

The Dynamics of Research Output by Indonesian Scientist, Period of 1945-2021

Prakoso Bhairawa Putera^{*}, Ida Widianingsih^{**}, Sinta Ningrum^{***}, Suryanto Suryanto^{****}, and Yan Rianto^{*****}

Abstract This research was conducted by applying a bibliometric analysis to determine the dynamics of research topics from ten percent of research output (international publications) generated by Indonesian scientists from the period of 1945-2021. This study utilizes VOSviewers version 1.6.18 for analysis and visualization of bibliometric networks. The research results indicate that 50.24% of Indonesian international publications are published in the form of articles, with subjects such as: Agricultural and Biological Sciences, Medicine, and Earth and Planetary Sciences as the most dominating subject areas. Regarding the author, Tjia, MO from Bandung Institute of Technology was acknowledged as the top author in terms of the number of publications produced for two periods. The article entitled "Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013" (Ng et al., 2014) became the most cited one.

Keywords Research outputs; most citations; bibliometrics; Co-occurrence analysis; VOSviewer; Indonesia

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^{*} Ph.D. candidate, Programme of Administrative Sciences, Faculty of Social and Political Sciences, Universitas Padjadjaran, Bandung, Indonesia; Research Center for Public Policy, National Research and Innovation Agency (BRIN), Jakarta Pusat, Indonesia; prakoso19001@mail.unpad.ac.id; pb.putera@brin.go.id

^{**} Professor, Faculty of Social and Political Sciences, Universitas Padjadjaran, Bandung, Indonesia; ida.widianingsih@unpad.ac.id

^{***} Associate Professor, Faculty of Social and Political Sciences, Universitas Padjadjaran, Bandung, Indonesia; sinta.ningrum@unpad.ac.id

^{****} Associate Professor, Faculty of Social and Political Sciences, Universitas Padjadjaran, Bandung, Indonesia; suryanto@unpad.ac.id

^{*****} Researcher, Deputy for Research and Innovation Infrastructure, National Research and Innovation Agency (BRIN), Jakarta Pusat, Indonesia; yanr001@brin.go.id



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I. Introduction

Research output in the form of international publications in reputable and globally indexed journals has become one of the goals of researchers worldwide. Further, international publications have become one of the indicators in measuring global competitiveness, including scientific and technical articles and viable documents H-index (Cornell University, INSEAD, 2019). In addition to international publications and the produced number of publications, another aspect serves as the consideration, which is the citation level of the published publications. Numerous studies have been conducted to navigate the research outputs with citations to the publications, such as measurement of global nursing research output (Singh & Pandita, 2018), review of research output of Australia and New Zealand (Rahme et al., 2020), innovation systems in Scopus journals (Putera et al., 2020), the research output of Indian universities (Mahala & Singh, 2021), R&D productivity (Abodunde & Jegede, 2020); and other unmentioned ones. However, research mapped the research outputs in the form of international publications by comparing them to the period of government in a country from time to time has been limitedly produced. Thus, this research was conducted to map the aforementioned conditions. However, this research focuses on international publications with the most citations from each period.

This study aims to conduct a bibliometric analysis within the framework with keywords of Co-occurrence analysis and several descriptive analyzes for the ten percent of international publications with the highest citations in each period of government in Indonesia. This study further explains the concept of research output related to international publications, followed by the methodology of data collection and analysis, findings, results, and limitations of the research, as well as suggestions for further research.

II. Methodology

2.1 Literature Review

The productivity of research and development has been measured by the total number of international publications in journals with global reputation produced by the researchers (Abodunde & Jegede, 2020), denoted from a number of indexation databases such as Scopus, Web of Science, or Google Scholar. Generally, such international publications are published by reputable publishers or the scientific community with a strict peer review process (Zia, 2021). Sources of international publications include journals, book series, conference proceedings, and trade publications. In terms of type, international publications have been in the form of articles, letters, editorials, notes, conference papers,

erratum, reviews, brief surveys, book chapters, conference reviews/abstract reports, books, and reports/data papers.

There are currently 43,132 international publication sources in the Scopus database (Elsevier B.V, 2022), which are: 40,079 in the form of journals (92.92%), 1,743 in the form of Book Series (4.04%), 510 in the form of Conference Proceedings (1.18%); and 800 in the form of Trade Publications (1.85%). This presentation indicates that most international publications are available from the published journals.

2.2 Data Collection Strategy

Bibliometric analysis refers to an analysis depicting and constructing a picture of trends as well as the dynamics of research topics at a certain time (Akhavan et al., 2016; Padrós-Cuxart et al., 2016; Wu & Ye, 2021; Zou & Laubichler, 2017), feasible to be implemented for mapping and visualizing research output (Rahaman et al., 2021). In fact, not all bibliometric analysis is applicable for developments in research topics from time to time, such as in technology trend monitoring (Ena et al., 2016), digital humanities research (Su & Zhang, 2021), scientific trends on management and public policy (Putera et al., 2021), marine science and limnology (Nielsen-Muñoz et al., 2018), rural tourism and development (Ruiz-Real et al., 2020), Parkinson's disease (Robert et al., 2019), Korea Citation Index (KCI) and also some macro statistics of KCI (Kim et al., 2013), and watershed governance research (Widianingsih et al., 2021). Therefore, bibliometric analysis is appropriate to navigate the trends and dynamics of the research topic developments from time to time, particularly in the top ten percent of international publications from Indonesian researchers with the highest citations.

The bibliometric analysis in this research applies to the Scopus database, retrieved on February 14, 2022, deploying query data from the Scopus database, as illustrated in Table 1. The unit of analysis from the Scopus database was a mapping of 10% of the total publications in that period. Approximately 10% of the total publications are sorted by publication with the highest citation. The example includes the period of 1945-1965 reporting 239 publications, thereby indicating that 10% of the total publications comprise 24 publications. Further, the 24 publications with the highest citations became the unit of analysis. A similar pattern is conducted for other periods. Visualization of data and results of Co-occurrence analysis was performed through VOSviewer version 1.6.18, which was released on January 24, 2022.

Table 1. Query Data from Scopus Database

No.	Year / Period of government in Indonesia	Query Data	Total Publications / Units of Analysis*
1.	1945-1965 / President Sukarno Era	(AFFILCOUNTRY(Indonesia)) AND (LIMIT-TO (PUBYEAR, 1966)) OR LIMIT-TO (PUBYEAR,1965) OR LIMIT-TO (PUBYEAR,1964) OR LIMIT-TO (PUBYEAR,1963) OR LIMIT-TO (PUBYEAR,1962) OR LIMIT-TO (PUBYEAR,1961) OR LIMIT-TO (PUBYEAR,1960) OR LIMIT-TO (PUBYEAR,1959) OR LIMIT-TO (PUBYEAR,1958) OR LIMIT-TO (PUBYEAR,1957) OR LIMIT-TO (PUBYEAR,1956) OR LIMIT-TO (PUBYEAR,1955) OR LIMIT-TO (PUBYEAR,1954) OR LIMIT-TO (PUBYEAR,1953) OR LIMIT-TO (PUBYEAR,1952) OR LIMIT-TO (PUBYEAR,1951) OR LIMIT-TO (PUBYEAR,1950) OR LIMIT-TO (PUBYEAR,1949) OR LIMIT-TO (PUBYEAR,1948) OR LIMIT-TO (PUBYEAR,1947) OR LIMIT-TO (PUBYEAR,1946) OR AND (EXCLUDE (PUBYEAR,1966))	239 Publications / 24 publications
2.	1966-1998 / President Suharto Era	(AFFILCOUNTRY(Indonesia)) AND (LIMIT-TO (PUBYEAR, 1998)) OR LIMIT-TO (PUBYEAR,1997) OR LIMIT-TO (PUBYEAR,1996) OR LIMIT-TO (PUBYEAR,1995) OR LIMIT-TO (PUBYEAR,1994) OR LIMIT-TO (PUBYEAR,1993) OR LIMIT-TO (PUBYEAR,1992) OR LIMIT-TO (PUBYEAR,1991) OR LIMIT-TO (PUBYEAR,1990) OR LIMIT-TO (PUBYEAR,1989) OR LIMIT-TO (PUBYEAR,1988) OR LIMIT-TO (PUBYEAR,1987) OR LIMIT-TO (PUBYEAR,1986) OR LIMIT-TO (PUBYEAR,1985) OR LIMIT-TO (PUBYEAR,1984) OR LIMIT-TO (PUBYEAR,1983) OR LIMIT-TO (PUBYEAR,1982) OR LIMIT-TO (PUBYEAR,1981) OR LIMIT-TO (PUBYEAR,1980) OR LIMIT-TO (PUBYEAR,1979) OR LIMIT-TO (PUBYEAR,1978) OR LIMIT-TO (PUBYEAR,1977) OR	5,784 Publications / 578 publications

		LIMIT-TO (PUBYEAR,1976) OR LIMIT-TO (PUBYEAR,1975) OR LIMIT-TO (PUBYEAR,1974) OR LIMIT-TO (PUBYEAR,1973) OR LIMIT-TO (PUBYEAR,1972) OR LIMIT-TO (PUBYEAR,1971) OR LIMIT-TO (PUBYEAR,1970) OR LIMIT-TO (PUBYEAR,1969) OR LIMIT-TO (PUBYEAR,1968) OR LIMIT-TO (PUBYEAR,1967) OR LIMIT-TO (PUBYEAR,1966)	
3.	1999 / President B.J Habibie Era	(AFFILCOUNTRY(Indonesia)) AND (LIMIT-TO (PUBYEAR, 1999))	654 Publications / 65 publications
4.	2000-2001 / President Abdurrahman Wahid Era	(AFFILCOUNTRY(Indonesia)) AND (LIMIT-TO (PUBYEAR,2001)) OR LIMIT-TO (PUBYEAR,2000)	1,449 publications / 144 publications
5.	2002-2004 / President Megawati Soekarnoputri Era	(AFFILCOUNTRY(Indonesia)) AND (LIMIT-TO (PUBYEAR,2004)) OR LIMIT-TO(PUBYEAR,2003) OR LIMIT-TO (PUBYEAR,2002)	2,635 publications / 263 publications
6.	2005-2009 / President Susilo Bambang Yudhoyono Periode I Era	(AFFILCOUNTRY(Indonesia)) AND (LIMIT-TO (PUBYEAR, 2009)) OR LIMIT-TO(PUBYEAR, 2008) OR LIMIT-TO(PUBYEAR, 2007) OR LIMIT-TO (PUBYEAR, 2006) OR LIMIT-TO (PUBYEAR, 2005)	7,880 publications / 788 publications
	2010-2014 / President Susilo Bambang Yudhoyono Periode II Era	(AFFILCOUNTRY(Indonesia)) AND (LIMIT-TO (PUBYEAR,2014)) OR LIMIT-TO (PUBYEAR,2013) OR LIMIT-TO (PUBYEAR,2012) OR LIMIT-TO (PUBYEAR,2011) OR LIMIT-TO (PUBYEAR,2010)	23,104 publications / 2,310 publications**
7.	2015-2019 / President Joko Widodo Periode I Era	(AFFILCOUNTRY(Indonesia)) AND (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)	224,325 publications / 22,432 publications**
	2020-2021 // President Joko Widodo Periode II Era	(AFFILCOUNTRY(Indonesia)) AND (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) AND (EXCLUDE (PUBYEAR,2019) OR	98,790 publications / 9,879 publications**

		EXCLUDE (PUBYEAR,2018) OR EXCLUDE (PUBYEAR,2017) OR EXCLUDE (PUBYEAR,2016) OR EXCLUDE (PUBYEAR,2015)	
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Notes:

* Unit of analysis is obtained from 10% as Cited by (highest)

** Due to the availability of data and data mining on the Scopus database, only 2,000 publications with the most citations could be processed.

III. Result and Discussion

3.1 Distribution of publications by period

During the period of 1945-2021, international publications from Indonesian authors based on the Scopus database were 265,576 publications. This number, if deducted by the 73 publications withdrawn by the publishers, becomes 265,503 publications. International publications from Indonesian authors are proliferated in 12 types of writing ranging from Articles to Reports / Data Papers (Table 2). However, only articles and Conference Papers are the most dominant, conveying: Article (50.24%), Conference Paper (45.36%), Review (2.11%), and Book Chapter (1.12%). When perceived from the periodization of government, particularly in the era of President Joko Widodo (2015-2021), most Indonesian authors published their research results in globally indexed journals, amounting to 88.56% of the total Indonesian publications since the 1945 era. This pattern indicates the high awareness of Indonesian authors to publish in reputable international journals. However, if perceived from the number of articles and conference papers published in the period of 2015-2021, such presentations (numbers) are almost equal, comprising articles (48.069%) and conference papers (48.067%).

The subject areas of Agricultural and Biological Sciences, Medicine, and Earth and Planetary Sciences since the period of 1945-1965 have dominated the international publications of Indonesian authors (Table 3). This finding is in accordance with the results of previous research, affirming that the three subject areas become the concern of Indonesian authors in publishing research results under international publications (Putera et al., 2022). In addition, one Indonesian researcher was acknowledged as the top author for two periods of government, who was Tjia, MO from the Bandung Institute of Technology in the period of 2000-2001 (President Abdurrahman Wahid Era) with 18 publications, cited 218 times, and in the period of 2002-2004 (President Megawati Soekarnoputri Era) with 28 publications, cited for 207 times. However, Munir, A from the Bandung Institute of Technology in the period of 2015-2019 (President Joko Widodo Period I Era) was acknowledged as the top author throughout the period, scoring 315 publications and 1,079 citations.

Table 2. Distribution of publications by type of publication and arranged based on the periodization of government (leading president) in Indonesia

Type of publication Period of government in Indonesia	1	2	3	4	5	6	7	8	9	10	11	12	13
1945-1965 / President Soekarno Era	213	18	3	2	1	1	1	-	-	-	-	-	-
1966-1998 / President Suharto Era	5091	82	9	41	431	1	104	12	6	5	1	1	-
1999 / President B.J Habibie Era	556	7	1	1	76	-	10	1	2	-	-	-	-
2000-2001 / President Abdurrahman Wahid Era	1162	7	4	12	209	1	46	1	6	-	1	-	-
2002-2004 / President Megawati Soekarnoputri Era	1842	23	14	6	515	4	128	8	86	-	9	-	-
2005-2009 / President Susilo Bambang Yudhoyono Period I Era	5199	43	35	48	1801	19	280	17	413	-	23	-	2
2010-2014 / President Susilo Bambang Yudhoyono Period II Era	13918	73	166	82	7139	37	564	20	1010	23	62	-	10

2015-2019 / President Joko Widodo Period I Era	106817	376	878	344	109012	275	4138	87	2056	2	104	177	59
2020-2021 / President Joko Widodo Period II Era	48473	222	407	163	46271	120	2431	55	508	1	17	120	2

Notes:

1 = Article 2 = Letter 3 = Editorial 4 = Note 5 = Conference Paper 6 =Erratum
 7 = Review 8 =Short Survey 9 = Book Chapter 10 = Conference Review / Abstract Report 11 = Book
 12 = Report / Data Paper 13 = Retracted

Table 3. Distribution of publications and the top 5 publications based on the subject area, source title, affiliation authors, funding sponsors, and countries of author collaboration and arranged based on the periodization of government (leading President) in Indonesia

No.	Year / Period of government in Indonesia	Top 5 subject area	Top Author	Top 5 of source title	Top 5 of affiliation authors	Top 5 of funding sponsors	Top 5 countries of author collaboration
1.	1945-1965 / President Sukarno Era	Medicine; Agricultural and Biological Sciences; Chemistry; Biochemistry; Genetics and Molecular Biology; & Engineering	Djojoseobagio, S. (6 publications)	Recueil Des Travaux Chimiques Des Paysbas; Lancet; Tijdschrift Over Plantenziekten; Nature; & Ophthalmologica	Universitas Indonesia; Universitas Gadjah Mada; Universitas Padjadjaran; Laboratorium voor Scheikundig Onderzoek; Institut Teknologi Bandung	Ford Foundation; California Department of Public Health; Commonwealth Scientific and Industrial Research Organisation; Research Corporation for Science Advancement; & State University of New York	United States; Netherlands; United Kingdom; Germany; & Malaysia
2.	1966-1998 / President Suharto Era	Medicine; Agricultural and Biological	Partono, F. (50 publications)	Medical Journal of Indonesia; Paediatrica Indonesiana; Southeast	Universitas Indonesia; Institut Teknologi Bandung;	United States Agency for International Development; Ministry	United States; Japan; Australia;

		<p>Sciences; Earth and Planetary Sciences; Environmental Science; & Engineering</p>		<p>Asian Journal of Tropical Medicine and Public Health; Bulletin of Indonesian Economic Studies; & Netherlands Journal of Sea Research</p>	<p>Universitas Gadjah Mada; Lembaga Ilmu Pengetahuan Indonesia; & Universitas Airlangga</p>	<p>of Education, Culture, Sports, Science and Technology; National Institutes of Health; Lembaga Ilmu Pengetahuan Indonesia; World Health Organization</p>	<p>Netherlands; & United Kingdom</p>
<p>3.</p>	<p>1999 / President BJ Habibie Era</p>	<p>Agricultural and Biological Sciences; Medicine; Earth and Planetary Sciences; Biochemistry, Genetics and Molecular Biology; Engineering</p>	<p>Cornain, S. (11 publications)</p>	<p>Medical Journal of Indonesia; Society of Petroleum Engineers SPE Asia Pacific Oil and Gas Conference and Exhibition 1999 Apogee 1999; Asian Australasian Journal of Animal Sciences; Geophysical Research Letters; & Journal of Asian Earth Sciences</p>	<p>Universitas Indonesia; Institut Teknologi Bandung; IPB University; Lembaga Ilmu Pengetahuan Indonesia; Center for International Forestry Research, West Java</p>	<p>Ministry of Education, Culture, Sports, Science and Technology; Universitas Indonesia; Japan Society for the Promotion of Science; United States Agency for International Development; & Australian Centre for International Agricultural Research</p>	<p>Japan; United States; Australia; Netherlands; United Kingdom</p>
<p>4.</p>	<p>2000-2001 / President Abdurrahman Wahid Era</p>	<p>Agricultural and Biological Sciences; Medicine; Engineering; Biochemistry, Genetics and Molecular Biology; Environmental Science</p>	<p>Tjia, M.O. (18 publications)</p>	<p>Medical Journal of Indonesia; Asian Australasian Journal of Animal Sciences; Gan to Kagaku Ryocho Cancer Chemotherapy; Proceedings of SPIE The International Society for Optical Engineering; Southeast Asian Journal</p>	<p>Universitas Indonesia; Institut Teknologi Bandung; IPB University; Universitas Gadjah Mada; Center for International Forestry Research, West Java</p>	<p>Ministry of Education, Culture, Sports, Science and Technology; National Science Foundation; European Commission; National Institutes of Health; & Natural Sciences and Engineering Research Council of Canada</p>	<p>Japan; United States; Australia; United Kingdom; & Netherlands</p>

	<p>2002-2004 / President Megawati Soekarnoputri Era</p>	<p>Medicine; Agricultural and Biological Sciences; Engineering; Social Sciences; & Biochemistry, Genetics and Molecular Biology</p>	<p>Tjia, M.O. (28 publications)</p>	<p>of Tropical Medicine and Public Health</p>	<p>Medical Journal of Indonesia; IEEE Asia Pacific Conference on Circuits and Systems Proceedings Apccas; Acta Medica Indonesiana; Southeast Asian Journal of Tropical Medicine and Public Health; Journal of Natural Products</p>	<p>Universitas Indonesia; Institut Teknologi Bandung; Universitas Gadjah Mada; Lembaga Ilmu Pengetahuan Indonesia; IPB University</p>	<p>Ministry of Education, Culture, Sports, Science and Technology; Japan Society for the Promotion of Science; National Cancer Institute; European Commission; National Institutes of Health</p>	
<p>5.</p>	<p>Agricultural and Biological Sciences; Medicine; Engineering; Social Sciences; & Biochemistry, Genetics and Molecular Biology</p>	<p>Suksmono, A.B. (40 publications)</p>	<p>Acta Medica Indonesiana; Medical Journal of Indonesia; Hayati Journal of Biosciences; AIP Conference Proceedings; International Conference on Instrumentation Communication Information Technology and Biomedical Engineering 2009 ICICI BME 2009</p>	<p>Medical Journal of Indonesia; Hayati Journal of Biosciences; AIP Conference Proceedings; International Conference on Instrumentation Communication Information Technology and Biomedical Engineering 2009 ICICI BME 2009</p>	<p>Universitas Indonesia; Institut Teknologi Bandung; Universitas Gadjah Mada; IPB University; Lembaga Ilmu Pengetahuan Indonesia</p>	<p>Ministry of Education, Culture, Sports, Science and Technology; Japan Society for the Promotion of Science; European Commission; Australian Research Council; Deutsche Forschungsgemeinschaft</p>	<p>Japan; United States; Australia; Netherlands; Malaysia</p>	
<p>6.</p>	<p>Engineering; Agricultural and Biological Sciences; Computer Science;</p>	<p>Khairunnijal (87 publications)</p>	<p>AIP Conference Proceedings; Advanced Materials Research; Applied Mechanics And Materials; Medical Journal of Indonesia; & Journal of The Indonesian</p>	<p>Institut Teknologi Bandung; Universitas Indonesia; Universitas Gadjah Mada; IPB University; & Institut Teknologi Sepuluh Nopember</p>	<p>Japan Society for the Promotion of Science; Ministry of Education, Culture, Sports, Science and Technology; Direktorat Jenderal Pendidikan Tinggi;</p>	<p>Japan; Malaysia; Australia; United States; & Netherlands</p>		

		Medicine; & Social Sciences		Tropical Animal Agriculture		Kementerian Pendidikan dan Kebudayaan; European Commission	
	2015-2019 / President Joko Widodo Periode I Era	Engineering; Physics and Astronomy; Environmental Science; Computer Science; Earth and Planetary Sciences	Munir, A. (315 publications)	IOP Conference Series Earth and Environmental Science; Journal of Physics Conference Series; IOP Conference Series Materials Science and Engineering; AIP & E3S Web of Conferences	Universitas Indonesia; Institut Teknologi Bandung; Universitas Gadjah Mada; Universitas Airlangga; & Universitas Diponegoro	Universitas Indonesia; Kementerian Riset Teknologi Dan Pendidikan Tinggi Republik Indonesia; Japan Society for the Promotion of Science; Universitas Gadjah Mada; Ministry of Education, Culture, Sports, Science and Technology	Malaysia; Japan; Australia; United States; & United Kingdom
7.	2020-2021 / President Joko Widodo Periode II Era	Environmental Science; Earth and Planetary Sciences; Physics and Astronomy; Engineering; Social Sciences	Dafik (116 publications) & Pranata, R. (116 publications)	IOP Conference Series Earth and Environmental Science; Journal of Physics Conference Series; IOP Conference Series Materials Science and Engineering; AIP & E3S Web of Conferences	Universitas Indonesia; Universitas Gadjah Mada; Universitas Airlangga; Institut Teknologi Bandung; & Hasanuddin University	Universitas Indonesia; Kementerian Riset Teknologi dan Pendidikan Tinggi Republik Indonesia; Universitas Gadjah Mada; Lembaga Pengelola Dana Pendidikan; Universitas Airlangga	Malaysia; Japan; Australia; United States; & United Kingdom

4.2 Most cited publications and authors

Table 4 presents the most cited international publications by Indonesian authors based on the periodization of government in Indonesia. The most cited article during the period of 1945-2021 was entitled “Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013” (Ng et al., 2014), generating 7241 citations. Table 4 further indicates that the publications with the most citations do not have to come from the earliest published publications (the first years); however, it is possible for the publications published for 1-2 years to obtain high numbers of citations due to the importance and impact of research topics towards the development of science (Rodriguez-Morales et al., 2020), published in 2020 despite generating 1144 citations.

Table 4. The most cited publications and authors

Year / Period of government in Indonesia	Title	Source	Total Citations
1945-1965 / President Sukarno Era	The viscosity of concentrated suspensions and solutions (Brinkman, 1952)	The Journal of Chemical Physics 20(4), pp. 571	3163
1966-1998 / President Suharto Era	The population genetic consequences of habitat fragmentation for plants (Young et al., 1996)	Trends in Ecology and Evolution 11(10), pp. 413-418	1535
1999 / President B.J Habibie Era	Prevention of diarrhea and pneumonia by zinc supplementation in children in developing countries: A pooled analysis of randomized controlled trials (Bhutta et al., 1999)	Journal of Pediatrics 135(6), pp. 689-697	556
2000-2001 / President Abdurrahman Wahid Era	Recent patterns and mechanisms of carbon exchange by terrestrial ecosystems (Schimel et al., 2001)	Nature 414(6860), pp. 169-172	999
2002-2004 / President Megawati Soekarnoputri Era	The amount of carbon released from peat and forest fires in Indonesia during 1997 (Page et al., 2002)	Nature 420(6911), pp. 61-65	1222

2005-2009 / President Susilo Bambang Yudhoyono Periode I Era	Gefitinib or carboplatin-paclitaxel in pulmonary adenocarcinoma (Mok et al., 2009)	New England Journal of Medicine 361(10), pp. 947-957	6676
2010-2014 / President Susilo Bambang Yudhoyono Periode II Era	Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013 (Ng et al., 2014)	The Lancet 384(9945), pp. 766-781	7241
2015-2019 / President Joko Widodo Periode I Era	Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: A systematic analysis for the Global Burden of Disease Study 2013 (Naghavi et al., 2015)	The Lancet 385(9963), pp. 117-171	4895
2020-2021 / President Joko Widodo Periode II Era	Clinical, laboratory and imaging features of COVID-19: A systematic review and meta-analysis (Rodriguez-Morales et al., 2020)	Travel Medicine and Infectious Disease 34,101623	1144

4.3 Ten percent of international publications generated from Indonesian Authors with the highest Citation

In the period of 1945-1965, 24 publications were included in the Top 10% of the total publications during such period (Fig.1), indicating that the period of 1957 was the largest distribution of publications with the highest citations. During this period, the five journals containing two publications have contributed to the highest citation, including Analytical Chemistry, British Medical Journal, Volcanology Bulletin, Journal of Comparative Neurology, and The Journal of Chemical Physics.

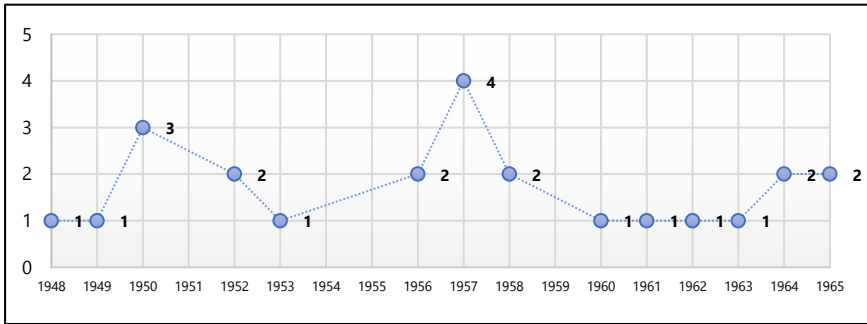


Figure 1. Distribution of publications by years 1945-1965

The dynamics of changing research topics from the period of 1945-2021 from international publications produced by Indonesian authors is illustrated from the Co-occurrence network. Fig. 2 depicts that in the early days of the Republic of Indonesia Independence (1945-1965), the publications produced by Indonesian authors had formed two clusters in which research topics regarding humans were the most dominant. In this period, the article entitled “The viscosity of concentrated suspensions and solutions” (Brinkman, 1952) generated the most citations (3163 citations).

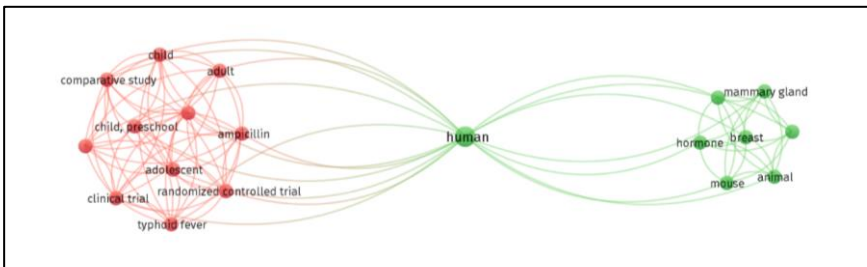


Figure 2. Co-occurrence network of the author keywords, 1945-1965

In the period of 1966-1998, the distribution of international publications from Indonesian authors denotes the highest number of publications (particularly in 1996), included in the Top 10% of the highest citations (Fig.3). During this period, the five journals were acknowledged as the most publications with the most citations, including The Lancet, American Journal of Clinical Nutrition, Agroforestry Systems, American Journal of Tropical Medicine and Hygiene, and Forest Ecology and Management.

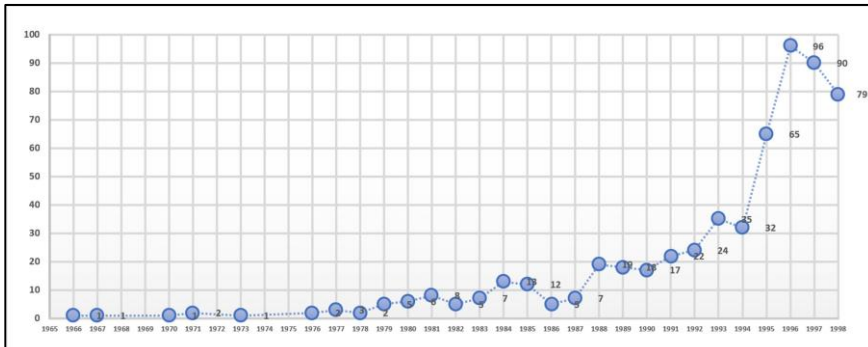


Figure 3. Distribution of publications by years 1966-1998

In the period of 1966-1998 (Fig.4), 11 research clusters of research topics were formed, most of which discussed topics on agriculture, forestry, and environmental issues. Nodes in this period generally do not stand out or form a larger circle, except for the Indonesian nodes, thereby indicating that the research topics in the 11 clusters had a similar citation level.

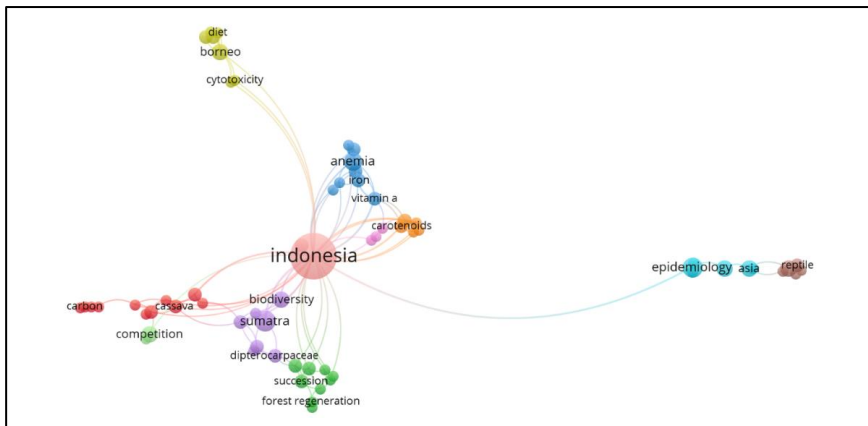


Figure 4. Co-occurrence network of the author keywords, 1966-1998

In the period of 1999 (Fig.5), environmental and forestry issues remained the most referenced topics by other researchers, particularly for topics related to deforestation, biodiversity and logging. During this period, the five clusters of research topics were formed, in which the agricultural topics were considered as additional issues alongside the environment topic. In particular, agricultural topics such as harvesting systems and farming systems have become topics that have been widely cited.

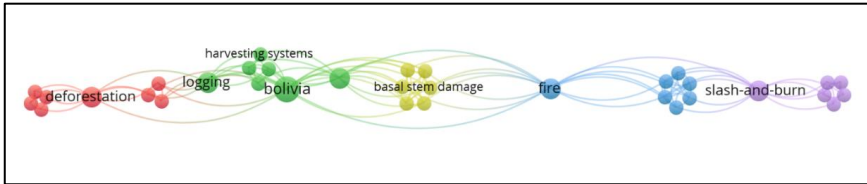


Figure 5. Co-occurrence network of the author keywords, 1999

In the period of 2000-2001 (Fig.6), the 8 research clusters were formed, in which the topic of Merapi volcano scored the biggest nodes, alongside other topics such as Java, Homo erectus, and climate change. Environmental and forestry issues were continuously referred to in the period of 2002-2004 (Fig.7). During this period, 8 clusters were formed. In the period of 2005-2009 (Fig.8), the 11 clusters that were formed began to reveal that there were other issues that were of concern to other researchers and became the references. Apart from environmental and forestry issues (deforestation, conservation, logging and biodiversity), other issues of concern, such as the tsunami, earthquake, Homo floresiensis, and a number of topics in the social sector, have initiated to serve as a concern including corporate governance and governance.

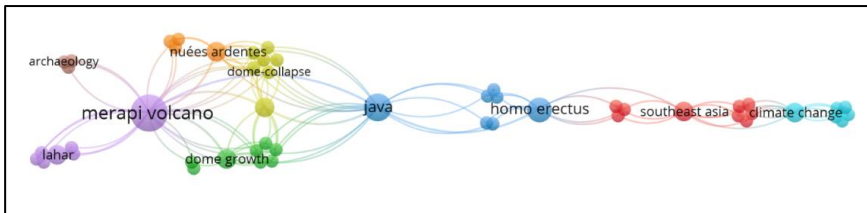


Figure 6. Co-occurrence network of the author keywords, 2000-2001

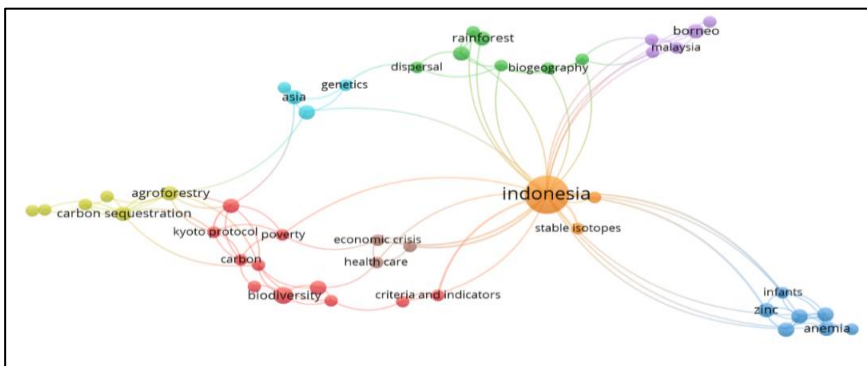


Figure 7. Co-occurrence network of the author keywords, 2002-2004

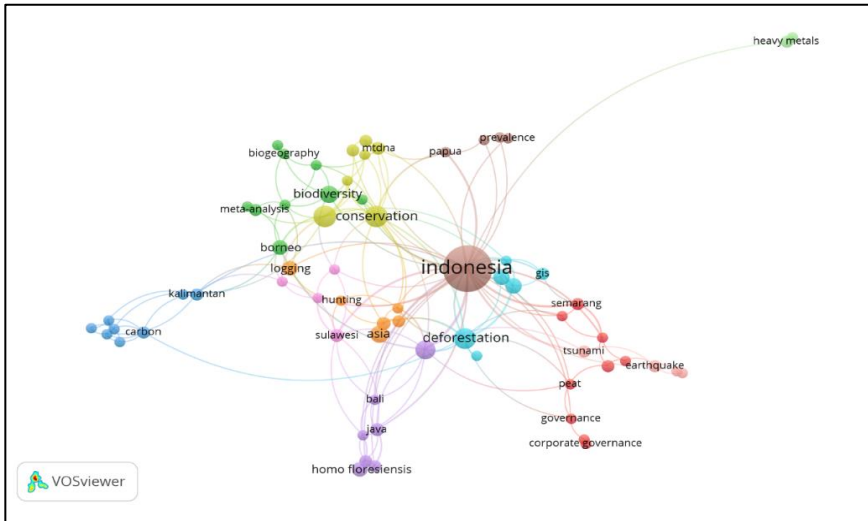


Figure 8. Co-occurrence network of the author keywords, 2005-2009

Although topics related to climate change, redd+, and biodiversity remain frequently referred to in articles by Indonesian authors during the period of 2010-2014, Fig.9 exhibits the emergence of other issues referred to internationally. During this period, 13 research clusters were formed. Other emerging issues include biodiesel and biogas (Cluster 5), epidemiology and malaria (Cluster 6), and oil palm and food security (Cluster 13).

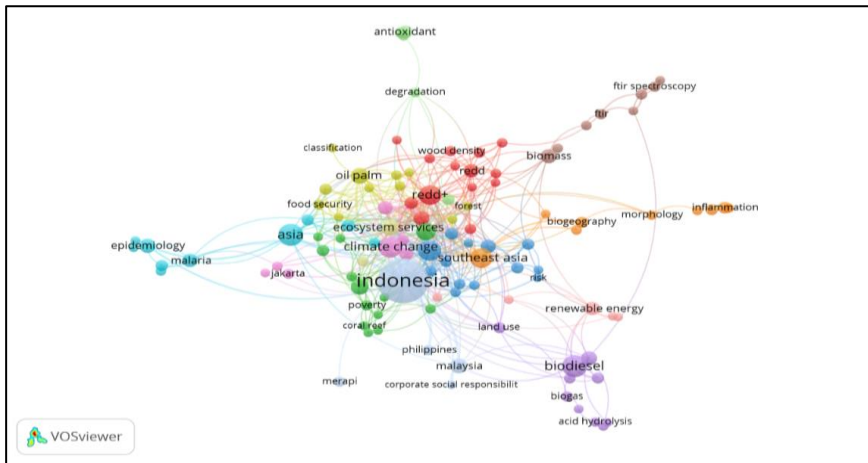


Figure 9. Co-occurrence network of the author keywords, 2010-2014

In the period of 2020-2021, 10 clusters were formed (Fig.11), in which the COVID-19-related research topics became a reference for other researchers. This finding is in accordance with the results of the identification from the most cited articles (Table 4), which are articles on the topic of COVID-19.

IV. Conclusion

This research was conducted on the ten percent of international publications with the highest citations generated by Indonesian authors. The unit of analysis includes 36,483 international publications distributed over seven periods of presidential leadership in Indonesia. This study employs a Scopus database with bibliometric analysis in the form of co-occurrence keyword analysis and several descriptive analyzes. An article entitled "Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013" (Ng et al., 2014) was regarded as the article with the most citations (7,241 citations) for seven respective periods of presidential leadership in Indonesia. Research topics around biodiversity, deforestation, farming systems, climate change, and renewable energy have become the most frequently cited topics from international publications composed by Indonesian authors.

This study, however, has limitations in terms of data collection, especially for ten percent of the period of 2010-2014, 2015-2019, and 2020-2021. In these three respective periods, this study is merely capable of collecting 2,000 data from international publications with the highest citations for each period. Whereas for the period of 2010-2014, the required data were 2,310 publications; for the period of 2015-2019, the required data were 22,432 publications; and for the period of 2020-2021, the required data were 9,879 publications. This limitation is due to the data mining system on the Scopus database, which could merely gather 2,000 data. Hence, better data mining is encouraged for future research. In addition, mapping using other databases, such as Web of Science, EBSCOhost or Google Scholar, is also encouraged. Bibliometric analysis employing different databases could enrich the knowledge base, including other analysis software, such as SciMAT, CiteSpace, and so forth. Research topics including biodiversity, deforestation, farming systems, climate change, and renewable energy have been the most cited ones for seven periods.

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