
SutteARIMA	10.1016/j.scitotenv.2020.138883 [36] 10.1016/j.dib.2020.105854 [37] 10.30630/joiv.4.3.389 [38]
TBATS	10.1016/j.bspc.2021.102494 [14]

4. Conclusion

Based on the results and discussion in this study, it can be concluded that publications regarding COVID-19 forecasting consist of 1 article in 2019, 500 articles in 2020, and 245 articles in 2021 in the Scopus database. Most publications in the e-Learning field are published in Chaos Solitons and Fractals (38 documents) and followed by Plos One (21 documents). Productive authors in the field of e-Learning are Chowell, G. (5 documents), and then Ramasamy, K. (4 documents) and Salisu, A.A (4 documents) with USA as the country or territory that publishes the most documents, specifically 134 documents.

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