

Publications Affiliated with Universitas Muhammadiyah Surakarta from Indonesia in Scopus Database: A Bibliometric Analysis

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ABSTRACT

The publication output of higher education institutions can have a significant impact on their reputation. This VOSviewer-based bibliometric study summarises Scopus-indexed Universitas Muhammadiyah Surakarta (UMS) publications. The number of UMS publications was rising. From the international collaboration perspective, UMS has collaborated the most with Malaysia. Tri Widodo B Riyadi is the most productive UMS-affiliated author, with 46 publications. Among UMS-affiliated authors who co-authored with fewer than 25 authors, Hidayah Karuniawati had the most cited publications. The current research hotspot of UMS is in health and drug development aspects. UMS outperformed other private universities in Central Java with its impressive record of 1350 publications and extensive international collaboration with 122 countries. UMS has succeeded in augmenting the quantity of Scopus articles, but UMS must seek out techniques to enhance its citation rate.

Keywords: Universitas Muhammadiyah Surakarta; Bibliometric analysis; Scopus; VOSviewer

1. INTRODUCTION

Institutional reputation articles have increased during the past decade¹, reflecting academics' rising awareness of their importance². One way to assess and classify higher education institutions is based on their researchers' productivity³. Publications, including scientific articles, review articles, book chapters, and conference proceedings, may provide research findings. Publication in reputable journals or publishers is essential in light of the current rise in questions about certain journals. These journals have been considered dubious, predatory, pseudo-deceptive, unethical, illegitimate, or dishonest⁴.

Scopus is an indexing database of peer-reviewed publications in all scientific, technological, and medical fields. Scopus developers say Scopus, the world's largest abstract and citation database, has over 22,000 titles from over 5,000 publishers. Scopus tracks, analyses, and displays scientific output with bibliometric tools. It helped researchers analyse a particular topic.

Previous bibliometric research has been conducted in certain fields such as science, medicine, psychology, and STEM⁵. As a result, bibliometric analysis has become popular in science education studies in recent years⁶. Some universities have conducted bibliometric analysis using the Scopus database to evaluate their publications. Al-Jouf University discovered through a bibliometric study that their research publications were increasing and improving⁷.

During the COVID-19 pandemic, Bucharest University of Economic Studies academics published more and better medical articles, according to a bibliometric analysis⁸. Through a bibliometric study, Universiti Teknologi Malaysia found their publications were lacking in various fields, even though they had a respectable number of authors and experts⁹. In Indonesia, Diponegoro University discovered their publication rate from 2014 to 2018 was the fastest compared to other top ten universities in Indonesia based on bibliometric analysis¹⁰. This finding prompted us to analyse Universitas Muhammadiyah Surakarta (UMS) publications using bibliometrics.

UMS is a higher education institution in Central Java of Indonesia, under the Muhammadiyah Association, which was founded on October 24, 1981. Academics at UMS continue to publish in both national and international journals. Using bibliometric methods, this study presents an overview of research productivity in a UMS study case to enhance previously published work in Scopus-indexed journals or publishers and to assess our institution to enhance its performance.

2. METHODOLOGY

Figure 1 presents the flowchart of the study methodology. Scopus database was queried for UMS-affiliated publications on June 12, 2023. The following was search query: (AFILL ("Universitas Muhammadiyah Surakarta") OR AFILL (Muhammadiyah University of Surakarta)) OR AFILL ("Muhammadiyah Surakarta University"). This

bibliometric analysis counted English-language UMS-affiliated publications with no year limit.

The bibliographic information was extracted and saved in CSV format. The data was exported and analysed with VOSviewer 1.6.18. Publications by UMS-affiliated authors were analysed annually for publication trends. The full-counting method was used for co-authorship, co-occurrence, and citation analysis. The weight of the analysis is proportional to the number of links it exposes¹¹. Citation and co-authorship analysis excluded publications with many authors, nations, or organisations. Twenty-five was the utmost number of authors, countries, or organisations allowed. The analysis findings were shown as network visualisation and/or overlay visualisation maps. In the visualisation maps, each item of the unit analyses (authors, keywords, organisations, etc.) is symbolised by a circle. Its dimensions expanded proportionally with publications or keyword occurrences¹². The colour of the circle corresponds to the cluster to which each item belongs¹³. Each circle with a relationship to another circle is linked by a line. Regarding co-authorship, co-occurrence, and co-citation, the distance between the two circles represents their relationship¹⁴.

3. RESULTS AND DISCUSSION

3.1 Publication Trends

UMS-affiliated authors published 1350 Scopus-indexed publications from 2004 to data collection. The publications were categorised into article (871), conference paper (422), review (26), book chapter (10), data paper (8),

editorial (7), erratum (5), and letter (1). Kusmiyati from the Department of Chemical Engineering at UMS and Nor Aishah Saidina Amin from Universiti Teknologi Malaysia co-authored the first article in the Journal of Natural Gas Chemistry. The most recent UMS-affiliated publication was authored by Kun Harismah from the Department of Chemical Engineering and Mahmoud Mirzaei from the Child Growth and Development Research Center of Isfahan University of Medical Sciences and published in Biointerface Research in Applied Chemistry.

Figure 2 illustrates the trend of publications by UMS-affiliated authors. The number of publications tended to increase every year. Publications roughly doubled in 2018 and 2019 with 111.86 and 84.80 annual growth rates (AGR), respectively (Table 1). The AGR was determined by applying the following formula¹⁵:

$$\text{AGR} = \frac{\text{end value} - \text{first value}}{\text{First value}} \times 100$$

Publications by UMS-affiliated authors increased slightly in 2020 and reached their peak in 2021 (Fig. 2). However, publications were down 18.75 percent in 2022. The COVID-19 pandemic likely caused the recent trend. After the pandemic, we anticipate the number of publications will increase again.

3.2 Analyses of Contributing Countries and Collaborations

All publications came from 135 different countries. After excluding publications co-authored by more than 25 countries, the analysis was limited to 61 countries.

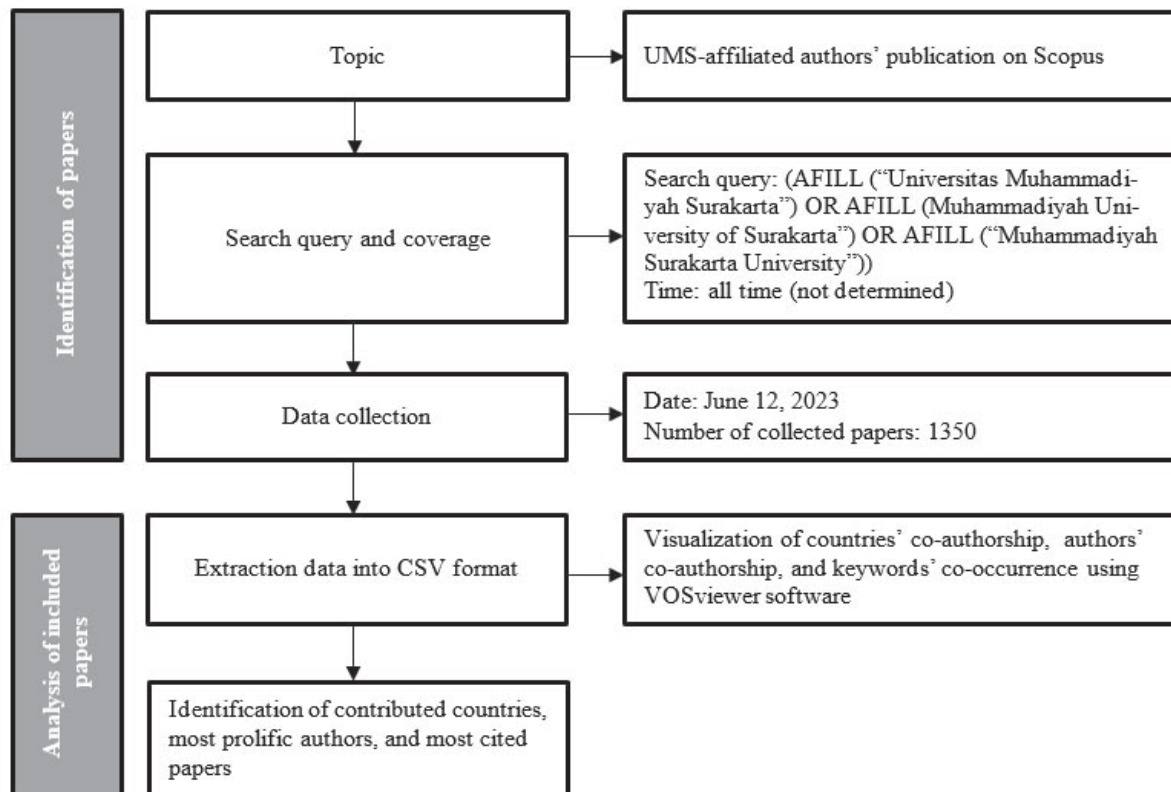


Figure 1. Study methodology flowchart.

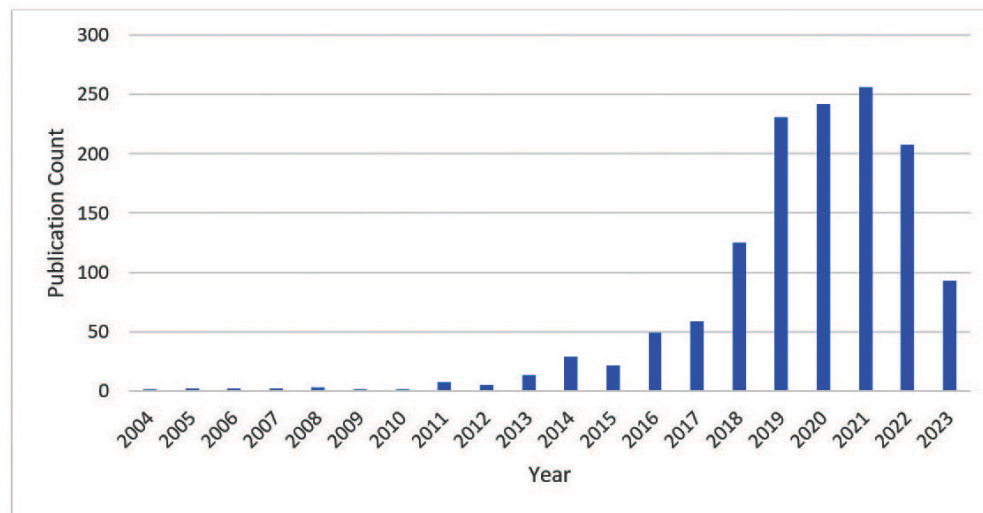


Figure 2. Publication trends of UMS-affiliated authors.

Table 1. Annual growth rate of publications by UMS-affiliated authors

Year	Publication count	AGR ¹
2014	29	0
2015	21	-27.59
2016	49	133.33
2017	59	20.41
2018	125	111.86
2019	231	84.80
2020	242	4.76
2021	256	5.79
2022	208	-18.75
2023	93	-55.29

¹AGR = annual growth rate

The top ten countries with the most publications co-authored by UMS-affiliated authors are listed in Table 2. The majority of the countries on the list were located in Asia. Malaysia has collaborated with UMS-affiliated authors on 199 publications, more than any other country. This may be related to the geographical proximity of Malaysia and Indonesia. The United Kingdom came in as the second-most collaborating country with UMS-affiliated authors, with 56 publications, followed by Iran (47), Australia (33), and India (25). When considering the average number of citations, publications co-authored with Australia have the greatest academic impact compared to those co-authored with other countries (8.67). The United Kingdom ranked second (8.09), followed by Saudi Arabia (8.00), Russia (7.85), and Iraq (7.38).

The network and overlay visualisation map of international collaboration revealed twenty-three countries with at least five publications co-authored with UMS-affiliated authors (Fig. 3). The thickness of the line and the distance between the circles represent the strength and the relationship between them^{13,14,16}. The circle of Indonesia, which represented the UMS-affiliated authors, had the thickest line and was closest to the circle of Malaysia. It

Table 2. Top 10 collaborative countries by publication count

S. No.	Country	PC ¹	CC ²	AC ³
1	Malaysia	199	700	3.52
2	United Kingdom	56	453	8.09
3	Iran	47	203	4.32
4	Australia	33	286	8.67
5	India	25	83	3.32
6	Japan	23	112	4.87
7	Iraq	21	155	7.38
8	Thailand	15	53	3.53
9	Russia	13	102	7.85
10	Saudi Arabia	13	104	8.00

¹PC = publication count; ²CC = citation count; ³AC = average citation

indicated they had the strongest collaborations. Additionally, both appeared in the same cluster, which was yellow (Fig. 3a). UMS-affiliated authors have had recent international collaborations with Iraq, Egypt, Saudi Arabia, and Hungary. (Figure 3b). Bibliometric studies can understand a topic more deeply and be able to find out existing research maps¹⁷. The absence of a dominant circle color on the overlay visualisation map indicated that the number of international collaborations tended to be stable each year.

3.3 Analyses of Contributing Authors and Collaborations

There were 6645 authors in total who contributed to the 1350 publications. After excluding articles with more than 25 authors, 2769 authors were analysed. The number of publications by UMS-affiliated authors reflects their contribution to the overall output of UMS. Table 3 summarises authors with 15 or more publications. Tri Widodo B. Riyadi had the most Scopus-indexed publication (46). Kun Harismah received the most citations, a total of 190 from 42 publications (citations averaged 4.52). Meanwhile, Andi Suhendi has the highest average citations (6.00) from his 15 publications. The top UMS-affiliated UMS had an H-index below 10, and the highest H-index

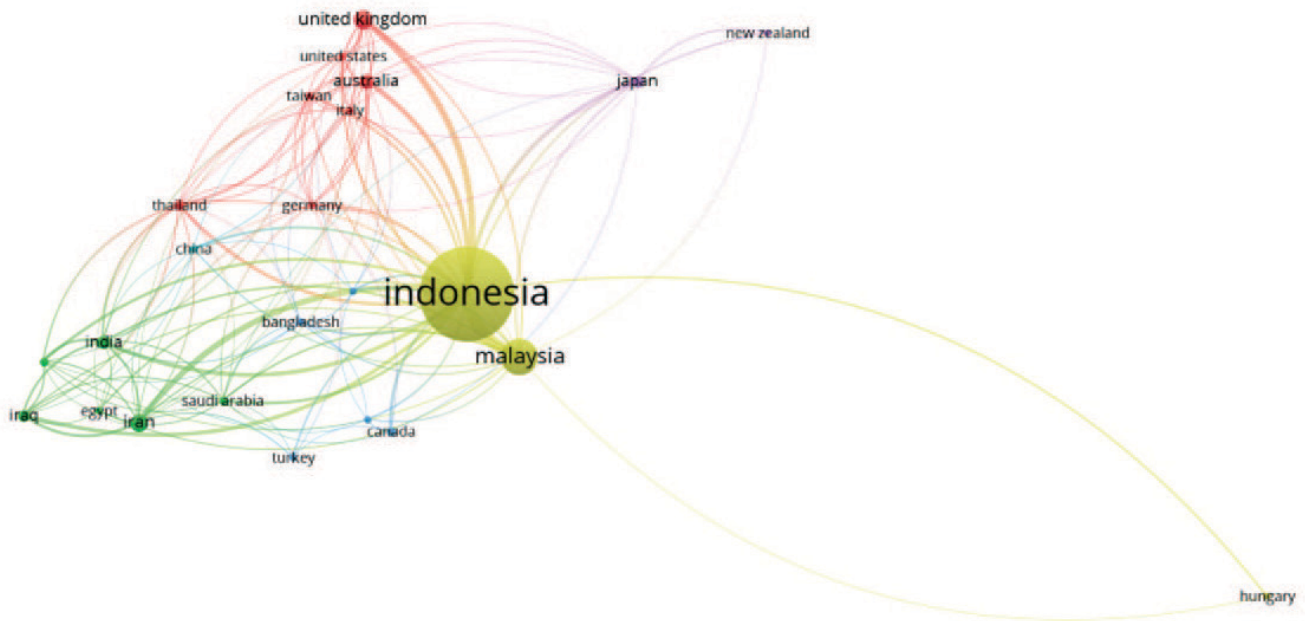


Figure 3(a). VOSviewer network visualisation map.

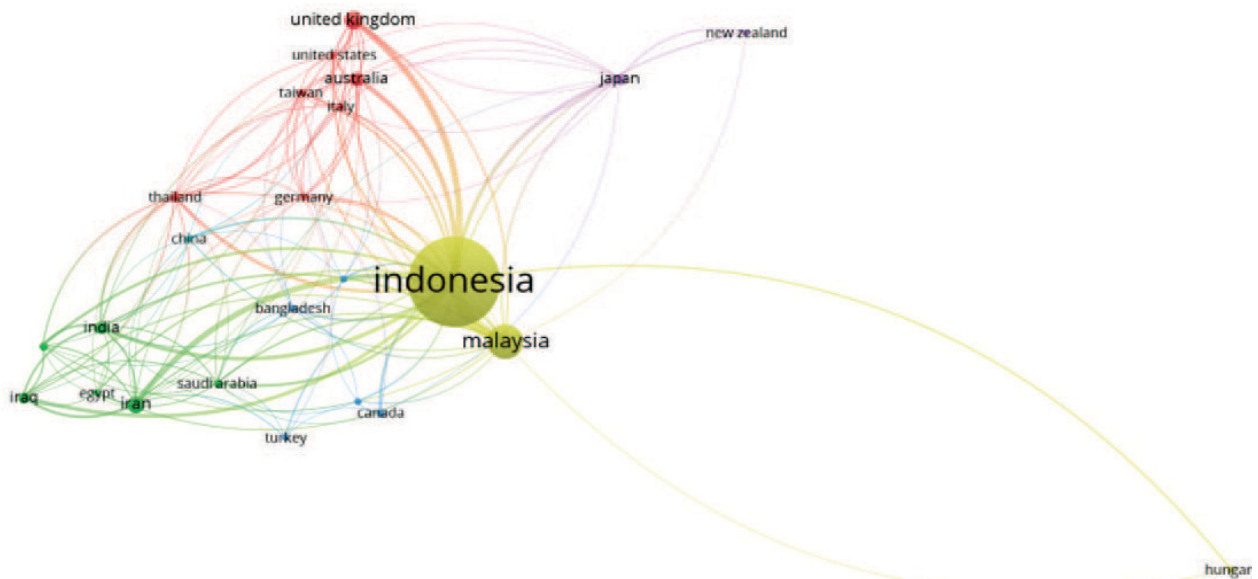


Figure 3(b). VOSviewer overlay visualisation map.

Figure 3. Largest set of connected countries on publications authored by UMS-affiliated authors.

was Kun Harismah (9). The h-index¹⁸ is commonly used to evaluate the productivity and influence of authors¹⁹. Based on this reality, UMS members must evaluate and improve their research performance. However, the majority of the top authors published in 2023, so we appreciate their efforts to enhance UMS publications.

A co-authorship analysis was created using a minimum of five publications per author to visualise the authors' collaboration. Only 162 of the 179 qualifying authors were connected and grouped into 14 clusters (Fig. 4a). The overlay visualisation (Fig. 4b) demonstrates that most writers published in 2019 and after. This is consistent with the trend of UMS publications in 2019, which had doubled.

3.4 Keyword Co-occurrence Analysis

Keyword co-occurrence analysis revealed UMS members' main study subjects. A total of 3600 keywords were examined from 1350 UMS-affiliated publications. Only five or more keywords were visualised. The largest group of connected keywords comprised 34 out of the 46 keywords that appear at least five times (Fig. 5a). They were divided into eight clusters with 59 links and a total link strength of 97. The relationship between two frequently occurring words in a publication may be closer than that of other word pairs¹⁴. "Indonesia", which had the largest circle size, appeared most frequently and had a shorter distance with "local wisdom". It indicated "Indonesia" had a strong relationship with "local wisdom". Indonesia's

Table 3. Top 24 most prolific UMS-affiliated authors

S. No.	Author name	H-index	PC ¹	CC ²	AC ³	Year of the latest publication
1	Riyadi, Tri Widodo B.	5	46	159	3.46	2023
2	Siswanto, W.A.	8	44	147	3.34	2023
3	Harismah, Kun	9	42	190	4.52	2023
4	Darmawan, Agung S.	7	36	100	2.78	2023
5	Anggono, Agus Dwi	6	35	89	2.54	2022
6	Budiono, Arief	5	32	59	1.84	2023
7	Hidayati, Nur	6	31	53	1.71	2023
8	Prayitno, Harun Joko	5	28	54	1.93	2023
9	Sudarmillah, Endah	5	27	67	2.48	2022
10	Effendy, Marwan	6	23	123	5.34	2023
11	Mirzaei, Mahmoud	32	23	129	5.61	2023
12	Dimyati, Khudzaifah	3	22	37	1.68	2023
13	Sunarjono, Sri	4	20	36	1.80	2023
14	Wikantyasning, Erindyah	5	19	52	2.74	2023
15	Absori, Absori	5	18	33	1.83	2023
16	Purboputro, Pramuko I.	3	18	29	1.61	2023
17	Da'i, Muhammad	8	17	67	3.94	2023
18	Ishartono, Naufal	3	17	31	1.82	2022
19	Yuspin, Wardah	2	17	15	0.88	2023
20	Febriantoko, Bambang W.	4	16	42	2.63	2023
21	Wardiono, Kelik	3	16	28	1.75	2023
22	Saputra, Aditya	5	16	58	3.63	2023
23	Suhendi, Andi	7	15	90	6.00	2023
24	Solikin, Mochamad	4	15	39	2.60	2022

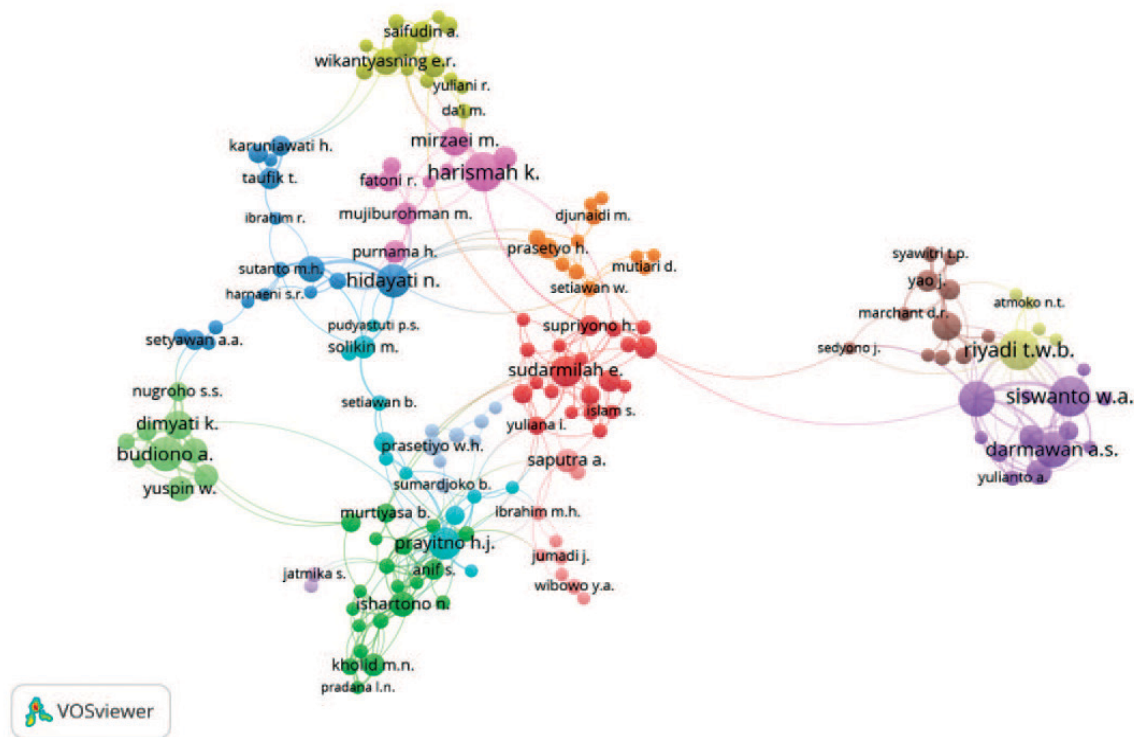
¹PC = publication count; ²CC = citation count; ³AC = average citation

Figure 4 (a). VOSviewer network visualisation map.

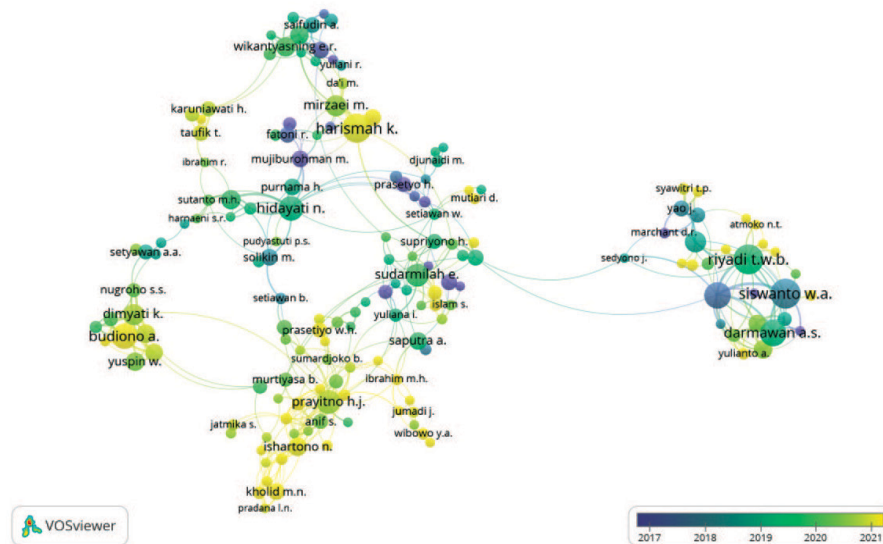


Figure 4 (b). VOSviewer overlay visualization map.

Figure 4. The largest set of connected authors with at least five publications authored by UMS-affiliated authors.

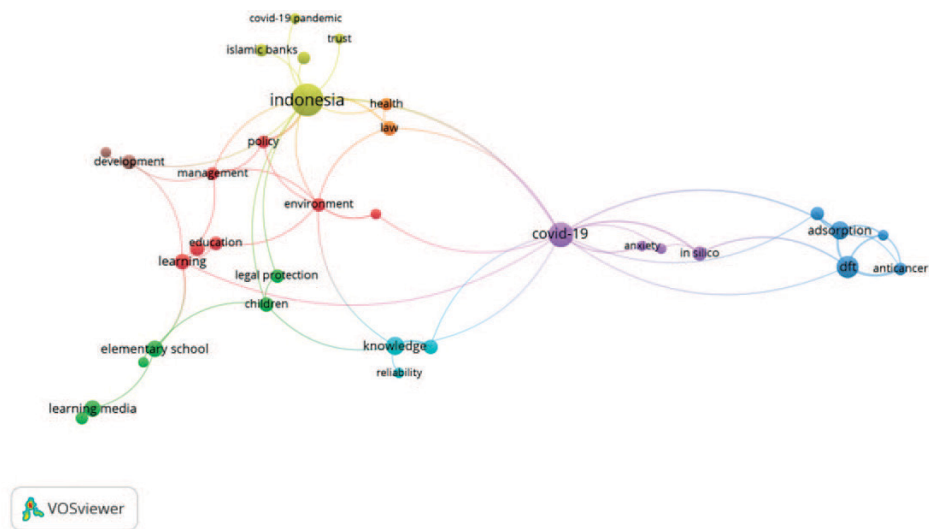


Figure 5 (a). VOSviewer network visualization map.

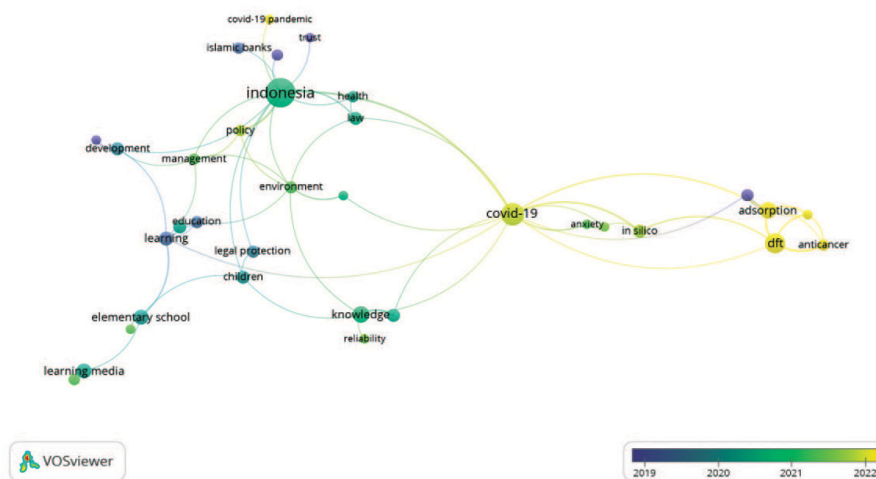


Figure 5 (b). VOSviewer overlay visualization map.

Figure 5. Largest set of connected authors' keywords with at least five occurrences.

diverse culture may explain this²⁰. Link line thickness indicates keyword co-occurrence²¹. “Indonesia” had the most link, which was 13. It had the thickest link line with “COVID-19” and “policy”, with 4 of link strength. It was also linked to “legal protection”, “law”, “health”, “children”, “environment”, “management”, “development”, etc. This demonstrates that UMS-affiliated authors have published on Indonesia’s economy, health, society, and law.

Figure 5(b) demonstrates how often two terms appear together over time. All of the 34 keywords were used around 2019 and after. Keywords marked in purple or blue circles were popular around 2019 and 2020. Meanwhile, green-circled keywords were popular in 2021.

Yellow circles, popular in 2022, represented the research hotspot. “COVID-19”, “COVID-19 pandemic”, “anticancer”, “adsorption”, “drug delivery”, and “DFT” were the most recent keywords provided by UMS-affiliated authors in their publications. All of these keywords reflected health and drug development aspects. COVID-19 is still a popular subject in publications. The “COVID-19” had 12 links that connected to other keywords. The “DFT” stands for density functional theory and calculates electronic structure in chemistry and physics using quantum mechanics²². In recent years, DFT has become a popular method for drug design. DFT accurately characterizes biological and molecular systems affordably²³.

Table 4. Most cited publications by UMS-affiliated authors

S. No.	Authors	UMS-affiliated authors	CC ¹	Title
1	Hossain, <i>et al.</i> (2021)	Hidayah Karuniawati	101	Andrographis paniculata (Burm. f.) Wall. ex Nees: An Updated Review of Phytochemistry, Antimicrobial Pharmacology, and Clinical Safety and Efficacy
2	Amran, <i>et al.</i> (2017)	Yadi Puwanto	70	Social responsibility disclosure in Islamic banks: a comparative study of Indonesia and Malaysia
3	Ngafwan, <i>et al.</i> (2022)	Ngafwan	53	Study on novel fluorescent carbon nanomaterials in food analysis
4	Hossain, <i>et al.</i>	Hidayah Karuniawati	50	Colorectal Cancer: A Review of Carcinogenesis, Global Epidemiology, Current Challenges, Risk Factors, Preventive and Treatment Strategies
5	Ulinuha, <i>et al.</i> (2008)	Agus Ulinuha	48	Optimal Scheduling of LTC and Shunt Capacitors in Large Distorted Distribution Systems Using Evolutionary-Based Algorithms
6	Ulinuha, <i>et al.</i> (2011)	Agus Ulinuha	46	Hybrid genetic-fuzzy algorithm for volt/var/total harmonic distortion control of distribution systems with high penetration of non-linear loads
7	Effendy, <i>et al.</i> (2016)	M. Effendy	43	DES study of blade trailing edge cutback cooling performance with various lip thicknesses
8	Nugroho, <i>et al.</i> (2016)	Munajat Tri Nugroho	38	Port and inland mode choice from the exporters’ and forwarders’ perspectives: Case study — Java, Indonesia
9	Sarjito, <i>et al.</i>	Sarjito	34	CFD-based simulation to reduce greenhouse gas emissions from industrial plants
10	Mujiburohman, <i>et al.</i> (2006)	Muhammad Muji-burohman	29	A preliminary study: Distillation of isopropa-nol–water mixture using fixed adsorptive distillation method

¹CC = citation count

Table 5. Publications of central java private universities

S. No.	Institutions	PC ¹	Number of collaborated countries	First publication year	Citation count of the most cited publication
1	Universitas Muhammadiyah Surakarta	1350	122	2004	6648
2	Universitas Kristen Satya Wacana	839	42	1984	233
3	Universitas Dian Nuswantoro	844	24	2004	161
4	Universitas Muhammadiyah Semarang	273	21	2013	57
5	Universitas Wahid Hasyim	116	9	2010	25
6	Universitas Muhammadiyah Purwokerto	388	29	2010	45

¹PC = publication count

In the keyword co-occurrence visualisation, “Indonesia” came first and appeared 42 times. “COVID-19” (25) ranked second, followed by “DFT” (19), “adsorption” (13), and “knowledge” (13). These keywords come from a variety of clusters. This showed that UMS publications cover several areas and that each faculty or scientific field participated.

3.5 Most Cited Papers

We used citation analysis with the document as a unit to find the most influential UMS-affiliated publication. We removed publications with more than 25 authors because more authors mean less contribution. A publication’s first and last authors are more likely to have diverse contributions²⁴. Table 4 lists the 10 most cited UMS-affiliated publications. Most were released in the last decade (7 publications). Hidayah Karuniawati’s publication co-authored with Hossain, *et al.* in 2021 was the most cited with 101 citations. Ngafwan was UMS-affiliated author with the most cited publication as the first author. The majority of the most cited papers have UMS-affiliated first authors. However, most of these authors were not listed as the most prolific, with a minimum of 15 publications. We anticipate more impactful Scopus-indexed publications from this author and others.

3.6 Comparison With Other Central Java Private Universities

In this study, we also analysed other private universities in Central Java. We counted their Scopus-indexed publications. The number of collaborating countries, first publication year, and most cited publications were also examined without exclusion of hyper authors’ publications. UMS is Central Java’s private university with the highest Scopus-indexed publications and international collaborations (Table 5). Universitas Dian Nuswantoro ranked second in Scopus-indexed articles and Universitas Kristen Satya Wacana ranked second in international collaboration. The first private university in Central Java to publish a Scopus-indexed publication was Universitas Kristen Satya Wacana in 1984. Even though UMS had its first Scopus-indexed publication 20 years after Universitas Kristen Satya Wacana, it now has the most publications. UMS had the most cited publication with 6648 citations for the publication entitled “Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017”. Universitas Kristen Satya Wacana and Dian Nuswantoro placed second and third, respectively.

4. CONCLUSION

The study discovered that the first publication of a UMS-affiliated author on a Scopus-indexed source occurred in 2004. From 2004 to the time of data collection for this study, the number of publications by UMS-affiliated

authors was steadily increasing, reaching 1350 in total. Although the publication fields vary, UMS-affiliated authors’ citation rates remain very low. Tri Widodo B. Riyadi was the most contributing author in Scopus-indexed papers, yet he only received 3.46 average citations. UMS must create a strategy to increase the citation rate. Despite this, UMS has the highest publications (1350) and international collaborations (122 countries) among Central Java’s private universities.

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CONTRIBUTORS

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She conceived the idea of this bibliometric study and contributed to the study concept and design, drafting of the manuscript, and creating the graphical presentations.

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Prof Dr Joko Harun Prayitno is a professor in the fields of adaptive, progressive, moderate education, holistic education, character building, holistic politeness education, and moderate politeness education at the Faculty of Teacher and Training Education at Universitas Muhammadiyah Surakarta. His contributions to this study include reviewing, revising, and overall supervising the manuscript.