

How to Conduct a Bibliometric Analysis using R Packages: A Comprehensive Guidelines

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Muhammad Fakhruhayat Ab Rashid*

*Geoinformatic Unit, Geography Section, School of Humanities, Universiti Sains Malaysia, 11800 USM, Pulau Pinang, Malaysia.
muhammadfakhruhayat97@gmail.com**

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Abstract

Bibliometric analysis is a common and rigorous technique for analyzing and evaluating vast quantities of scientific data. This research aims to provide bibliometric methodological guidelines by providing step-by-step instructions for doing bibliometric analysis. Biblioshiny is the shiny application for bibliometrix that employs an R package for bibliometric research processes. For bibliometric analysis, researchers have utilized "hajj pilgrims" as a topic of example study. Hajj pilgrims are one of the most rapidly expanding study topics globally. A textual query on Scopus database using the term "hajj pilgrims" was performed retrieving 236 scholarly documents from 2000 to 2022. In the current analysis, the researcher came to the conclusion that the number of annual scientific productions in Scopus has significantly highest publications in global trends in 2019 with 29 documents (12.29%). The most relevant authors is Rashid H with highest publication of 33 (14%) documents. In addition, the most popular journals in hajj pilgrims research are Travel Medicine and Infectious Disease with 18 (7.63%) documents published. The country of Australia has the highest contribution of scientific articles production with 508 frequency.

Keywords:

Bibliometrix, Bibliometric Analysis, R Package, Hajj Pilgrims, Biblioshiny App

1 Introduction

In recent years, the technique of bibliometric analysis has seen a popularity increase in the any area of research. This is because this technique provides a trend of research topic, citation, author, countries, collaboration, and so on (Donthu et al., 2021; Khan et al., 2021; Donthu et al., 2020). A bibliometric analysis involves utilized statistical methods in order to analyze qualitative and quantitative changes in a specific area of

scientific research, as well as the profile publications on the field and identify trends in the research (De Bakker et al., 2005). Furthermore, this type of analysis gives important information for scholars and academicians eager in analyzing scientific activity trends in any research topic (Duque Oliva et al., 2006).

Scholars utilize bibliometric analysis for a variety of purposes, including identifying emerging trends in article and journal performance, collaboration trends, and research topics, as well as analyzing the intellectual structure of a certain area in the existing research (Donthu et al., 2021; Donthu et al., 2020). When writing bibliometric articles, the appropriate data to focus on in bibliometric analysis tend to be large (e.g., hundreds, if not thousands) and the objective (e.g., number of citations and publications, occurrence of keywords and topics), although its interpretation frequently relies on both objective (e.g., performance analysis) and subjective (e.g., thematic analysis) evaluations established through informed techniques and procedures. The data utilized should preferably be large in order to analyze the trend development of the research topic. If the size of database gathered is small, it cannot provide satisfactory trend development information. This is due to the fact that when there is small data, there is no need to do bibliometric analysis since we can identify the development of trends in the database itself.

In other words, bibliometric analysis is useful for rigorously evaluating vast volumes of unstructured data, as well as for understanding and mapping the gathered scientific knowledge and the complexity of the growth of an already well-established research topic. Therefore, a bibliometric study that is properly carried out can provide a solid foundation for the advancement of the field. The bibliometric analysis help academics the ability to gain a comprehensive view, identify knowledge gaps, obtain research ideas, and outline their expected contribution to the field. In the modern era, bibliometrics has become a significant tool for assessing and analyzing researchers' production, collaboration between institutions and country, impact of status scientific productivity, and academic quality status. There are two hot themes in bibliometrics: performance analysis and scientific mapping analysis (SMA). The purpose of performance analysis is to assess various scientific entities such as researchers, institutions, countries, and so on using bibliographic indexes based on publications and citation data. In contrast, SMA is based on the topological and temporal representations of the cognitive and social structure of a certain research issue (Moral-muñoz et al., 2020). Bibliometric analysis is a powerful tool for exploring and analyzing large volumes of scientific data. For information, bibliometric analysis also can be performed by CiteSpace, CitNetExplorer, VOSviewer, Sci2 Tool, SciMAT, Bibexcel, and BiblioMaps.

The justification for doing this paper is to provide a comprehensive step-by-step how to conduct bibliometric analysis and to fill research gaps in bibliometric studies hajj pilgrims by providing information in the form of a literature review, overview, and guidelines. This article will guide through the steps of writing a bibliometric analysis using the R Package in a step-by-step approach. The significance of this studies showed that it has the potential to be helpful to new researchers and academics by providing information on significant steps that must be taken while writing research articles of

bibliometric analysis. This study's objective is to provide a comprehensive steps on how to write bibliometric analysis using the R package (R Programming and RStudio). It is important to do bibliometric analysis on articles in order to assess the current knowledge of any research topic. Network analysis may be used to discover hot issues and research trends, which can lead to a better understanding of the topics. The contribution of this study is that it may help researchers or academics who are new to articles of bibliometric analysis by providing information on how to write articles of bibliometric analysis. As a result of this, researcher have recommended that future study should concentrate on figuring out how to write bibliometric analysis using other software such as VOSviewer. In particular, this paper introduces bibliometric analysis to hajj pilgrims as example of overview trends using bibliometric analysis methods by R package.

2 Literature Review

In this part, researcher will briefly discuss the advantages of bibliometric analysis using R packages and the significance of bibliometric analysis.

2.1 Advantages of R Package: Bibliometric Analysis Technique

A bibliometric analysis review gives an overview of the body of research that has been carried out within the subject area that has been analyzed in a reasonable number of depth articles. Driven by this circumstance, the primary purpose of this study is to provide an in-depth guidelines of steps how to conduct a bibliometric analysis with employing software R packages (RStudio and Biblioshiny). The Biblioshiny analysis function generates research output analysis to determine the analysis of annual scientific production, the most productive authors, the most frequently used words, the most popular journal, countries collaborations, and so on related to the selected research issue. This analysis may help to update the present status, as well as the progress of trend research issue. In this study analysis, research has choose research issue in hajj pilgrims as example to conduct a bibliometric analysis using R packages. Although the researcher is aware that there are a few of tool and software that may do bibliometric analysis, but researcher has chosen to perform bibliometric analysis using R packages. This is because researchers recognize the advantages of bibliometric analysis using R packages compared to other software. Among the advantages of using R packages are make data analysis easier and faster, that visualizations and data are clearer, have many features that can be used for analysis, the web interface of Biblioshiny is constantly maintained and updated, and have been include a map that displays the results of data analysis.

2.2 The Significance of Bibliometric Analysis

Scholars and researchers use bibliometric analysis for a variety of significant. Several studies have highlighted the significance and function of R and its packages in a wide range of scientific disciplines. As example, the significance for bibliometric analysis studies is can help understanding of trends and patterns in order to discover hot topic

of research study. In addition, when conduct bibliometric analysis can help with analysis of structures and dynamics in order to discover of connections, relations, networks, collaboration among author, institutions, countries, and so on. It's also can help to discover journal impact metrics, calculated by the number of citations. As stated by Fakruhayat et al., (2022), there are a few features of the Biblioshiny web-interface that may be used to analyze data. The figure below shows the analysis of features that may be performed in Biblioshiny using the R package. This features analysis have significance to help novice and experts researchers to conduct a bibliometric analysis.

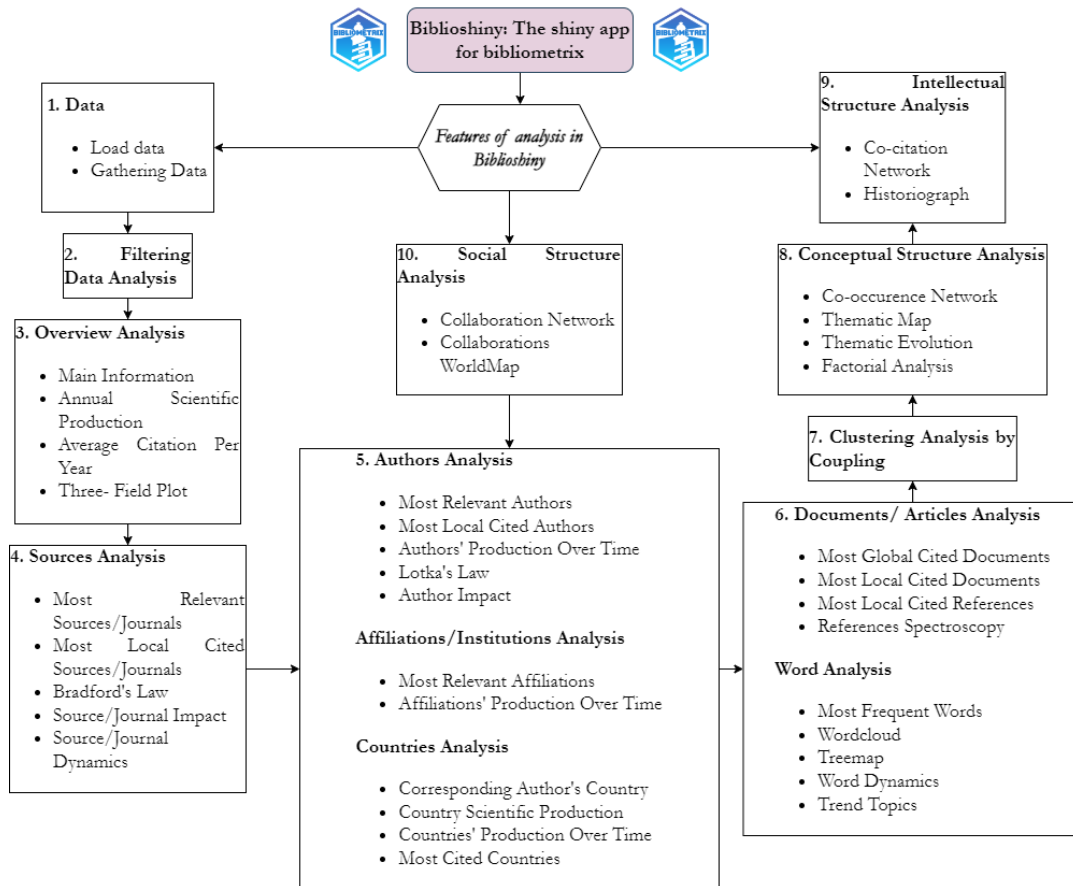


Figure 1: Features of Biblioshiny app for bibliometric

Source: (Ab Rashid, 2023)

3 Methodology

Bibliometrics has evolved into an essential tool for monitoring and analyzing academic and technological production and effect. Some inclusion criteria have already been specified in order to provide a sufficient state-of-the-art of the available tools for doing bibliometric and scientometric studies;

- a) Install the R Package bibliometric software
- b) Download the database that with bibliographic data

- c) Eligibility criteria (Screening process) of database
- d) Data analysis using bibliometric software

3.1 Installing Software tools for conducting bibliometric analysis

The bibliometric analysis consists of many processes, beginning with the selection of any software for performing bibliometrics, followed by the collection of databases from appropriate search engines, and the import of databases into bibliometric software. In this study, the researcher has decided to do a bibliometric analysis using R tools. Installing R packages such as R Programming and RStudio is the first step. R programming need to install (<https://cran.r-project.org/>), and RStudio (<https://posit.co/>) in order to open web interface of Biblioshiny.

R is a freely used software application. It offers open source software, such as the bibliometrix R-package, developed for bibliometric and scientometric analysis. The bibliometrix R-package is an impressive, flexible, and adaptable tool that assists in the bibliometric analyzes of this study (Aria & Cuccurullo, 2017). R packages utilized R Programming, RStudio, and Biblioshiny web interface to conduct a bibliometric. Biblioshiny is “*bibliometrix for no coders*”. It is the web-based graphical interface of Bibliometrix (Ahmi, 2022; Derviş, 2019; Aria & Cuccurullo, 2017). Biblioshiny for b Bibliometrix was written in R to facilitate interconnectivity with other R products. It was created by Massimo Aria and Corrado Cuccurullo from the University of Naples, as well as Luigi Vanvitelli from the University of Campania in Italy. It mainly works with database from Web of Science, Scopus, Dimensions, Lens.org, PubMed, and Cochcrane Library. The interface is simple and well-organized, with the main menu separated according to the SMA process. This menu includes statistics and graphs for three levels of metrics (source, author, and document) as well as three knowledge structures (conceptual, intellectual and social).

The analysis possibilities are extensive and are separated into seven categories, which are divided in the previously mentioned analytics and graphs. The produced graphs and performance assessments may be exported to a variety of file formats, including Pajek and HTML maps, and tables that can be copied to the clipboard, saved as Excel, pdf, or printed.

- a) Overview
- b) Sources
- c) Authors
- d) Documents
- e) Conceptual structures
- f) Intellectual structure
- g) Social structure

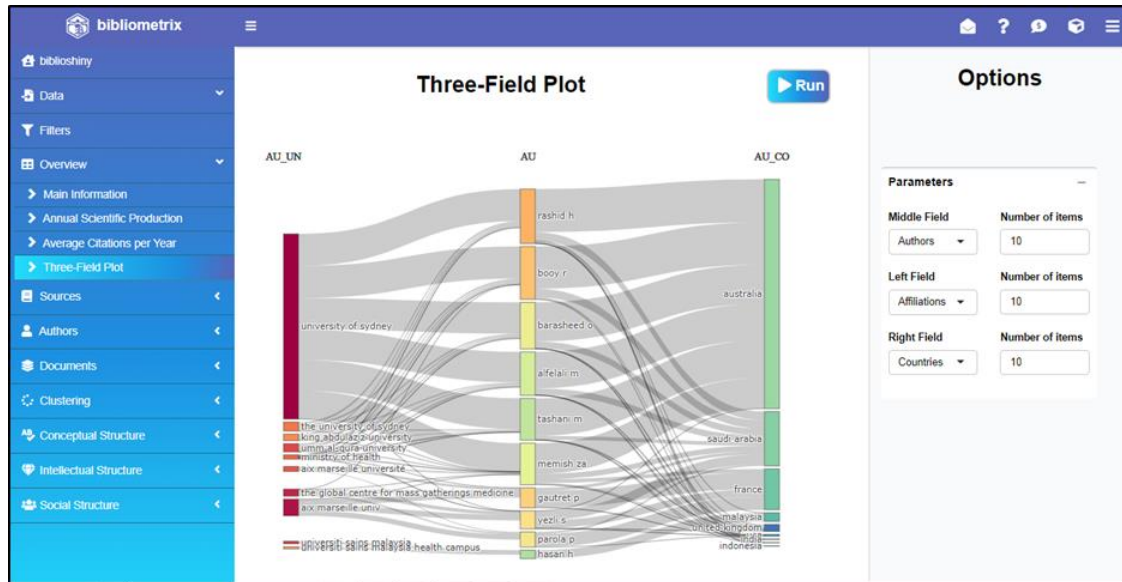


Figure 2: Illustration web interface of Biblioshiny using the RStudio 4.2.0 version

3.2 Downloading database source and Search strategy (Identification)

To conduct a bibliometric study, the first step is to choose the suitable data source that fits to the scientific scope of our research field. It is imperative to highlight the number of bibliographic databases. Using a general search query, data for this study were gathered from electronic databases in Scopus. Scopus is one of four well-known databases often used for bibliometric analysis, along with Web of Science, Google Scholar, and PubMed (Thananusak, 2019; Zheng & Kouwenberg, 2019; Falagas et al. 2008).

On December 16, 2022, a comprehensive and systematic search was conducted utilizing the online database Scopus. Database searches were restricted to a single day in order to avoid the possibility of bias induced by the frequent updates. For the example bibliometric analysis review, the researcher focused on articles regarding hajj pilgrims that were indexed by Scopus databases between 2000 and 2022. The terms “hajj pilgrims” assessment have been used specifically in the search query, as well as in the titles, abstracts, and keywords of the results. According to the standards of Scopus database, words that are surrounded by double quotes are considered as a whole (one unit) throughout the search process, and the terms will appear together in the exact order as in the formula that was searched. The following is an example of the search strategy as below;

- a) Topic: (“hajj pilgrims”)
- b) Refined by: Document types in Scopus: Only articles research documents
- c) Criteria : “titles, abstract and keywords (topic area)”
- d) Year Published: 2000-2022
- e) Language: English

Table 1: The search string

Database Search string	Search string strategy Boolean operators	No. Documents
Scopus	TITLE-ABS-KEY(("hajj pilgrims")) AND (LIMIT-TO (PUBYEAR,2022) OR LIMIT-TO (PUBYEAR,2021) OR LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013) OR LIMIT-TO (PUBYEAR,2012) OR LIMIT-TO (PUBYEAR,2011) OR LIMIT-TO (PUBYEAR,2010) OR LIMIT-TO (PUBYEAR,2009) OR LIMIT-TO (PUBYEAR,2008) OR LIMIT-TO (PUBYEAR,2007) OR LIMIT-TO (PUBYEAR,2006) OR LIMIT-TO (PUBYEAR,2005) OR LIMIT-TO (PUBYEAR,2004) OR LIMIT-TO (PUBYEAR,2003) OR LIMIT-TO (PUBYEAR,2002) OR LIMIT-TO (PUBYEAR,2000)) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (LANGUAGE,"English"))	236
Scopus	Total documents database	236

Researchers retrieved an example database of documents from Scopus in *CSV format in order to analyze all of the important information included in publication databases. This comprises the paper's title, author's name and affiliation, abstract, keywords, journal's name, citations, and so on. The gathered data were analyzed using RStudio software, version 4.2.0, by the researcher. After refining the database publishing, 236 papers were obtained from Scopus. Utilizing the bibliometric tool known as Biblioshiny, it is possible to visualise and analyze trends in hajj pilgrims' study.

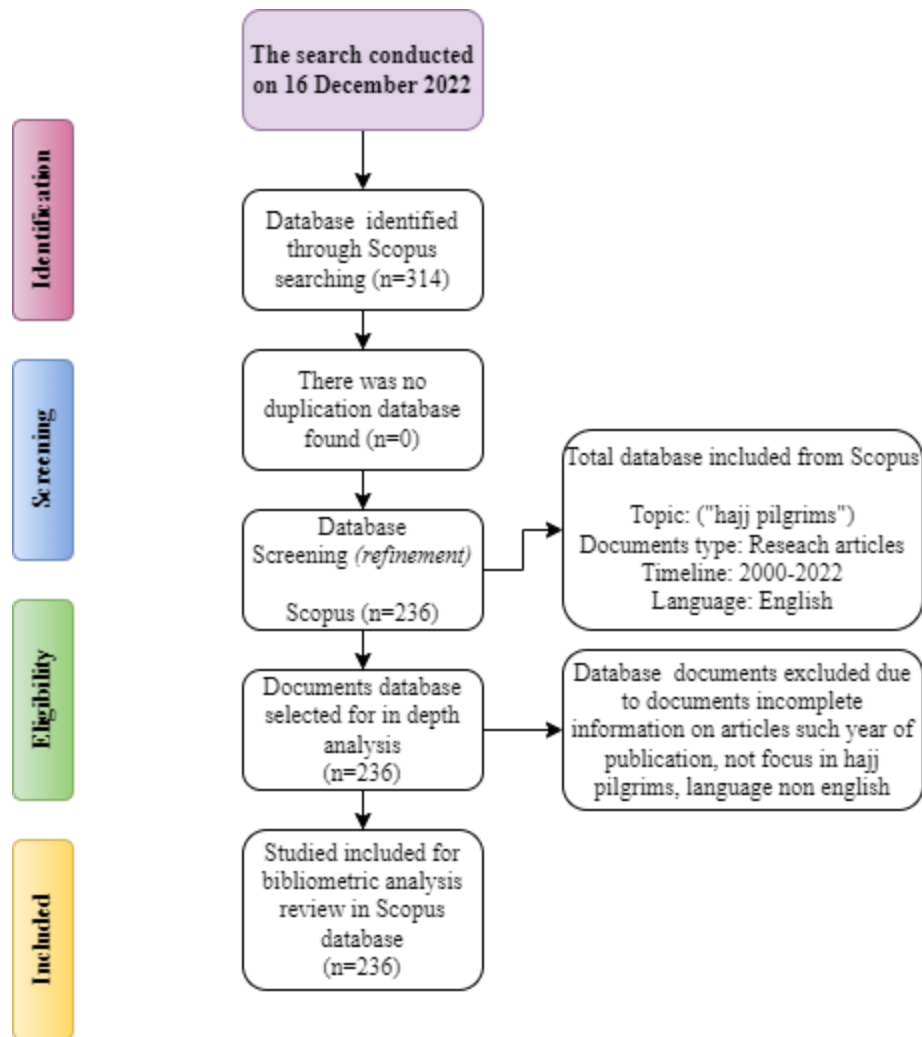


Figure 3: Flowchart for study selection

3.3 Data Analysis (Imported Data)

A bibliometric analysis study based on a systematic evaluation of documents on hajj pilgrims was conducted using the R packaged (R programming language and RStudio version 4.2.0). Open source tools, such as the bibliometrix R-package, designed specifically for bibliometric and scientometric analysis which is are provided with free and sufficient R programming language. RStudio 4.2.0 was used by the researcher and was operating on a Windows 8.1 computer. The steps to open and launch Biblioshiny using RStudio is as below;

- a) Type > install.packages("bibliometrix") – Applicable for first time user
- b) Type > library(bibliometrix)
- c) Type > Biblioshiny(bibliometrix)/ > Biblioshiny()

After types the coder on RStudio at the command console to launch the Biblioshiny web-interface. Researcher imported data from Scopus databases into the Biblioshiny

programme to analyze the data (Fakruhayat et al., 2022). A bibliometric analysis of the hajj pilgrims research area has been conducted in order to obtain a research output analysis of annual scientific production, country scientific production, the most relevant authors, and the most relevant journals. Figure 3 below shows the steps to launch Biblioshiny web-interface that can be used to analyze the data.

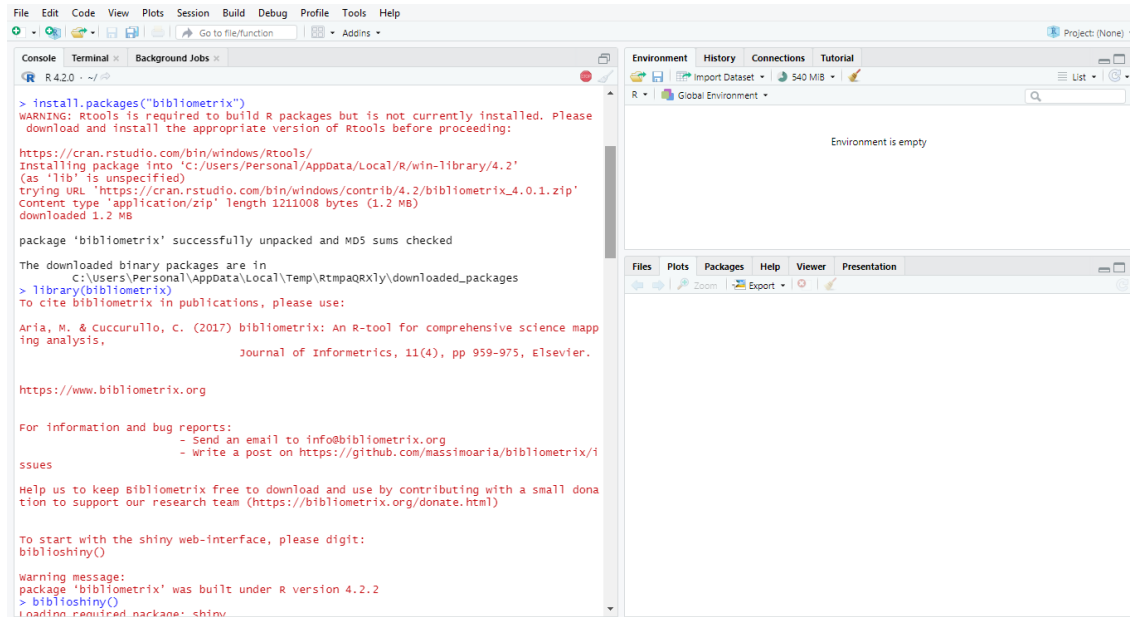


Figure 4: Steps to launch Biblioshiny web-interface using RStudio version 4.2.0

4 Findings and Discussion

Based on the published literature, an overview of hajj pilgrims research is presented. From 2000 to 2022, the gathered database comprised all types research articles and was limited to English only. The database information gathered from Scopus has been retrieved. Researcher obtained 236 databases of documents from Scopus on relevant topics such as hajj pilgrims from 2000 to 2022. Using Biblioshiny web interface, research will run a few analysis to show how Biblioshiny can help to perform bibliometric analysis review.

4.1 Annual Scientific Production

Table 2 contains data from the scopus database. The collection comprises 236 documents spanning the years 2000 to 2022, with an annual growth rate of 13.1%. According to the findings of the Scopus database analysis, 2019 had the most number of article publishing with 29 articles, followed by 2021 with 22 articles, and 2001 with zero articles. The trend of article publishing in Scopus from 2000 to 2022 is increasing, despite slight inconsistencies.

Table 2: Annual scientific publications and average citation per year from 2000 to 2022

Year	Articles	Percentage (%)	MeanTCperYear	CitableYears
2000	1	0.42	10.59	22
2001	0	0.0	0.00	0
2002	4	1.70	3.73	20
2003	8	3.39	2.55	19
2004	3	1.27	3.93	18
2005	2	0.85	2.50	17
2006	4	1.70	1.19	16
2007	5	2.12	0.85	15
2008	4	1.70	2.23	14
2009	5	2.12	2.34	13
2010	9	3.81	1.83	12
2011	3	1.27	1.45	11
2012	4	1.70	2.30	10
2013	18	7.63	2.83	9
2014	16	6.78	3.64	8
2015	15	6.36	3.43	7
2016	19	8.05	2.50	6
2017	10	4.24	2.86	5
2018	21	8.90	2.21	4
2019	29	12.29	1.80	3
2020	19	8.05	2.16	2
2021	22	9.32	1.86	1
2022	15	6.36	0	0

Annual Scientific Production

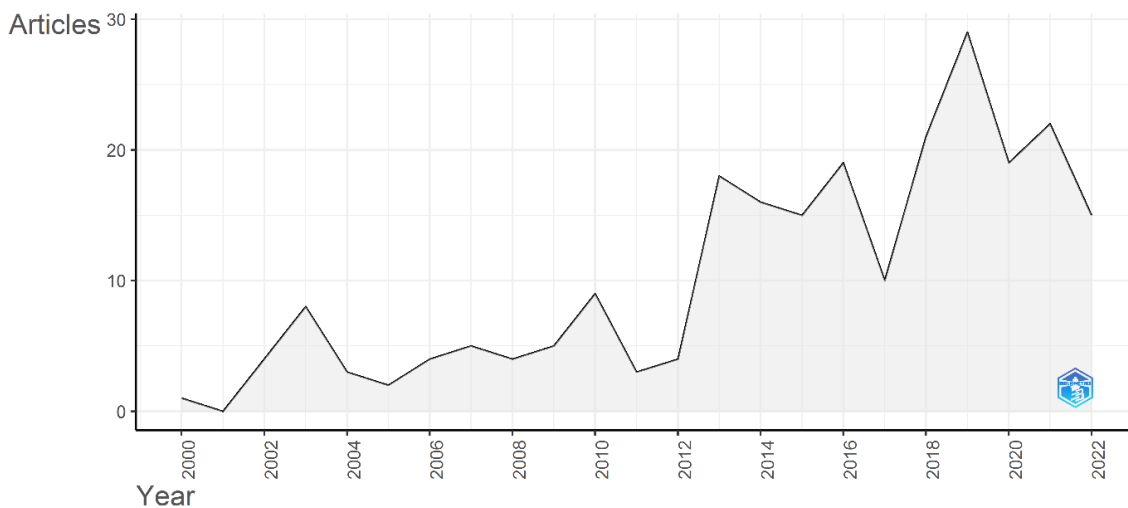


Figure 5: An annual publication of the research paper in hajj pilgrims.

Source: Graph generated using Bibliometrix - R tool

4.2 Most relevant Authors

The top authors who contributed to the hajj pilgrims research papers from 2000 to 2022 are shown in Table 3 and Figure below; the following parameters are - articles produced by authors in the hajj pilgrims, and authors local impact. In 236 documents, a total of 1560 authors contributed to research on hajj pilgrims. The table below lists the top 10 authors. According to the results, Rashid H is the author has contributed a total of 33 documents in that study. This author was followed by Booy R (29 documents), Gautret P (27 documents), and Yezli S (24 documents). The data also reveals that Rashid H has the most total citations among the top 10 overall authors, with 554 citations.

Table 3: Top 10 most relevant author in hajj pilgrims

Authors	Articles	Percentage (%)	Articles Fractionalized	h_index	g_index	m_index	C	P	PY_start
Rashid H	33	14.00	4.01	15	23	0.938	54	3	2007
Booy R	29	12.30	2.99	14	22	0.875	00	9	2007
Gautret P	27	11.40	3.68	15	22	0.938	24	7	2007
Yezli S	24	10.20	3.05	10	18	1.111	52	4	2014
Parola P	20	8.50	2.55	12	20	0.75	02	0	2007
Barasheed O	19	8.10	1.39	10	16	1.111	81	9	2014
Memish ZA	19	8.10	2.41	15	19	0.789	15	9	2004
Alfelali M	17	7.20	1.81	8	13	0.889	71	7	2014
Tashani M	15	6.40	1.22	8	14	0.889	19	5	2014
Hasan H	14	5.90	2.27	6	14	0.429	07	4	2009

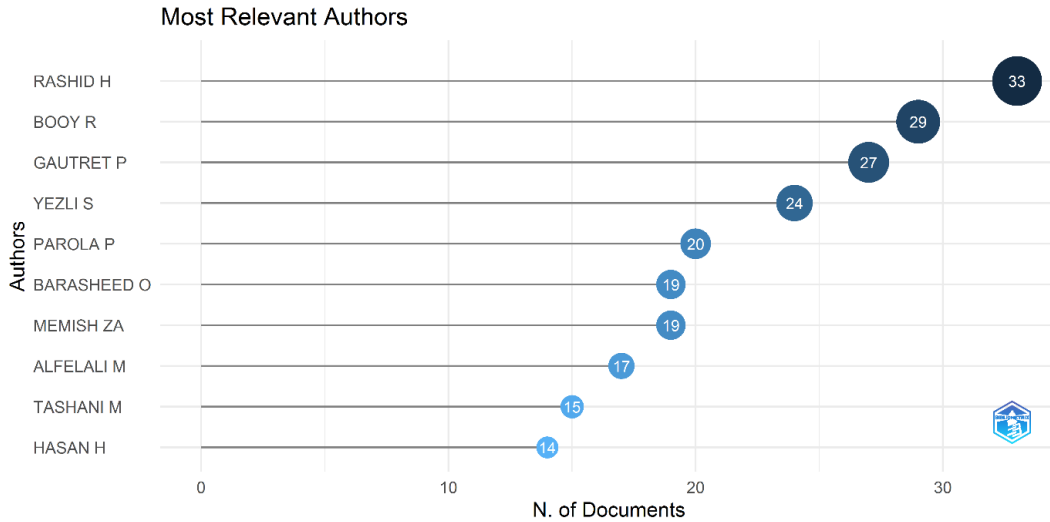


Figure 6: The top ten most relevant authors in the research paper of hajj pilgrims.

Source: Graph generated using Bibliometrix - R tool

4.3 Most Relevant Journals (Sources)

In 236 document publications, the Scopus database recognised 133 journals. The table 4 below lists the top ten most relevant journals that have published a large number of documents on hajj pilgrims study. The most popular journals, according to the study’s results, are Travel Medicine and Infectious Disease which have 18 articles published. The Journal of Travel Medicine came in second placed with 14 published documents, while the Indian Journal of Public Health Research and Development ranked in tenth place with 4 published articles. The Journal of Travel Medicine had the most total citations with 517 citations.

Table 4: Top 10 most relevant journals in hajj pilgrims

Most Relevant Journals	Articles	Percentage (%)	h_index	g_index	m_index	TC	NP	PY_start
Travel Medicine and Infectious Disease	18	7.63	11	18	0.688	326	18	2007
Journal of Travel Medicine	14	5.93	10	14	0.5	517	14	2003
International Journal of Infectious Diseases	9	3.81	9	9	1	241	9	2014
Saudi Medical Journal	7	2.97	6	7	0.286	84	7	2002
Infectious Disorders - Drug Targets	6	2.54	6	6	0.667	137	6	2014
Vaccine	6	2.54	5	6	0.333	86	6	2008
Emerging Infectious Diseases	5	2.12	5	5	0.25	228	5	2003
BMC Infectious Diseases	4	1.7	2	4	0.118	40	4	2006
Eurosurveillance	4	1.7	4	4	0.4	111	4	2013
Indian Journal of Public Health Research and Development	4	1.7	1	1	0.25	2	4	2019

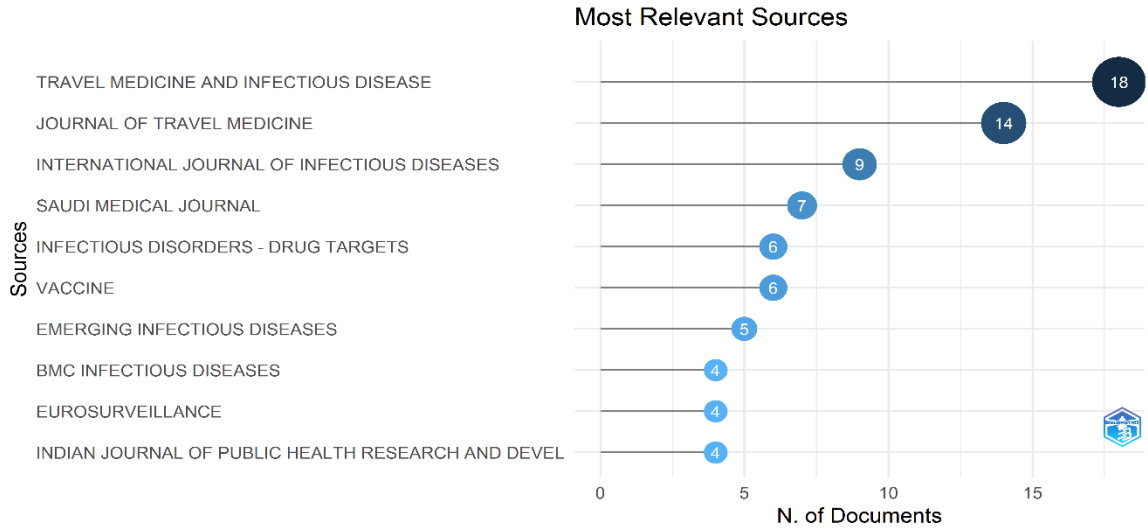


Figure 7: The top ten most relevant journals in the research paper of hajj pilgrims.

Source: Graph generated using Bibliometrix - R tool

4.4 Country Scientific Production

The table 5 below shows the findings of a global analysis of the country’s scientific production. The top 10 countries in the world in terms of scientific articles on the topic of hajj pilgrims were identified in this study. The databases Scopus showed the world’s top ten countries in terms of country scientific productivity between 2000 and 2022. In Scopus database, there are 38 countries around the world had contributed. There have been approximately 508 articles relating to this subject in the Scopus database from the Australia. The country of Saudi Arabia has 344 articles came in second position; France (227 articles) came in third; whereas the 10th-placed is India with 40 article published. In addition, The highest total citation among top ten countries is France with 612 citations.

Table 5: Top 10 most country scientific production in hajj pilgrims

Country	Frequency	TC	Average Article Citations
Australia	508	434	16.07
Saudi Arabia	344	505	13.65
France	227	612	19.74
Malaysia	219	251	8.96
Iran	80	242	16.13
USA	75	330	41.25
Indonesia	73	41	3.15
UK	72	142	14.20
Turkey	49	97	19.40
India	40	35	7.00

Country Scientific Production

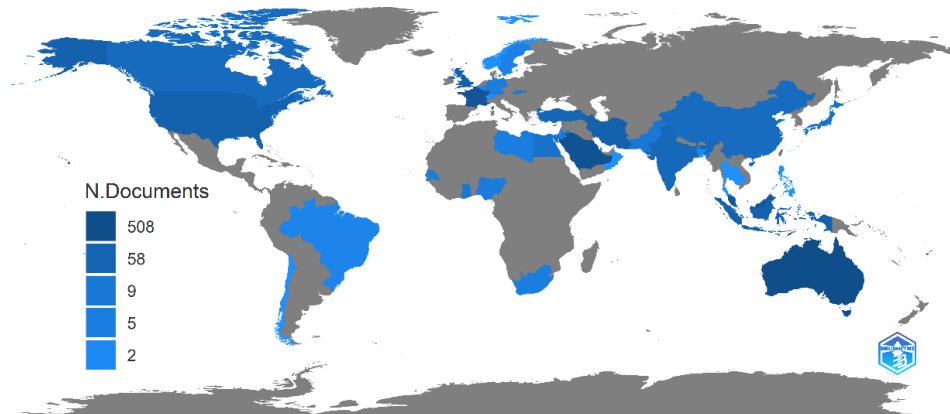


Figure 8: Top 10 most country scientific production in hajj pilgrims

Source: Map generated using Bibliometrix - R tool

DISCUSSION

This section will be discussed and shown a detailed study of the most important bibliometric or scientometric tools and software. Bibliometrix and interface Biblioshiny are noteworthy for including a wide range of various analysis. In practice, since it is new, most of the prior software tools' analyses have been merged into Bibliometrix or Biblioshiny. For instance, it allows to extract and analyze a bibliometric network (thematic, authors, and references, among others), conduct an evolution study, construct a performance analysis based on various indicators, apply burst detection, draw a spectrogram, and display the geographical component. Taking into view bibliometric networks, however, most SMA can function with the most common (thematic, authors, and references).

Other types of bibliometric networks may be used with Biblioshiny or Bibliometrix. Metaknowledge can function with a wide range of networks due to the R and Python libraries. A spectrogram may be created with Bibliometrix or Biblioshiny and metaknowledge. Bibliometrix or Biblioshiny, can allow for the creation of an evolution analysis. Finally, we should note that each of the evaluated software tools has benefits and disadvantages, and so the analyst should choose the appropriate software for each individual study. At this moment, maybe Bibliometrix and Biblioshiny platform contain the more extensive set of techniques implemented, and together with the easiness of its interface, could be a great software for practitioners.

A bibliometric analysis was performed to analyze global trends in hajj pilgrims research from 2000 to 2022. Annual scientific production and average citations per year, most relevant journals, most relevant authors, and country scientific production to get research output have all been analyzed. In the current analysis, the researcher came to the conclusion that the number of annual scientific productions in Scopus has significantly highest publications in global trends in 2019. The most relevant authors,

according to the findings of the analysis is Rashid H with highest publication 33 documents published. In addition, the most popular journals in hajj pilgrims research are Travel Medicine and Infectious Disease with 18 documents published. The country of Australia has the highest contribution of scientific articles production with 508 frequency.

5 Conclusion

In conclusion, this work showed that bibliometric analysis is a scientific approach that may be beneficial for both experienced and new researchers who seek to pursue a retrospective of trends and overview of any research topic. This study demonstrates the importance of the methods used and the choices made at each stage of the bibliometric analysis process since it affect the outcomes of the analysis. A R package for bibliometric analysis is called Bibliometix. As an example of how to carry out a bibliometric study using the R package, the researcher analyzed the trends and development of research on hajj pilgrims. Software tools for bibliometric analysis are widely available. However, for beginners, utilizing R packages is more easy.

Bibliometric analysis is an effective method of summarizing and synthesizing literature research trends. The bibliometric methodology can empower and help scholars to understands the trend of any research topic with large bibliometric datasets. The enhanced understanding of steps to conducting a bibliometric analysis can facilitate novice researcher. This research note was carried out to cover gaps in previous studies by showing a comprehensive step-by-step how to conduct a bibliometric analysis. Researcher recommend for future research note is evaluate and focus on other software tools to discover how its work to help others novice researcher to learn more about other software when conducting a bibliometric analysis.

6 About the author

Muhammad Fakruhayat Bin Ab Rashid is a talented researcher from Universiti Sains Malaysia, Penang campus. He pursued his Degree in Arts (Geography), specializing in geographic information system (GIS), Human Geography, Physical Geography and then continued his Master Degree by research mode, specializing in Human Geography at Universiti Sains Malaysia. He has more than 3 years experiences in research, writing and publishing high impact articles. He is currently acting as research assistant.

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