Top Indonesia's Journal Efficiency Analysis: Bibliometrics (Scientific Strength) and Data Envelopment Analysis (DEA)

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Notes	ABSTRACT
  	This study aims to analyze the efficiency of a journal by examining the correlation between the number of researchers associated with the journal and the expenses borne by researchers for publication concerning the scientific strengths achieved. The analysis is conducted through the Data Envelopment Analysis (DEA) approach. The data for scientific journal articles is collected from the metadata of Scopus, and WoS (Web of Science) was indexed in SINTA 1. Meanwhile, the APC (Article publication charge) data was obtained from the journal website. The input variables include the author, the editorial team, and the APC. In contrast, the output variables in this study are the scientific strength (publications and citations) generated. The study showed that the SINTA 1 journal indexed in Scopus and WoS with a DEA value of 1,000 was Operations and Supply Chain Management: An International Journal. The DEA value for journals indexed in Scopus and WoS is greater compared to the DEA value of journals indexed in WoS, as opposed to the DEA value of journals indexed in Scopus, but the difference is small. **Keywords:** Indonesian journals; Data Envelopment Analysis; scientific strength; bibliometrics

1. INTRODUCTION

Research in every academic institution is measurable output because the quality of a university can be seen in how much research is produced. Due to the current situation, universities engage in fierce competition to generate extensive research that needs publication in journals. The institution itself mandates lecturers or researchers to contribute to research endeavors to enhance the university's ranking. Furthermore, government systems necessitate lecturers or researchers to produce scientific publications or research to advance their career paths. The positive side of the implemented system makes lecturers or researchers at universities work hard to produce research, not just teaching. Lecturers must also continually learn about the latest scientific developments to enrich their references related to their research. In addition to learning new knowledge related to their field, lecturers must also speak foreign languages and quickly adapt to information technology because many research references are written in foreign languages, especially English. Even some well-known universities require their lecturers

to produce scientific publications or research published in international journals, so they must be written in a foreign language. A university's quality is evaluated not solely based on the quantity of research it generates, but also by the impact that research has made.

Eugene Garfield pioneered the measurement of the impact of this study, such as Impact Factor or Journal Impact Factor, SNIP (Source Normalized Impact per Paper), Eigenfactor Score (EF), H-index, Cited Half-Life, Immediacy Index, and Article Influence Score. The impact measurement is adapted by the Schimago Journal Ranking (SJR), such as using the Impact Factor or Journal Impact Factor, H-index to see the quality of journals indexed by Scopus, such as Journals in Q1, Q2, Q3, and Q4. In addition to SJR, Journal Citation Report (JCR) such as the use of Impact Factor or Journal Impact Factor, Eigenfactor Score (EF), Cited Half-Life, Immediacy Index, and Article Influence Score to see the quality of journals indexed by Web of Science (WoS).

In Indonesia, measuring the impact of Indonesian research is known as the Science and Technology Index (SINTA) under the auspices of BRIN Research and Technology. This platform is to see quality Indonesian journals such as the SINTA 1 Journal, SINTA 2, SINTA 3, SINTA 4, SINTA 5, and SINTA 6. Thus, many lecturers and researchers are trying hard or even competing to be able to publish their papers in reputable or quality international journals. Even at the level of lecturers or researchers, they are required to publish in national or international journals with minimum standards, such as at least in SINTA 2 (for certain positions) and reputable international journals indexed by Scopus and Web of Science (for certain positions). This phenomenon is prevalent in both Indonesia and globally due to the shaping and demanding nature of the existing system. It is not surprising that many lecturers or researchers exert considerable effort to secure publications in national or international journals, sometimes being willing to pay substantial fees for publication in reputable journals. However, even when published in a prestigious journal, there is no guarantee of a significant impact, such as a high number of citations or direct benefits derived from the research results.

When undertaking research, it is crucial to take into account a range of variables. The focus should extend beyond merely conducting high-quality research to gain citations. Other factors need to be considered in conducting research, namely financing, infrastructure (facilities), and the number of researchers. This is because universities producing research require research costs and even costs for publication in international journals. The expenses involved in the process are substantial. Nevertheless, if the research gets published in an international journal, it is not ideal if the number of citations is minimal, particularly when assessing its practical utility. This is particularly true in the realm of social sciences, where the direct benefits may not be immediately evident. Therefore, it is necessary to measure efficiency related to the number of articles published in a journal with the impact obtained from its publication.

Efficiency measurement is a vital thing that must be done to evaluate whether it is effective or not related to the research produced in terms of how many variables are spent to produce research with the impact obtained. Data Envelopment Analysis (DEA) is a method developed to evaluate performance effectiveness. Efficiency measurement is a vital thing that must be done to evaluate whether it is effective or not related to the research produced in terms of how many variables are spent to produce research with the impact obtained. It is a method developed to evaluate performance effectiveness (Gökşen et al., 2015). The DEA method is usually used to measure university performance, as in the research entitled "Performance of Indonesia's World-Class University Efficiency with Bibliometrics (Scientific Strength) Approach and Data Envelopment Analysis" (Ibrahim & Fadhli, 2021), but in this study, applied to the Journal. DEA is a simple but powerful method to measure efficiency and how much input is produced with the resulting output. Based on these problems, the purpose of the study is to see the value of journal efficiency, where the maximum efficient value can be used as a reference for publication references so that the publication can get more citations.

Bibliometrics

Bibliometrics is one approach to measuring productivity. Besides that, it can also be used for research assessment or evaluating information. According to Daraio et al., research assessment is more and more becoming a 'big data' activity, involving multiple comprehensive citation indexes, electronic full-text databases, large publication repositories, usage data from publishers' sites, and altmetric, webometric, and other new data sources (Daraio et al., 2016). Bibliometric tools began to be used for evaluating the productivity and scientific impact of research activities in the 1980s, especially in the public sector and universities in the 1990s (Gușu & Butnariu, 2021). Bibliometrics in addition to measuring or evaluating in the field of the public sector and universities, bibliometrics can also be used to measure scientific journals, so it can be said that bibliometrics is an approach or method that can be used to assess or evaluate research performance of a university or Journal. The assessment or evaluation of the performance of this research has a very crucial impact on the institution in its future policy-making strategies.

Economic indicators in conducting research are closely related to the research impact, such as citation impacts; scholarly impact. Economic law recognizes the term profit, so how much money we spend to produce something, the product must also have a significant impact (profit). The evaluation functions provided by the ESI (Essential Science Indicators) agency of ISI (Institute for Scientific Information) are for those who are mainly engaged in scientific and technological or economic policy in government departments (Qiu et al., 2017). Economic indicators (bibliometrics) are not only used as variables in measuring university efficiency but can also be used to evaluate a journal. Evaluating journals from both usage and economic benefits provides a comprehensive measure for periodical ordering and funding (Qiu et al., 2017). Journal publication costs can be used as a variable in measuring efficiency or evaluating journals, according to Qiu et al., (2017) statement that the price component can be used to evaluate journals(Qiu et al., 2017; Rousseau et al., 2018). Economic indicators are a crucial component in producing research because quality articles should have a good impact, such as the number of productive citations disseminated on social media so that they can be used directly by the broader community for their work.

Data Envelopment Analysis

DEA is a simple approach that can be used to measure the efficiency of an object (fields: commercial/economic, educational, social, etc.; institutions: companies, universities, institutes, activities). Following the statement by Petridis et al., (2013) that DEA can be used to measure efficiency in DMUs (Decision-Making Units) such as institutions, departments, journals, etc. (Petridis et al., 2013). This DEA approach can be made if in an activity there are input variables in and output variables generated from these activities. Following the statement by Ahmed (2021) et al., "DEA can measure the efficiency of DMU with multiple inputs and multiple outputs" (Ahmed et al., 2021). Calculation of input variables and output variables with the formula constant return to scale (CRS) and variable return scale (VRS) will produce an efficient or inefficient value. So it can be said that DEA is one of the mathematical methods (Ahmed et al., 2021; Mutz et al., 2017; Ortega & Gavilan, 2013; Rosenthal & Weiss, 2017).

Implementation of Data Envelopment Analysis

Research with the DEA approach is usually carried out at a university to measure efficiency, but in recent years it has been used to measure the efficiency or impact of a journal. However, in this case, the variables measured are different. The reality in the field is that journals apply fees to be published. The following is a previous study using the DEA approach and its input and output variables, including:

Table 1. Previous study using the DEA approach and its input and output variables

No	Title	Input	Output
1	Technical Efficiency and Productivity of Higher Education Institutions in the Nordic Countries(Andersson & Sund, 2021)	• teaching and/or research staff (full-time equivalents) • other staff (full-time equivalents) • number of full-time undergraduate students at the undergraduate and graduate levels (adjusted for differences in prerequisites) • doctoral students (full-time equivalents) • office space in square meters.	• number of ECTS credits which serves as a measurement of successfully completed undergraduate- and graduate-level education (adjusted for cost differences depending on the varying educational mix between HEIs) • number of Ph.D. degrees (moving average) • number of publications in scientific journals (moving average) • number of highly cited publications in scientific journals (moving average)
2	A novel approach for assessing academic journals: Application of integer DEA model for management science and operations research field(K. Chen et al., 2021)	• Costs: • Excessive self-citation rate	• IF • Eigenfactor score • H-index • Scimago Journal rank database • ABS Ranking UT/DALLAS list
3	Efficiency analysis of forestry journals: Suggestions for improving journals' quality(Petridis et al., 2013)	• Frequency • Articles published per year	• Eigenfactor Score (EGSC) • h-index (H) • 5-year impact factor (IF5)
4	Efficiency assessment of universities through data envelopment Analysis(Kuah & Wong, 2011)	• Number of academic staff • Number of taught course students • Average students' qualifications (CGPA) • University expenditures (Million USD) • Number of research staff • Average research staff's qualifications • Number of research students Research grants (Million USD	• Number of graduates from taught courses • Average graduates' results (CGPA) • Graduation rate (%) • Graduates' employment rate (%) • Number of graduates from research • Number of publications • Number of awards • Number of intellectual properties
5	A data envelopment analysis approach for ranking journals(Rosenthal & Weiss, 2017)	• Total articles	• Total Cites, • impact factor, • Five-Year Impact Factor, • Immediacy Index, • Eigenfactor Score, and • Article Influence Score

6	Performance of Indonesia's World-Class University Efficiency with Bibliometrics (Scientific Strength) Approach and Data Envelopment Analysis(Ibrahim & Fadhli, 2021)	• Number of researchers/author • Number of Students	• Scientific Strength (SS)
7	A field-standardized application of DEA to national-scale research assessment of Universities(Abramo et al., 2011)	• Staff-years of full professors • Staff-years of associate professors Input • Staff-years of assistant professors	• Scientific Strength
8	Measuring journal performance for multidisciplinary research: An efficiency perspective(Lee & Shin, 2014)	• Articles • Citation density • Citation dynamics	• Total citations • External citations • Self-citations
9	Measuring Performance Evolution of Academic Journals in Management Science and Operations Research: A DEA-Malmquist Approach(K. Chen et al., 2017)	• Articles • City half-life • Citation density • IF	• Total citations
10	Assessment of research efficiency of critical care medicine in hospitals affiliated university based on data envelopment method: taking the 13th Five-Year Plan period as an example(Qi et al., 2022)	• The scientific research investment funds • The number of physicians involved in scientific research	• The number of science citation index (SCI) papers • Chinese sciencecitationdatabase (CSCD) papers • The number of masters and doctors
11	Research quality and efficiency An analysis of assessments and management issues in Dutch economics and business research programs(Groot & García-Valderrama, 2006)	• Academic staff directly funded by the government • Academic staff funded by national research councils • Academic staff funded by third parties	• Dissertations • International academic publications • Dutch academic publications • Professional publications
12	A Data Envelopment Analysis Application for Measuring Efficiency of University Departments(Gökşen et al., 2015)	• Outdoor-indoor area of the university • Number of Academic Staff and • Number of Administrative Staff	• Number of Publications • Number of Graduate Students
13	Evaluating the Efficiency of Faculties in University of Malaya Using Data	• Academic Staff Number	• Local Student Number • International Student Number

	Envelopment Analysis(Ahmed et al., 2021)		• Employment Student Number
14	Measuring the efficiency of university departments: an empirical study using data envelopment analysis and cluster analysis (S. P. Chen & Chang, 2021)	• Personnel • Expenses (1000) • Space (square • meters)	• Teaching • (credit-hours) • Publication • External grants (1000)

2. METHODS

This study aims to determine the efficiency of journals in Indonesia indexed by SINTA ranked 1-50 contained in the SCOPUS and WoS journal databases between the number of authors who wrote the article, the team working on the Journal the cost of publication with Scientific Strength (total publication and citation) with DEA approach. The following is an image of the research design, including:
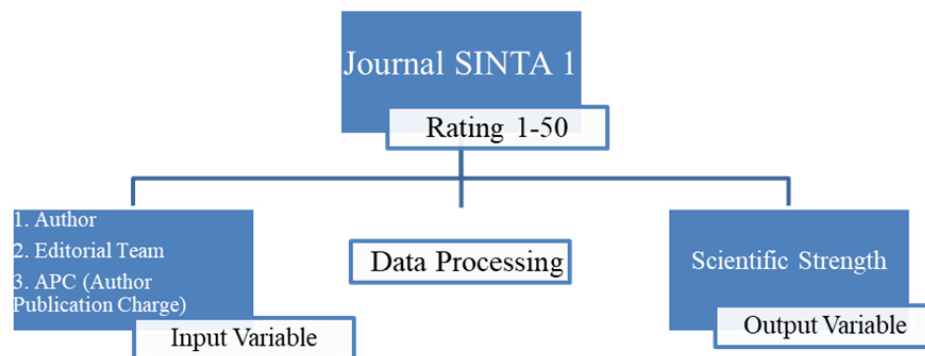
Figure 1. Research design

In the process of collecting scientific/research article data in journals, there are two journals not indexed in Scopus. While journals that WoS do not index, only 19 journals indexed by SINTA are indexed by WoS.

The second stage is to determine DMU (Decision Making Units) variable. This variable consists of two parts, namely input variables and output variables, where this input variable is the input made by the Journal in producing the publication of scientific articles. In contrast, the output variable is the output produced by a journal. The following are the input and output variables in this study, including:

Table 2. Variable Input and output research

Variable	Category
Author	Input
Editorial team (editor, reviewer, etc.)	Input
APC (Article Publication Charge)	Input
Scientific Strength	Output

This study is aimed to to analyze the efficiency of the SINTA Indonesia-indexed journal with the DEA approach by determining the input and output variables. Based on the data

above, the input variables consist of the author, the editorial team, and the APC, while the output variables in this study are scientific strength (publications and citations) generated from journals and scientific articles in the Journal. Then the variable is calculated using the DEA method to measure the efficiency of the Journal; if the value is 1 or 100%, then the Journal can be said to be efficient.

Data Collection

Table 3. Total article publications in Scopus and WoS

Sinta 1 Journals	Total Publication		Citations	
	Scopus	**WoS**	**Scopus**	**WoS**
Journal on Mathematics Education	220	_	1649	_
International Journal of Evaluation and Research in Education (IJERE)	356	_	381	_
Jurnal Pendidikan IPA Indonesia (Indonesian Journal of Science Education)	414	_	2228	_
Indonesian Journal of Science and Technology	149	_	815	_
Makara Journal of Science	15	407	0	610
International Journal of Electrical and Computer Engineering	3553	_	13539	_
TELKOMNIKA (Telecommunication Computing Electronics and Control)	1980	_	6392	_
Indonesian Journal of Islam and Muslim Societies	121	125	237	158
IJoLE: International Journal of Language Education	109	110	90	29
ACTA MEDICA INDONESIANA	_	438	_	1409
Forest and Society	104	105	405	295
QIJIS (Qudus International Journal Of Islamic Studies)	49	_	50	_
IJAL (Indonesian Journal of Applied Linguistics)	426	_	823	_
Operations and Supply Chain Management: An International Journal	96	264	249	931
International Journal on Advanced Science, Engineering and Information Technology (IJASEIT)	1828	_	5372	_
IAES International Journal of Artificial Intelligence	258	_	464	_
Gadjah Mada International Journal of Business (GamaIJB)	182	257	563	664
Ahkam: Jurnal Ilmu Syariah	9	_	0	_
International Journal of Technology	800	1159	2373	3241
AGRIVITA, Journal of Agricultural Science (AJAS)	303	_	646	_
Biodiversitas : Journal of Biological Diversity	2485	_	5215	_
Jurnal Cakrawala Pendidikan	191	_	284	_
Indonesian Journal of Electrical Engineering and Computer Science	3489	_	8886	_
International Journal of Power Electronics and Drive Systems	1526	_	6529	_
Indonesian Journal of Electrical Engineering and Informatics	304	_	563	_
Bali Medical Journal	336	917	20	1437
International Journal of Renewable Energy Development : JRED	361	329	1412	1045
Automotive Experiences	55	_	86	_

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Bulletin of Chemical Reaction Engineering & Catalysis	531	560	2477	2098
Bulletin of Electrical Engineering and Informatics	881	_	1965	_
Journal of Indonesian Islam	211	_	377	_
Studies in English Language and Education	93	_	71	_
Paediatrica Indonesiana: Indonesian Journal of Pediatrics and Perinatal Medicine	91	395	7	246
Register: Jurnal Ilmiah Teknologi Sistem Informasi	90	_	71	_
Al-Jami'ah: Journal of Islamic Studies	140	241	214	221
International Journal of Public Health Science	156	_	47	_
Indonesian Journal of Biotechnology	62	_	42	_
Indonesian Journal of Chemistry	638	_	1714	_
Science and Technology Indonesia	26	_	8	_
Economic Journal of Emerging Markets	_	248	_	152
Studia Islamika	315	270	790	191
IJAIN (International Journal of Advances in Intelligent Informatics)	151	_	464	_
JOIV: International Journal on Informatics Visualization	245	_	386	_
Islamic Guidance and Counseling Journal	49	_	24	_
Tropical Animal Science Journal	141	163	249	148
BIOTROPIA	261	_	626	_
Electronic Journal of Graph Theory and Applications	157	214	247	532
Squalen Bulletin of Marine and Fisheries Postharvest and Biotechnology	43	_	32	_
Journal of ICT Research and Applications	36	200	23	406
Jurnal Manajemen Hutan Tropika	217	319	537	450

Table 4. Total numbers of authors, editorial team, & APC

Journal (by Sinta 1-Rank 1-50)	Input					
	Authors	Scopus Editorial Team	APC	Authors	WoS Editorial Team	APC
Journal on Mathematics Education	442	24	250 USD	_	24	250 USD
International Journal of Evaluation and Research in Education (IJERE)	957	22	250 USD	_	22	250 USD
Jurnal Pendidikan IPA Indonesia (Indonesian Journal of Science Education)	964	14	Rp. 4000000	_	14	Rp. 4000000
Indonesian Journal of Science and Technology	412	30	Free	_	30	Free
Makara Journal of Science	58	25	Free	1277	25	Free
International Journal of Electrical and Computer Engineering	8147	126	295 USD	_	126	295 USD
TELKOMNIKA (Telecommunication Computing Electronics and Control)	4877	54	265 USD	_	54	265 USD
Indonesian Journal of Islam and Muslim Societies	179	25	450 USD	202	25	450 USD
IJoLE: International Journal of Language Education	203	17	235 USD	249	17	235 USD
ACTA MEDICA INDONESIANA	_	32	Rp. 7.500.000	1865	32	Rp. 7.500.000
Forest and Society	303	36	300 USD	372	36	300 USD
QIJIS (Qudus International Journal Of Islamic Studies)	86	86	Free	_	86	Free

Journal						
IJAL (Indonesian Journal of Applied Linguistics)	702	25	350	_	25	350
Operations and Supply Chain Management: An International Journal	207	55		644	55	
International Journal on Advanced Science, Engineering and Information Technology (IJASEIT)	4752	33	255 USD	_	33	255 USD
IAES International Journal of Artificial Intelligence	738	95	256 USD	_	95	256 USD
Gadjah Mada International Journal of Business (GamaIJB)	388	18	Free	547	18	Free
Ahkam: Jurnal Ilmu Syariah	18	30		_	30	
International Journal of Technology	2389	41	550 USD	4336	41	550 USD
AGRIVITA, Journal of Agricultural Science (AJAS)	888	24	250 USD	_	24	250 USD
Biodiversitas: Journal of Biological Diversity	6364	43	250 USD	_	43	250 USD
Jurnal Cakrawala Pendidikan	514	39	Rp. 2.500.000	_	39	Rp. 2.500.000
Indonesian Journal of Electrical Engineering and Computer Science	7993	115	275 USD	_	115	275 USD
International Journal of Power Electronics and Drive Systems	3449	67	265	_	67	265
Indonesian Journal of Electrical Engineering and Informatics	835	19	200	_	19	200
Bali Medical Journal	1075	14		3385	14	
International Journal of Renewable Energy Development: JRED	1056	35	200 USD	1096	35	200 USD
Automotive Experiences	157	20	Rp. 1.000.000	_	20	Rp. 1.000.000
Bulletin of Chemical Reaction Engineering & Catalysis	1449	25	150 USD	2149	25	150 USD
Bulletin of Electrical Engineering and Informatics	2555	177	256	_	177	256
Journal of Indonesian Islam	218	36		_	36	
Studies in English Language and Education	219	24	120 USD	_	24	120 USD
Paediatrica Indonesiana: Indonesian Journal of Pediatrics and Perinatal Medicine	287	34		1518	34	
Register: Jurnal Ilmiah Teknologi Sistem Informasi	215	19	175 USD	_	19	175 USD
Al-Jami'ah: Journal of Islamic Studies	166	39	Free	297	39	Free
International Journal of Public Health Science	476	34	215 USD	_	34	215 USD
Indonesian Journal of Biotechnology	263	21	150 USD	_	21	150 USD
Indonesian Journal of Chemistry	1929	25	300 USD	_	25	300 USD
Science and Technology Indonesia	94	41	200 USD	_	41	200 USD
Economic Journal of Emerging Markets	_	19	Free	489	19	Free
Studia Islamika	257	37		301	37	
IJAIN (International Journal of Advances in Intelligent Informatics)	405	43	385 USD	_	43	385 USD
JOIV : International Journal on Informatics Visualization	599	28	Free	_	28	Free
Islamic Guidance and Counseling Journal	102	9	300 USD	_	9	300 USD
Tropical Animal Science Journal	494	31	300 USD	743	31	300 USD
BIOTROPIA	683	17		_	17	
Electronic Journal of Graph Theory and Applications	310	38	Free	491	38	Free
Squalen Bulletin of Marine and Fisheries Postharvest and Biotechnology	145	23	Free	_	23	Free

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Journal of ICT Research and Applications	100	20	150 USD	572	20	150 USD
Jurnal Manajemen Hutan Tropika	451	31	Rp. 1.000.000	1017	31	Rp. 1.000.000

The APC value above is uniformized in the dollar exchange rate to facilitate the process of calculating input and output variables using DEAP software.

Journal Efficiency Analysis with Bibliometric Approach (Scientific Strength)

Bibliometric analysis (scientific strength) was first introduced by Abramo et al., (2008), where to measure the scientific strength of a university or journal. Tt is not only seen from the number of publications but also the number of authors and citations obtained. The bibliometric approach (scientific strength) is commonly used to measure university efficiency by considering the input variables and resulting output variables (research). However, apart from being used to measure university research performance, a bibliometric approach (scientific strength) can also be used to measure the efficiency of a journal by taking into account the economic input indicator variable (APC/article publication charge) because several journals apply a reasonably expensive fee for publication in a journal.(Abramo & D'Angelo, 2014).

The formula for calculating data in this study is Scientific Strength (SS), adopted from Abramo et al., (2011).

$$SS = \sum_{i=1}^{n} \bar{C}_i \cdot f_i$$

Where: = standardized citations of publication I by Journal. Citations of each publication are standardized dividing them by the median of citations of all publications of the same year

$$\bar{C}_i$$

f_i = fractional count of publication i, ie, the ratio of the number of co-authors of the Journal to the total number of co-authors.

SINTA-Indexed Journal Efficiency Analysis with DEA Approach

In addition, bibliometric analysis (scientific strength) is used to see the scientific strength of the journal and efficiency analysis with the DEA method. The calculation test technique used is the constant return to scale (CRS) method and the variable return scale (VRS) method. This study also uses the concept of super efficiency, which was adopted by Andersen & Petersen (1993); the highest efficiency value is 1 or 100%.

CRS model formula:

$$
\begin{aligned}
\max_{\mu_k, v_i} \quad & \sum_{k=1}^{p} \mu_k v_{k_0} \\
\text{s.t.} \quad & \sum_{i=1}^{m} v_i x_{i_0} = 1 \\
& \sum_{k=1}^{p} \mu_k y_{kj} - \sum_{i=1}^{m} v_i x_{ij} \le 0 \qquad j = 1,\dots,n \\
& \mu_k \ge \varepsilon, v_i \ge \varepsilon \qquad\qquad\quad k = 1,\dots,p \\
& \qquad\qquad\qquad\qquad\qquad\quad i = 1,\dots,m
\end{aligned}
$$

VRS model formula:

$$\max_{\mu_k, v_i} \sum_{k=1}^{p} \mu_k v_{k_0} - u_0$$

$$\text{s.t.} \quad \sum_{i=1}^{m} v_i x_{i_0} = 1$$

$$\sum_{k=1}^{p} \mu_k y_{kj} - \sum_{i=1}^{m} v_i x_{ij} - u_0 \leq 0 \quad j = 1,...,n$$

$$\mu_k \geq \varepsilon, v_i \geq \varepsilon \qquad k = 1,...,p$$

$$i = 1,...,m$$

(Rusyidiana, 2013)

3. RESULTS AND DISCUSSION

DEA (Data Envelopment Analysis) is an analysis to see how efficient the impact of the success of a journal in publishing a scientific article. The success of a scientific article can be seen from the number of citations obtained from publications in the published journal. The inputs to a journal in the process of publishing scientific articles in this research are the authors, editorial team (reviewer, editor, and etc.), and APC (article publication charge). In comparison, the output of a journal is to calculate the bibliometric (scientific strength) articles.

Journal Efficiency Analysis with Bibliometric Approach (Scientific Strength)

Based on the author's data analysis, the following are the results of scientific strength calculations in SINTA 1 BRIN journals indexed by Scopus and WoS.

Table 5. The results of scientific strength calculations in SINTA 1 BRIN journals indexed by Scopus and WoS

No	Journal (by SINTA 1-Rank 1-50)	Scientific Strength	
		Scopus	WoS
1	Journal on Mathematics Education	831.4358	_
2	International Journal of Evaluation and Research in Education (IJERE)	10289.17	_
3	Indonesian Journal of Science Education (Indonesian Journal of Science Education)	3239,465	_
4	Indonesian Journal of Science and Technology	790.3179	_
5	Makara Journal of Science	0	476.0338
6	International Journal of Electrical and Computer Engineering	335203.4	_
7	TELKOMNIKA (Telecommunication Computing Electronics and Control)	112498.3	_
8	Indonesian Journal of Islam and Muslim Societies	147.7029	104.0849
9	IJoLE: International Journal of Language Education	456.2936	122.6012
10	ACTA MEDICA INDONESIANA	_	2494,807
11	Forest and Society	583.8953	361.0294
12	QIJIS (Qudus International Journal Of Islamic Studies)	120.8953	_
13	IJAL (Indonesian Journal of Applied Linguistics)	3097.88	_

14	Operations and Supply Chain Management: An International Journal	493,374	405.6448
15	International Journal on Advanced Science, Engineering, and Information Technology (IJASEIT)	78755.12	_
16	IAES International Journal of Artificial Intelligence	3498111	_
17	Gadjah Mada International Journal of Business (GamaIJB)	436.6229	191.3863
18	Ahkam: Journal of Sharia Science	0	_
19	International Journal of Technology	23937.95	20787.13
20	AGRIVITA, Journal of Agricultural Science (AJAS)	137.9857	_
21	Biodiversity: Journal of Biological Diversity	213761.7	_
22	Journal of Education Horizon	2115.542	_
23	Indonesian Journal of Electrical Engineering and Computer Science	449130.5	_
24	International Journal of Power Electronics and Drive Systems	43850.69	_
25	Indonesian Journal of Electrical Engineering and Informatics	4189,411	_
26	Bali Medical Journal	1808.032	5066,685
27	International Journal of Renewable Energy Development: JRED	1526.013	969.4047
28	Automotive Experiences	126.1847	_
29	Bulletin of Chemical Reaction Engineering & Catalysis	3696,772	3189,473
30	Bulletin of Electrical Engineering and Informatics	89805.39	_
31	Journal of Indonesian Islam	242.2993	_
32	Studies in English Language and Education	726.8754	_
33	Paediatrica Indonesiana: Indonesian Journal of Pediatrics and Perinatal Medicine	106.2439	332.07
34	Register: Scientific Journal of Information System Technology	110.1391	_
35	Al-Jami'ah: Journal of Islamic Studies	353.5083	170.9699
36	International Journal of Public Health Science	989.4454	_
37	Indonesian Journal of Biotechnology	178.0989	_
38	Indonesian Journal of Chemistry	10115.68	_
39	Science and Technology Indonesia	46.22222	_
40	Economic Journal of Emerging Markets	_	158.8989
41	Islamic Studies	279.36	135.5379
42	IJAIN (International Journal of Advances in Intelligent Informatics)	553.5781	_
43	JOIV: International Journal on Informatics Visualization	2188.21	_
44	Islamic Guidance and Counseling Journal	34.60784	_
45	Tropical Animal Science Journal	1057.66	781.8333
46	BIOTROPIA	304.4978	_
47	Electronic Journal of Graph Theory and Applications	538.4306	452.7637
48	Squalen Bulletin of Marine and Fisheries Postharvest and Biotechnology	210.9172	_
49	Journal of ICT Research and Applications	56.64	201.6308
50	Journal of Tropical Forest Management	619,4145	331.7937

Components in the calculation of scientific strength, total publications, total authors, and total citations. The journals that have the highest scientific strength value are *Indonesian Journal of Electrical Engineering and Computer Sciencei*, 449130.5, Scopus indexed. In contrast, the scientific strength value of the highest WoS-indexed Journal is *the International Journal of Technology*, 20787.13.

SINTA-Indexed Journal Efficiency Analysis with DEA Approach

The last step to analyze the efficiency of a journal is to calculate the DEA value contained in the Journal. The component of calculating the DEA value is to calculate the input and output variables of the Journal. Based on the author's data analysis, the results of DEA calculations in SINTA 1 BRIN journals indexed by Scopus and WoS.

Table 6. The results of DEA calculations in SINTA 1 BRIN journals indexed by Scopus and WoS

No	Journal (by SINTA 1-Rank 1-50)	DEA	
		Scopus	WoS
1	Journal on Mathematics Education	0.175	–
2	International Journal of Evaluation and Research in Education (IJERE)	1,000	–
3	Indonesian Journal of Science Education (Indonesian Journal of Science Education)	0.495	–
4	Indonesian Journal of Science and Technology	1,000	–
5	Makara Journal of Science	0	1,000
6	International Journal of Electrical and Computer Engineering	1,000	–
7	TELKOMNIKA (Telecommunication Computing Electronics and Control)	0.783	–
8	Indonesian Journal of Islam and Muslim Societies	0.02	0.385
9	IJoLE: International Journal of Language Education	0.055	0.368
10	ACTA MEDICA INDONESIANA	–	1,000
11	Forest and Society	0.047	0.726
12	QIJIS (Qudus International Journal Of Islamic Studies)	1,000	–
13	IJAL (Indonesian Journal of Applied Linguistics)	0.266	–
14	Operations and Supply Chain Management: An International Journal	1,000	1,000
15	International Journal on Advanced Science, Engineering and Information Technology (IJASEIT)	1,000	–
16	IAES International Journal of Artificial Intelligence	0.286	–
17	Gadjah Mada International Journal of Business (GamaIJB)	1,000	1,000
18	Ahkam: Journal of Sharia Science	–	–
19	International Journal of Technology	0.605	1,000
20	AGRIVITA, Journal of Agricultural Science (AJAS)	0.009	–
21	Biodiversity: Journal of Biological Diversity	1,000	–
22	Journal of Education Horizon	0.073	–
23	Indonesian Journal of Electrical Engineering and Computer Science	1,000	–
24	International Journal of Power Electronics and Drive Systems	0.226	–
25	Indonesian Journal of Electrical Engineering and Informatics	0.089	–
26	Bali Medical Journal	–	–
27	International Journal of Renewable Energy Development: JRED	0.086	0.184
28	Automotive Experiences	0.023	–
29	Bulletin of Chemical Reaction Engineering & Catalysis	0.291	0.665
30	Bulletin of Electrical Engineering and Informatics	1,000	–
31	Journal of Indonesian Islam	–	–
32	Studies in English Language and Education	0.094	–

33	Paediatrica Indonesiana: Indonesian Journal of Pediatrics and Perinatal Medicine	–	–
34	Register: Scientific Journal of Information System Technology	0.098	–
35	Al-Jami'ah: Journal of Islamic Studies	1,000	1,000
36	International Journal of Public Health Science	0.396	–
37	Indonesian Journal of Biotechnology	0.129	–
38	Indonesian Journal of Chemistry	1,000	–
39	Science and Technology Indonesia	0.23	–
40	Economic Journal of Emerging Markets	–	1,000
41	Islamic Studies	–	–
42	IJAIN (International Journal of Advances in Intelligent Informatics)	0.638	–
43	JOIV: International Journal on Informatics Visualization	1,000	–
44	Islamic Guidance and Counseling Journal	0.158	–
45	Tropical Animal Science Journal	1,000	1,000
46	BIOTROPIA	–	–
47	Electronic Journal of Graph Theory and Applications	1,000	1,000
48	Squalen Bulletin of Marine and Fisheries Postharvest and Biotechnology	1,000	–
49	Journal of ICT Research and Applications	0.412	0.516
50	Journal of Tropical Forest Management	1,000	1,000

Journals with the highest efficiency values are DEA values of 1,000 or 100%; in this case, the SINTA 1 BRIN journals indexed by Scopus and WoS, which have DEA values of 1,000 are five journals. In this case, the Journal is proven effective and efficient in terms of the cost of journal publication and the impact (citations) obtained after publication in the Journal.

Discussion

The Demands of Academics and Researchers for Publication In Reputable Journals

Researchers and academics, in Indonesia context, both lecturers and students (postgraduate), must publish in reputable journals with an impact factor value determined by government regulations and laws. According to Operational Guidelines for Assessment of Credit Scores for Academic Promotion/Lecturer Ranks in 2019 (PO PAK 2019) which is based on Law Number 20 of 2003 concerning the National Education System; Law Number 14 of 2005 concerning Teachers and Lecturers; Government Regulation Number 37 of 2009 concerning Lecturers and Law Number 12 of 2012 concerning Higher Education, states that articles must be published and indexed in reputable international journals recognized by the Ministry of Research, Technology and Higher Education (Clarivate Analytics WoS and/or Scopus) with SJR Journals above 0.05 (Kemdikbud, 2019).

This demand requires academics and researchers to produce studies with a high value of originality and novelty. Because for publication in a reputable journal, research must have novelty; this follows the statement that quality research is research that has novelty and is scientifically measurable. (Yan et al., 2022). However, the phenomenon in Indonesia is that there is still a low research culture in Indonesia. In this case, the government, universities, and research institutions are trying to increase the number of existing researchers in Indonesia with various schemes, including research grants and incentive assistance for researchers. Conducting research cannot be denied that it requires high research costs. Besides that, publication in reputable journals requires very high costs. Research assistance from the government, universities, and research institutions, can increase the number of research in Indonesia and positively impact Indonesia, both institutionally and individually, especially in

career paths. Based on DEA calculations, the Journal that has the highest efficiency value is the Journal with free publication fees because the Journal is open access, so the opportunity for citation is higher than others. Based on the results of this study, it is hoped that researchers will obtain information about research results that will be published in journals, especially in Indonesia. So that scientific articles that will be published in these journals will have an impact, especially citations, and the publication costs are not too high.

Scopus and WoS

Calculation of the DEA value in SINTA 1 journals indexed by Scopus and WoS shows that the DEA value is greater in journals indexed by WoS compared to Scopus, with a very thin comparison of DEA values. It can be seen in the following image.
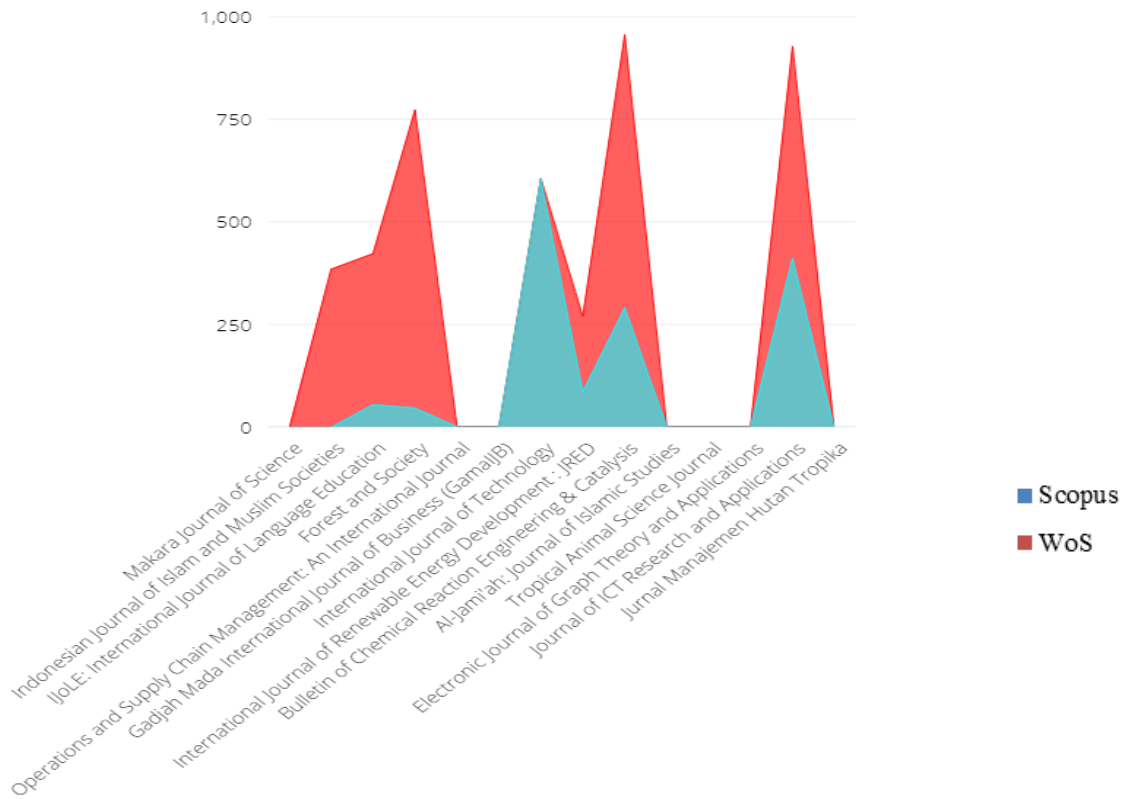
Figure 2. Comparison of DEA values

Based on this research, particularly Indonesian researchers, can have considerations regarding research results or scientific articles that they want to be published in journals, especially in Indonesia. Do you want to publish in Scopus or WoS-indexed journals or better index the two of both So that the impact of publication after the article is published will be optimal.

4. CONCLUSION

The results of this study show that the top journals in Indonesia indexed by Scopus and WoS, which have a DEA value of 1,000, are Operations and Supply Chain Management: An International Journal; Gadjah Mada International Journal of Business (GamaIJB); Al-Jami'ah: Journal of Islamic Studies; Tropical Animal Science Journal; Electronic Journal of Graph Theory and Applications; Journal of Tropical Forest Management. The DEA value of the top journals in Indonesia that WoS index is greater than the DEA value of the journals indexed by Scopus, but

the difference is small. The lowest DEA value is 0 in the Makara Journal of Science. Research can recommend researchers determine journals for publication so that published articles can be optimally helpful, especially regarding impact citations.

REFERENCES

Abramo, G., Cicero, T., & D'Angelo, C. A. (2011). A field-standardized application of DEA to national-scale research assessment of universities. *Journal of Informetrics*, *5*(4), 618–628. https://doi.org/10.1016/j.joi.2011.06.001

Abramo, G., & D'Angelo, C. A. (2014). How do you define and measure research productivity? *Scientometrics*, *101*(2), 1129–1144. https://doi.org/10.1007/s11192-014-1269-8

Abramo, G., D'Angelo, C. A., & Pugini, F. (2008). The measurement of Italian universities' research productivity by a non parametric-bibliometric methodology. *Scientometrics*, *76*(2), 225–244. https://doi.org/10.1007/s11192-007-1942-2

Ahmed, S. A. M., Talib, M. A., Noor, N. F. M., & Jani, R. (2021). Evaluating the Efficiency of Faculties in University of Malaya Using Data Envelopment Analysis. *Journal of Physics: Conference Series*, *1860*(1). https://doi.org/10.1088/1742-6596/1860/1/012024

Andersen, P., & Petersen, N. C. (1993). A Procedure for Ranking Efficient Units in Data Envelopment Analysis. *Management Science*, *39*(10), 1261–1264. https://doi.org/10.1287/MNSC.39.10.1261

Andersson, C., & Sund, K. (2021). Technical Efficiency and Productivity of Higher Education Institutions in the Nordic Countries. *International Journal of Public Administration*, *00*(00), 1–14. https://doi.org/10.1080/01900692.2020.1868508

Chen, K., Ren, X. T., & Yang, G. L. (2021). A novel approach for assessing academic journals: Application of integer DEA model for management science and operations research field. *Journal of Informetrics*, *15*(3), 101176. https://doi.org/10.1016/J.JOI.2021.101176

Chen, K., Yang, G., & Khoveyni, M. (2017). Measuring Performance Evolution of Academic Journals in Management Science and Operations Research: A DEA-Malmquist Approach. *Journal of Management Science and Engineering*, *2*(1), 34–54. https://doi.org/10.3724/SP.J.1383.201002

Chen, S. P., & Chang, C. W. (2021). Measuring the efficiency of university departments: an empirical study using data envelopment analysis and cluster analysis. *Scientometrics*, *126*(6), 5263–5284. https://doi.org/10.1007/s11192-021-03982-3

Daraio, C., Lenzerini, M., Leporelli, C., Moed, H. F., Naggar, P., & Bonaccorsi, A. (2016). Data integration for research and innovation policy: an Ontology-Based Data Management approach. *Scientometrics*, *December*. https://doi.org/10.1007/s11192-015-1814-0

Gökşen, Y., Doğan, O., & Özkarabacak, B. (2015). A Data Envelopment Analysis Application for Measuring Efficiency of University Departments. *Procedia Economics and Finance*, *19*(15), 226–237. https://doi.org/10.1016/s2212-5671(15)00024-6

Groot, T., & García-Valderrama, T. (2006). Research quality and efficiency. An analysis of assessments and management issues in Dutch economics and business research programs. *Research Policy*, *35*(9), 1362–1376. https://doi.org/10.1016/j.respol.2006.07.002

Guşu, P. F., & Butnariu, A. R. (2021). Bibliometrics and Research Evaluation: Uses and Abuses (History and Foundations of Information Science). In *The Annals of the University of Oradea. Economic Sciences TOM XXX* (Issue July). The MIT Press.

Ibrahim, C., & Fadhli, R. (2021). Performance of Indonesia's World-Class University Efficiency with Bibliometrics (Scientific Strength) Approach and Data Envelopment Analysis. *Webology*, *18*(1), 32–50. https://doi.org/10.14704/WEB/V18I1/WEB18003

Kemdikbud. (2019). *Pedoman Operasional Penilaian Angka Kredit Kenaikan Jabatan Akademik/Pangkat Dosen*.

Kuah, C. T., & Wong, K. Y. (2011). Efficiency assessment of universities through data envelopment analysis. *Procedia Computer Science*, *3*, 499–506. https://doi.org/10.1016/j.procs.2010.12.084

Lee, H., & Shin, J. (2014). Measuring journal performance for multidisciplinary research: An efficiency perspective. *Journal of Informetrics*, *8*(1), 77–88. https://doi.org/10.1016/j.joi.2013.10.004

Mutz, R., Bornmann, L., & Daniel, H. D. (2017). Are there any frontiers of research performance? Efficiency measurement of funded research projects with the Bayesian stochastic frontier analysis for count data. *Journal of Informetrics*, *11*(3), 613–628. https://doi.org/10.1016/j.joi.2017.04.009

Ortega, F. J., & Gavilan, J. M. (2013). The measurement of production efficiency in scientific journals through stochastic frontier analysis models: Application to quantitative economics journals. *Journal of Informetrics*, *7*(4), 959–965. https://doi.org/10.1016/j.joi.2013.09.004

Petridis, K., Malesios, C., Arabatzis, G., & Thanassoulis, E. (2013). Efficiency analysis of forestry journals: Suggestions for improving journals' quality. *Journal of Informetrics*, *7*(2), 505–521. https://doi.org/10.1016/j.joi.2013.02.002

Qi, T., Zang, X., Bian, W., Zhen, J., & Li, X. (2022). Assessment of research efficiency of critical care medicine in hospitals affiliated S university based on data envelopment method: taking the 13th Five-Year Plan period as an example. *Zhonghua Wei Zhong Bing Ji Jiu Yi Xue*, *34*(3), 294–300. https://doi.org/10.3760/CMA.J.CN121430-20220112-00050

Qiu, J., Zhao, R., Yang, S., & Dong, K. (2017). *Informetrics*. Springer Nature.

Rosenthal, E. C., & Weiss, H. J. (2017). A data envelopment analysis approach for ranking journals. *Omega (United Kingdom)*, *70*, 135–147. https://doi.org/10.1016/j.omega.2016.09.006

Rousseau, R., Egghe, L., & Guns, R. (2018). *Becoming Metric-Wise: A Bibliometric Guide for Researchers*. Chandos Publishing.

Rusyidiana, A. S. (2013). *Measuring the Efficiency Level with the Data Envelopment Analysis (DEA) Method*. SMART Consulting Team.

Yan, Y., Xia, J., Sun, D., & Hu, Q. (2022). Research on combination evaluation of operational stability of energy industry innovation ecosystem based on machine learning and data mining algorithms. *Energy Reports*, *8*, 4641–4648. https://doi.org/10.1016/j.egyr.2022.02.178