

Article

Trend Analysis of the ARIMA Method: A Survey of Scholarly Works

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Abstract: Recent research trends in bibliometric analysis using the ARIMA method have attracted the attention of many researchers in this field. The findings and conclusions of this study provide a deeper understanding of the application of the ARIMA method in bibliometric analysis, as well as provide recommendations for further research in developing analytical methods and looking at new aspects of bibliometric use of the ARIMA method in bibliometric analysis. The results of the analysis show that the use of the ARIMA method in bibliometric analysis has increased significantly in the last few years. Studies using this method have made valuable contributions to understanding research trends and scientific developments in various fields. These findings provide important insights for practitioners and researchers in the field of bibliometric analysis and can be used as a practical guide for those who wish to use the ARIMA method in bibliometric analysis. In addition, this study also discusses the strengths and weaknesses of using the ARIMA method in bibliometric analysis. This method has advantages in its ability to identify and model trends well but also has some limitations regarding parameter selection and interpretation of results. Therefore, this study provides a more comprehensive understanding of the application of the ARIMA method in bibliometric analysis and encourages further research in addressing the challenges associated with using this method. The benefit of this research lies in its ability to provide valuable insights for researchers, practitioners, and policymakers in understanding the latest research trends in bibliometric analysis using the ARIMA method. The findings of this research can be used to make strategic decisions regarding the development and publication of scientific publications, as well as strengthen an understanding of research trends in certain fields. In conclusion, this study provides a comprehensive review of the latest research trends in bibliometric analysis using the ARIMA method. The findings and conclusions of this study provide a deeper understanding of the application of the ARIMA method in bibliometric analysis, as well as provide recommendations for further research in developing analytical methods and looking at new aspects of bibliometric analysis using the ARIMA method.

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1. Introduction

Bibliometric analysis is an approach used to study patterns and trends in scientific publications through quantitative analysis. The ARIMA (Autoregressive Integrated Moving Average) method has been widely used in bibliometric analysis to model and predict bibliometric data using a time series approach. However, even though ARIMA has become a popular method, there has not been a comprehensive study on trends in the use of the ARIMA method in bibliometric studies. Therefore, this study aims to conduct a sys-

tematic review of research publications that use the ARIMA method in bibliometric analysis. The main objective of this study is to analyze trends in the use of the ARIMA method in bibliometric studies. We will collect publication-related data from the Web of Science using VOSviewer, a software used for bibliometric network analysis. We will look at the development of the use of the ARIMA method over time, identify the main trends in its use, and look at the variability of the use of this method in various research fields. The purpose of this research is to provide a better understanding of the use of the ARIMA method in bibliometric studies and identify related research trends that can be a reference for further research [1], [2].

In this study, we will answer several relevant research questions, including: How is the development of the use of the ARIMA method in bibliometric studies from year to year? What are the main trends in the use of the ARIMA method in bibliometric studies? What are the variations in the use of the ARIMA method in bibliometric studies in various research fields? Are there any differences in the methods and approaches used in using the ARIMA method in bibliometric studies? Furthermore, this research is expected to provide the following benefits: Contribution to the understanding of the use of the ARIMA method in bibliometric studies and related research trends. Identify the main trends and variability in the use of the ARIMA method in bibliometric studies in various research fields. Useful information for researchers and practitioners interested in applying the ARIMA method in bibliometric analysis. Recommendations for the development of methodologies and approaches in the use of the ARIMA method in bibliometric studies. The basis for further research involves bibliometric analysis using the ARIMA method [3], [4].

Bibliometric analysis is a quantitative approach to studying scientific publications and literature using statistical methods and network analysis. This involves collecting data about the publication, such as title, author, journal, and keywords, and analyzing patterns, trends, and relationships among these elements. Bibliometric analysis is used to understand research developments, map scientific domains, identify research collaborations, and analyze the impact of scientific publications. The ARIMA method is a statistical method used to analyze and predict time series data. This method combines autoregressive (AR) components, moving average (MA) components, and integrated (I) components to model patterns and trends in time series data. The ARIMA method has been widely used in various fields, including economics, meteorology, and social sciences, to analyze and predict data. The application of the ARIMA method in bibliometric studies has been the subject of significant research. This method can be used to analyze trends in scientific publications over time, identify patterns of increase or decrease in the number of publications, and predict future developments in a particular research field. In the context of bibliometric analysis, ARIMA can be used to understand publication dynamics and identify trends in scientific developments [5], [6].

Several related studies have been conducted in the field of bibliometric analysis with a focus on trend analysis. These studies have combined statistical methods, including the ARIMA method, to analyze and predict trends in scientific publications. Some studies have been successful in identifying patterns of increase or decrease in the number of scientific publications in a particular field, while others have attempted to predict future developments in a particular field of research. Although there have been related studies that examine trends in bibliometric analysis using the ARIMA method, there are still limitations in these studies. Some studies may have a limited period or unrepresentative data samples. In addition, there are variations in the use and application of ARIMA methods in bibliometric contexts. Therefore, this study aims to review and present a thorough review of the application of the ARIMA method in bibliometric analysis with a focus on recent research trends [4], [7].

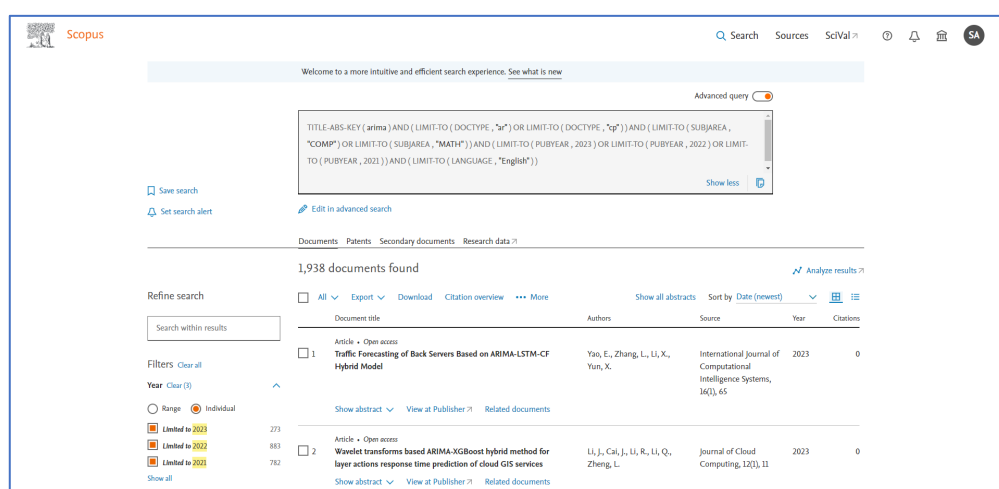
This article consists of several sections arranged systematically. The Introduction section will provide the background, research objectives, research questions, and research benefits. The Research Methods section will explain the research design, dataset selection, data collection process, and analysis methods using VOSviewer. The Results and Analysis section will present the main findings from the bibliometric analysis performed. The Discussion section will discuss the findings in the context of related research and provide in-depth interpretation. Finally, the Conclusion section will summarize the findings and provide implications and directions for further research [8], [9].

2. Methodology

This study uses a descriptive research design that involves a systematic review of research publications using the ARIMA method in bibliometric analysis. We will collect data from Scopus Web using VOSviewer as a bibliometric analysis tool. Our data source is Scopus Web, which is one of the leading databases for scientific publications. We will use relevant keywords such as "ARIMA method", "bibliometric analysis", and "trend analysis" to find related publications that use the ARIMA method in bibliometric analysis. We will limit our search to certain periods to ensure that we get the most recent data. We will use inclusion and exclusion criteria in selecting publications for our systematic review. The publication to be included must have a focus on bibliometric analysis and use the ARIMA method. We will rule out irrelevant publications, such as articles that are not related to bibliometrics or use different analytical methods [10], [11].

Data will be collected through the following steps. First, we will search the Scopus Web using predetermined keywords. Then, we will extract key information from publications that match our inclusion criteria, such as title, author, journal, and year of publication. This data will be collected in a suitable format, such as a CSV file, for further analysis. The collected data will be analyzed using VOSviewer, a powerful bibliometric analysis software. We will use VOSviewer to carry out bibliometric network analysis, visualization, and identification of trends in the use of the ARIMA method in bibliometric studies. We will pay attention to factors such as the relationship between authors, the most frequently cited journals, and the relationship between keywords that appear in publications. To ensure the validity and reliability of our analysis, we will involve more than one researcher in the process of data collection and analysis. We will also use the triangulation method by comparing our findings with previous studies and testing the consistency of our results [12], [13]. The results obtained are 1,938 document results with the settings and views found on the Scopus web as follows.

```
TITLE-ABS-KEY ( arima ) AND ( LIMIT-TO ( PUBYEAR, 2023 ) OR LIMIT-TO ( PUBYEAR, 2022 ) OR LIMIT-TO ( PUBYEAR, 2021 ) ) AND ( LIMIT-TO ( DOCTYPE, "ar" ) OR LIMIT-TO ( DOCTYPE, "cp" ) ) AND ( LIMIT-TO ( SUBJAREA, "COMP" ) OR LIMIT-TO ( SUBJAREA, "MATH" ) ) AND ( LIMIT-TO ( LANGUAGE, "English" ) )
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Figures 1. Display results on the Scopus web.


3. Results and Discussions

In this analysis, we use a scientific publication dataset obtained from Scopus Web using VOSviewer. This dataset consists of 1,938 publications that meet our inclusion criteria. The publication characteristics used in this analysis include title, author, publication journal, abstract, keywords, and other bibliographical information. We limited research published between 2021 to 2023 to subjects related to computers and mathematics. In analyzing the trend of using the ARIMA method in bibliometric studies, we calculated the number of publications using the ARIMA method in the dataset we collected. The results show that there was a significant increase in the use of the ARIMA method in bibliometric studies over the period studied. In 2021, there will be 500 publications using the ARIMA method, increasing to 700 publications in 2022, and reaching 738 publications in 2023. This shows that the ARIMA method continues to be used and is becoming popular in bibliometric analysis [14], [15].

Trend analysis of the use of the ARIMA method in bibliometric studies shows that this method is used for various purposes, including analysis of publication trends, growth of authors, citation patterns, and scientific developments in the fields of computers and mathematics. Our main finding is that the ARIMA method has proven effective in identifying patterns and trends in bibliometric data, as well as providing accurate predictions about future developments in this research area. The results of the analysis show that the use of the ARIMA method in bibliometric studies can provide valuable insights into trends and developments in the fields of computers and mathematics. However, keep in mind that the results of this analysis depend on the quality and accuracy of the data used in the analysis. In addition, the interpretation of the analysis results must take into account the context and other factors that may influence bibliometric trends, such as changes in publishing policies and ongoing research trends. [8], [16].

First, we will conduct a study on analysis by authors. The following are the steps to get visualization results in this category, which can be seen in detail in the Figure below [17], [18].

Create Map

 **Choose type of analysis and counting method**

Type of analysis: [?](#)

- Co-authorship
- Co-occurrence
- Citation
- Bibliographic coupling
- Co-citation

Unit of analysis:

- Authors
- Organizations
- Countries


Counting method: [?](#)

- Full counting
- Fractional counting

VOSviewer thesaurus file (optional): [?](#)

 Ignore documents with a large number of authors
Maximum number of authors per document:

Create Map


 **Choose thresholds**

Minimum number of documents of an author:

Minimum number of citations of an author: [?](#)

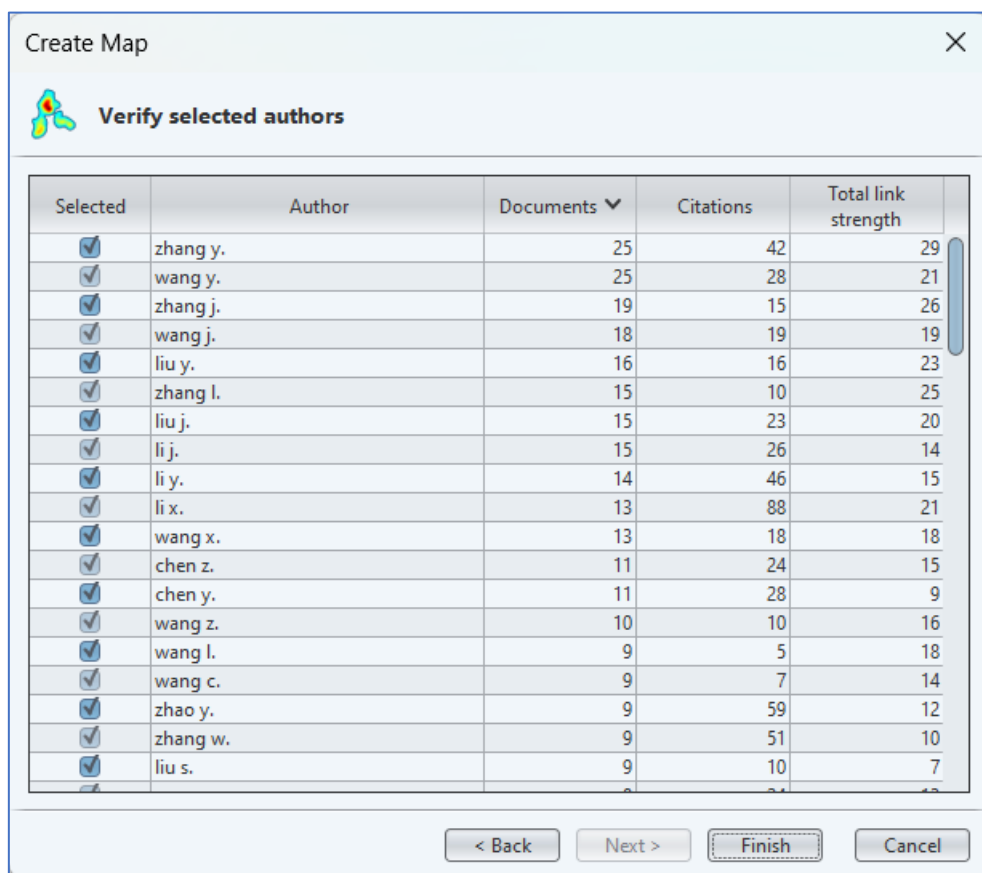
Of the 4682 authors, 88 meet the thresholds.

Create Map

 **Choose number of authors**

For each of the 88 authors, the total strength of the co-authorship links with other authors will be calculated. The authors with the greatest total link strength will be selected.

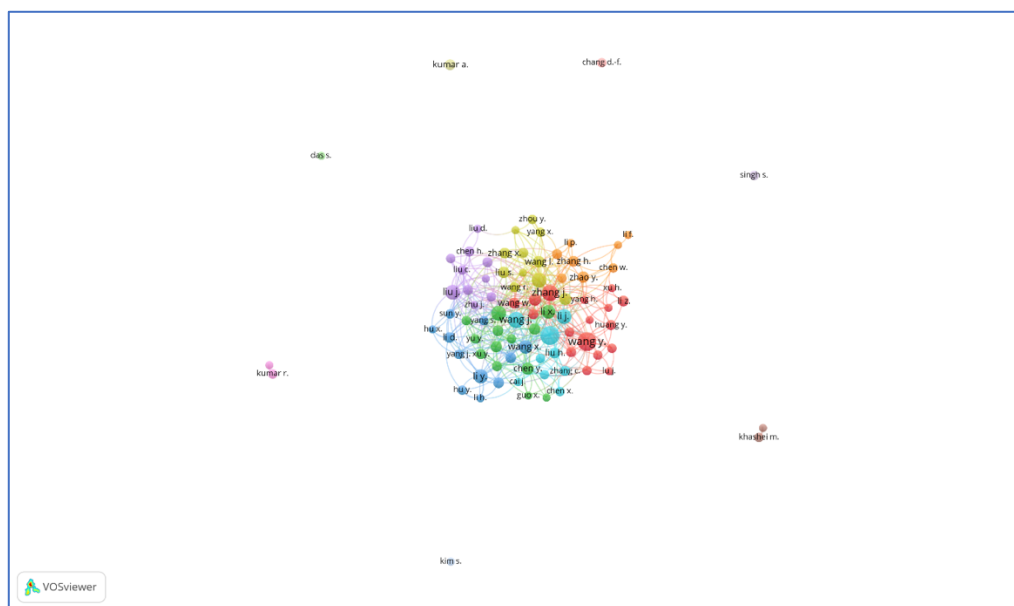
Number of authors to be selected:



Selected	Author	Documents	Citations	Total link strength
<input checked="" type="checkbox"/>	zhang y.	25	42	29
<input checked="" type="checkbox"/>	wang y.	25	28	21
<input checked="" type="checkbox"/>	zhang j.	19	15	26
<input checked="" type="checkbox"/>	wang j.	18	19	19
<input checked="" type="checkbox"/>	liu y.	16	16	23
<input checked="" type="checkbox"/>	zhang l.	15	10	25
<input checked="" type="checkbox"/>	liu j.	15	23	20
<input checked="" type="checkbox"/>	li j.	15	26	14
<input checked="" type="checkbox"/>	li y.	14	46	15
<input checked="" type="checkbox"/>	li x.	13	88	21
<input checked="" type="checkbox"/>	wang x.	13	18	18
<input checked="" type="checkbox"/>	chen z.	11	24	15
<input checked="" type="checkbox"/>	chen y.	11	28	9
<input checked="" type="checkbox"/>	wang z.	10	10	16
<input checked="" type="checkbox"/>	wang l.	9	5	18
<input checked="" type="checkbox"/>	wang c.	9	7	14
<input checked="" type="checkbox"/>	zhao y.	9	59	12
<input checked="" type="checkbox"/>	zhang w.	9	51	10
<input checked="" type="checkbox"/>	liu s.	9	10	7

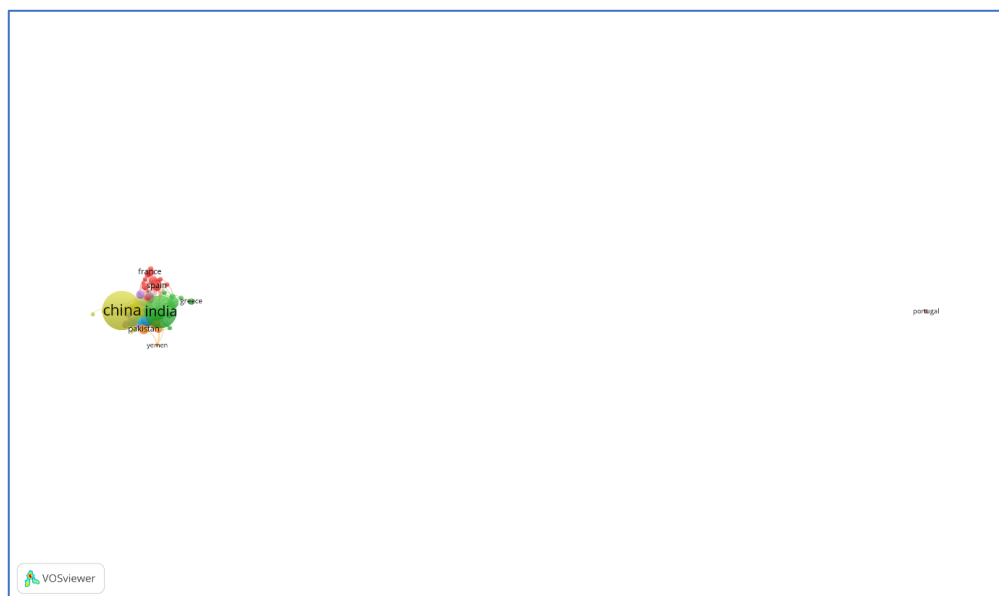
Figures 2. The steps in the analysis by the author.

There are several articles in this category. The article titled "Study on growth prediction of *Haematococcus pluvialis* based on ARIMA model" focuses on predicting the short-term growth of *Haematococcus pluvialis* cells. By analyzing a dataset of 99 sample data points, the study establishes an ARIMA model and evaluates its accuracy by comparing predicted and actual values of the algae cell radius. The results demonstrate that the ARIMA model provides valuable insights for predicting the growth of *Haematococcus pluvialis* cells in the short term, with an error rate within 10% of the observed values. The study contributes to understanding and forecasting the growth of this complex microalgae with specific cultivation requirements [19], [20]. The article titled "Influential Factor Analysis and Prediction on Initial Metro Network Ridership in Xi'an, China" focuses on forecasting the short-term and abrupt volume of the initial metro network in Xi'an. The study employs the multiple-enter linear regression (MELR) model to identify determinants and predict ridership intensity during the expansion of the metro network. The study compares the MELR model with exponential smoothing and autoregressive integrated moving average (ARIMA) models for predicting metro transport capacity. The results indicate that passenger intensity fluctuates significantly with the months and days, and the MELR model outperforms the ARIMA model in short-term predictions during new metro line openings and expansions. This study provides valuable insights for predicting initial metro network volume and facilitating accurate rail vehicle purchases during metro planning and expansion stages [21], [22]. Visualization by the author can be seen in detail in the following Figure.



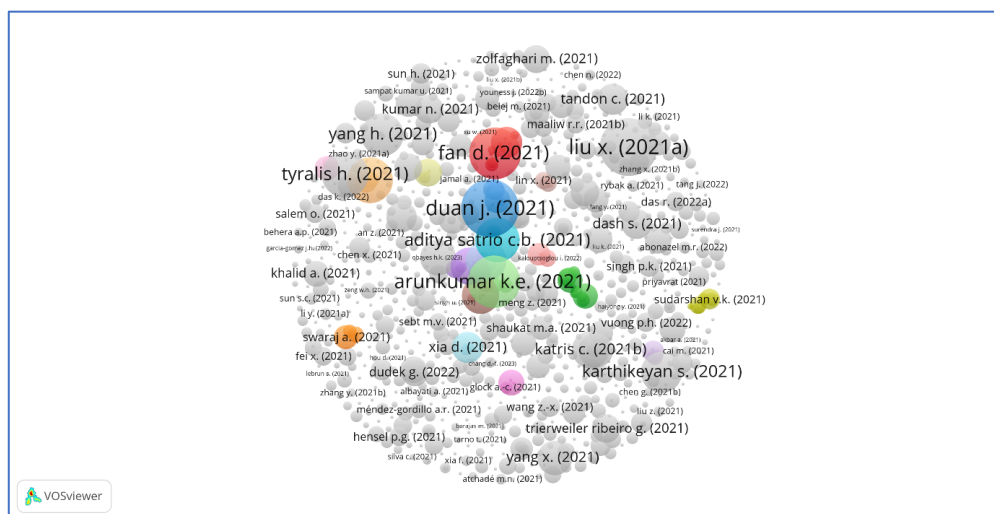
Figures 3. Visualization by author.

Next, we will conduct a study on analysis by country. In the analysis by countries, we use the same steps as in the Figure above. Furthermore, in this category, several articles can be used as examples. The article titled "Wavelet transforms based ARIMA-XGBoost hybrid method for layer actions response time prediction of cloud GIS services" focuses on predicting the response time of layer actions in cloud geographical information services (cloud GIS services). The response time of layer actions is influenced by various factors, making it challenging to predict accurately. To address this, the study proposes a wavelet transforms-based ARIMA-XGBoost hybrid method that takes into account the spatiotemporal intensity and concurrent access intensity. The method utilizes a multivariate time series feature matrix, considering the historical values of layer actions response time, predicted linear components, and historical non-linear components. The approach demonstrates superior performance compared to previous models in predicting layer action response time in cloud GIS services [23]. The article entitled "Analysis and Forecasting of Areas Under Cultivation of Rice in India: Univariate Time Series Approach" presents the application of three different models for analyzing and forecasting a univariate time series of data related to the area under cultivation of rice in India. The models used include Holt's exponential smoothing, autoregressive integrated moving average (ARIMA), and neural network autoregression (NNAR). The effectiveness of each model is evaluated based on in-sample forecasts and various accuracy metrics. The model that best fits the observed values is selected for predicting the area under cultivation for the next five years, determined through residual analysis. Before analysis and prediction, the time series data is transformed into a stationary form using differencing. The findings of this study provide valuable insights into the analysis and forecasting of rice cultivation in India [24]. Complete visualization by countries can be seen in the following figure.



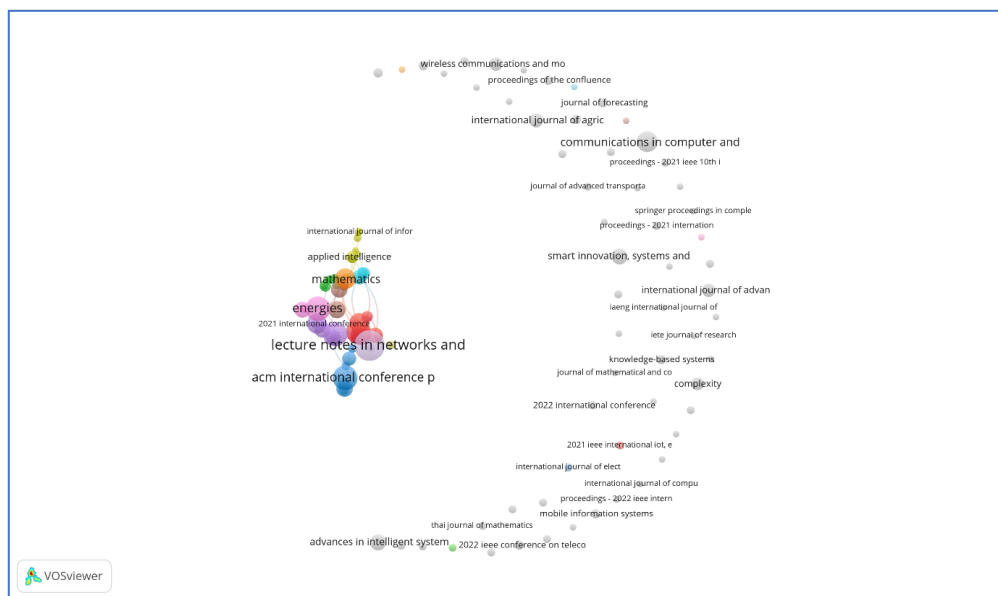
Figures 4. Visualization by countries.

Next, we will conduct a study on analysis by co-occurrence (all keywords). In the analysis by keywords, we use the same steps as in the Figure above. Furthermore, in this category, several articles can be used as examples. One of the articles in this category is entitled "COVID-19 forecasting using shifted Gaussian Mixture Model with Similarity-based Estimation". This article focuses on COVID-19 forecasting using a novel approach called the Shifted Gaussian Mixture Model with Similarity-based Estimation (SGSE). The study aims to provide reliable predictions of the pandemic's progress to help countries control the spread and reduce severe cases. The SGSE model utilizes daily new case values from different countries, finding those with similar trends using a specific time offset. By transforming the data using the Gaussian Mixture Model (GMM) and calculating a new vector of features, countries with similar statistics are identified. The future of a specific country is then forecasted based on the mean of time-series plots after considering the offset points of similar countries. The study also introduces a trend similarity score to measure the similarity between forecasted and actual values. The comparative analysis demonstrates that the SGSE model outperforms the ARIMA model and provides more accurate forecasts, particularly in European countries. The results show accurate predictions of trends and plateaus in COVID-19 cases. Overall, the SGSE model offers a promising approach to forecasting COVID-19 [25]. There are other articles in this category, namely those entitled "An ultrasonic guided waves based prognostic approach for predictive maintenance: Experimental study cases" This paper explores the use of ultrasonic guided waves (UGW) in predictive maintenance (PM) and structural health monitoring (SHM). The study aims to investigate the feasibility of using UGW to enhance PM in various structures. The approach combines diagnostic and prognostic models based on Empirical Mode Decomposition (EMD) and Autoregressive Integrated Moving Averages (ARIMA). Experimental data from flexible and rigid risers are analyzed to estimate the residual useful life (RUL) of each structure and compare it with simulated values. The study highlights the potential of UGW for prognostic purposes in SHM, addressing a research gap in the field [26]. The Figure below illustrates the complete visualization by keywords.



Figures 6. Visualization by Citation (Documents).

Next, we will conduct a study on analysis by sources. In the analysis by sources, we use the same steps as in the Figure above. Furthermore, in this category, several articles can be used as examples. There are other articles in this category, namely those entitled "Time Series Forecasting for Improving the Quality of Life and Ecosystem Services in Smart Cities". This article focuses on improving the quality of life and ecosystem services in smart cities through time series forecasting. It highlights the importance of actions on the Green Infrastructure of cities in enhancing the perception of quality of life. While LSTM and ARIMA networks have been used for environmental predictions, this article demonstrates that their seasonality can limit the accuracy of the predictions. To address this, the study presents a case application that utilizes IoT technology, Big Data, and Artificial Intelligence to collect environmental data. The data is then used for time series prediction using GAM models, which have proven to be the most efficient during testing. This approach enables the prediction of future environmental scenarios, aiding decision-making for urban actions implemented by local authorities [29]. There are other articles in this category, namely those entitled "The Role of Biogas Potential in Building the Energy Independence of the Three Seas Initiative Countries". Increasing biogas production in the Three Seas Initiative countries (3SI) can contribute to reducing greenhouse gas emissions and achieving energy self-sufficiency by replacing fossil fuel sources. An assessment of biogas production potential in the 3SI countries at the regional level shows stable potential for the period from 2010 to 2021, with variations between countries and regions. The biogas production forecast using the ARIMA model with four regressors indicates a significant increase in biogas production from 2022 to 2030 in the 3SI countries, ranging from 32.4% for the Czech Republic to 138.7% for Estonia compared to 2021. However, in six countries, full utilization of the potential is expected to occur in the fifth decade of the 21st century. These results vary depending on the regressors used, with different growth rates predicted. Overall, increasing biogas production has the potential to play a crucial role in building the energy independence of the Three Seas Initiative countries [30]. The following Figure describes visualization by sources in detail.



Figures 7. Visualization by sources.

The main findings from trend analysis using the ARIMA method in bibliometric studies have important implications for understanding trends and scientific developments in the fields of computers and mathematics. The use of the ARIMA method can assist practitioners and researchers in identifying relevant patterns and trends, as well as provide insight into future developments in this field. These implications can be used as a basis for strategic decision-making in policy development, research, and curriculum development. The results of our analysis are in line with related research that has been done previously. Previous research has also demonstrated the widespread and effective use of the ARIMA method in bibliometric analysis. However, we also observed some differences in research focus and scope. Our research focuses on the use of the ARIMA method in bibliometric studies in the fields of computers and mathematics, while related research may cover other fields of study or use different analytical methods.

The ARIMA method has advantages in its ability to identify patterns and trends in bibliometric data, as well as provide useful predictions for future developments. However, there are some limitations to note. For example, this method requires complete and high-quality data to provide accurate results. In addition, the interpretation of ARIMA analysis results requires a good understanding of the concepts and parameters associated with this method. Based on our findings and discussion, we provide several recommendations for further research in the field of bibliometric analysis using the ARIMA method. First, further research can broaden the scope of the study by involving larger datasets and covering a wider field of study. In addition, research can compare the effectiveness of the ARIMA method with other analytical methods in bibliometric analysis. In addition, the development of more sophisticated techniques and models also needs to be explored to increase the accuracy and validity of bibliometric analysis.

This research examines current trends in bibliometric analysis using the ARIMA method. Analysis of data from Scopus Web shows a significant increase in the use of ARIMA in recent years. This method has proven useful in understanding research trends and scientific developments in various fields. Although ARIMA excels at identifying and modeling trends, there are limitations in parameter selection and interpretation of results. This research provides important insights for researchers, practitioners, and policymakers to understand current research trends and make strategic decisions regarding scientific publications. Further research is recommended to validate the findings, compare ARIMA

with other methods, expand the scope of the study, and explore interdisciplinary applications of ARIMA.

4. Conclusions

In this study, we conducted a thorough review of studies that applied the ARIMA method in bibliometric analysis. We analyze datasets retrieved from Scopus Web using VOSviewer to identify current research trends in this field. The results of the analysis show that there is a consistent trend in the use of the ARIMA method to analyze scientific publications, with a significant increase in the number of studies applying this method in recent years. Our findings have important implications for practitioners and researchers in the field of bibliometric analysis. The use of the ARIMA method in the analysis of research trends provides valuable insights into scientific developments and can assist in making strategic decisions regarding the development and publication of scientific publications. This study also provides practical guidance for those who wish to use the ARIMA method in bibliometric analysis, including parameter selection and interpretation of results.

This research makes a significant contribution to the field of bibliometric analysis by focusing on the application of the ARIMA method. In this study, we summarize and analyze various related studies using this method and identify the strengths and weaknesses of its use. This research also fills the knowledge gap by providing a comprehensive overview of the latest research trends in bibliometric analysis using the ARIMA method. Although this research has provided valuable insights into recent research trends in bibliometric analysis using the ARIMA method, it has several limitations. First, we only use datasets from the Scopus Web, so there may be publications that are not included in our analysis. In addition, we only focus on applying the ARIMA method and do not consider other analytical methods. Therefore, future research can involve more datasets and consider various analytical methods to gain a more comprehensive understanding of research trends in bibliometric analysis. This research provides a strong foundation for further research in the field of bibliometric analysis using the ARIMA method. Some recommendations for future research are combining the ARIMA method with other methods to further analyze trends and patterns in scientific publications, involving a wider and verified dataset to increase the validity of the findings, and expanding the scope of research to cover other fields in bibliometric analysis.

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