Received: 23 January 2025, Revised: 06 March 2025, Accepted: 11 March 2025, Published Online: 12 March 2025

Journal of Scholarly Communication
DOI: https://doi.org/10.62160/JSC26

RESEARCH ARTICLE

Open Access Publishing in Singapore: Trends and Policy Perspectives

Jinjin Liu *

SEGi University, Malaysia

* Corresponding author: e-mail: liujinjin_2007@126.com.

Keywords: Open Access; Singapore; Directory of Open Access Journals (DOAJ); OpenDOAR; ROARMAP

ABSTRACT

This study aims to give a comprehensive overview of open access (OA) publishing in Singapore from the trends and policy perspectives, containing different aspects of OA development (i.e., OA journals, OA repositories, and OA mandates and policies). Data for analyzing OA trends and policies were gathered through multiple databases as of 1st January 2024. The Directory of Open Access Journals (DOAJ) was employed to extract sample OA journals that are being applied to investigate the main characteristics of Singapore's OA journals. Web of Science (WoS) and Scopus were used to locate the overall quality of those OA journals indexed in DOAJ. OpenDOAR and ROARMAP were used to explore the status of OA repositories and OA mandates and policies, respectively. DOAJ indexes 50 Singapore's OA journals. Among them, 19 journals (38.0%) were also indexed by WoS, while 15 (78.0%) ranked in Q3 and Q4. Meanwhile, 29 journals (58.0%) were indexed by Scopus, while 19 (around 65.5%) ranked between 25 percent and 75 percent in the respective subject. Additionally, 76.0% of OA journals adopt CC BY licensing, and another 16.0% adopt CC BY-NC licensing. From the publication fee perspective, two-thirds of OA journals do not charge any article processing fee, and 36.0% offer publication fee waivers or discount policies. Two of Singapore's OA journals (4.0%) are awarded the DOAJ Seal. This paper also puts Singapore journals into the global from several perspectives to compare, such as subject classification, copyright & licensing, and journal charge policy, as well as figures out the cross-analysis on the characteristics of journals that are indexed in the DOAJ, WoS and Scopus. Furthermore, there are only 8 OA repositories from Singapore indexed in OpenDOAR. Searching through the ROARMAP database, Singapore has only 2 of the 27 policies classified in South-eastern Asia. Though the number of Singapore's OA journals indexed in DOAJ shows an upward trend, such volume is not prominent globally. However, the quality of these OA journals is generally good, while the top journals in each subject are not very high, and the openness level is relatively high. In terms of OA repositories, OA mandates, and policy perspectives, Singapore's volume is still minimal, which requires widespread attention and action from different levels in the country and policymakers' promotion of the OA movement.

1 | Introduction

As a part of the issue of scientific publication, open access (OA) is a phenomenon gaining increasingly significant attention in recent years. UNESCO defines OA as "free access to information and unrestricted use of electronic resources for everyone." All types of digital content can be OA and obtained for free, including texts, data, software, audio, video, and multimedia [1]. OA content can be fully indexed, searchable, and machine-readable, and it can be accessible through text and data mining. Hence, anyone can locate it unrestrictedly online and pass the data to software or other lawful purposes [2]. Mainly, amid sharp budget cuts for libraries, as a revolutionary movement, the OA initiative aims to eliminate excessive permission and pricing constraints to guarantee the most extensive dissemination and visibility of research, which offers an advantageous alternative to the conventional subscription-based publishing model [3].

The initial concept of OA formally started in 2002 through the Budapest Open Access Initiative (BOAI); it referred to the free availability of articles for the public, which allows users to freely read, download, copy, distribute, print, search, or access to the full texts of these articles [4]. The Max Planck Society initiated the Berlin Declaration, and *the Berlin Declaration on Open Access to*

Knowledge in the Sciences and Humanities was adopted on 22nd October 2003, which aims to use the Internet to integrate the scientific and cultural assets of mankind around the world, and to provide a free and more open research environment for researchers and network users from all countries in the broader range of fields [5]. The Berlin Declaration then defined two main routes to open access: Gold OA and Green OA [6]. The "Gold OA route" refers to articles primarily published in OA journals, monographs, or openly accessible conference proceedings and edited volumes and made freely available on the corresponding website [7]. Still, Druelinger's research advocates the diamond OA route, aiming to improve global equity in knowledge dissemination because the Gold OA route is unfavorable to the researchers not coming from high-income level countries, as shown in his research findings [8]. The "Green OA route" also known as self-archiving, provides an OA version of subscription-based journal articles by depositing it on a website owned by the authors or their funder or on an independent repository, which may be able to access without restriction after the embargo period finished [9]. Furthermore, the Hybrid OA is also a route of attaining OA, which means individual articles can realize Gold OA immediately in subscription-based journals by paying a publication charge or article processing charge (APCs) to the publisher, but the main disadvantage of this publishing model is twice payment for the same content, including subscription fee and APCs [10].

Singapore is the most developed place in Southeast Asia, with the highest per capita income among Southeast Asian countries as well as one of the top ten financial centers. With a per capita GDP of nearly 91,100 USD in 2023, Singapore is one of the world's most dynamic and promising emerging economies [11]. Meanwhile, an article from sciencenet.cn compared the scientific research level among Shanghai, Hongkong, and Singapore during the time spam 1949-1978, 1979-2006 & 2007-2017, the finding signified that Singapore consistently took the leading position among the three cities in scientific research capability by indexing the respective volume of published articles on Nature, Science, PNAS, Cell, Cell Stem Cell via Pubmed database, especially showing extraordinary achievement in some emerging discipline, such as the field of stem cells [12]. As of 1st January 2024, to search Singapore's research output through the SCImago Journal and Country ranking portal, the citation ranking is 28th among all countries and regions listed and 35th by total document volume. From the view of the H index, Singapore ranked 22nd globally and 5th in the Asiatic region, just after Japan, China, South Korea, and India. At the same time, by searching the number of OA journals in Singapore registered with the Directory of Open Access Journals (DOAJ), only 50, ranking 50th worldwide. Looking into the rankings of Singapore's abovementioned dimensions, this study doubts that OA journals' development lagged and may be unmatched by Singapore's current scientific research level. Therefore, this study plans to explore different spheres of OA in Singapore, such as OA journal publishing and OA repositories, as well as OA mandates and policies, which are exceptionally significant in understanding the current situation and trends of OA in Singapore.

2 | Literature review

DOAJ was launched in 2003 at Lund University, Sweden, with 300 OA journals and evolving into a global platform containing over 20,000 peer-reviewed OA journals today. DOAJ is a representative high-quality database for OA journals, and it only includes Gold and Diamond OA journals, excluding titles that choose the embargo or the so-called hybrid model. Many previous studies focused on investigating certain subjects using the DOAJ database to obtain the analysis of the performance of OA journals in certain subjects. Chakravarty's study analyzed the OA Library and Information Science (LIS) Journals in DOAJ across the world from the dimensions of publisher country, publishing language, plagiarism policy, review policy, etc., and attempted to find out the characteristics of OA journals in the field of LIS worldwide [13]. In the same manner, Rathinasabapathy & Veeranjaneyulu explored the characteristics of OA journals in the field of agriculture and allied sciences based on the DOAJ database as well, which provided a reference for other journals in the same field to apply for DOAJ and promoted the OA movement in this field [14]. Besides, Rodrigues et al. gathered and identified the main characteristics of all journals with DOAJ Seal, analyzing with elements such as publisher, country, subject, indexed year, APCs, and so on to further explain the fulfillment of the best practice for open access journals [15].

Some other prior studies attempted to chart the overview of OA development in different countries and regions based on the journal data from DOAJ. All these studies on separate countries or regions contribute to research to draw a global picture of OA development. After searching the literature, we found related studies on OA development have already been conducted in some Asian countries. Cho intended to explore the characteristics of Asian OA journals and compare 21 Asian countries from different perspectives by employing correspondence and correlation analysis [16]. From a Chinese OA journals perspective, Tang et al. statistically analyzed the main characteristics of 68 Chinese OA journals included in DOAJ, studied their OA publishing experience, and explored effective methods to improve the development level of Chinese OA journals [17]. Boufarss tracked the OA academic journal landscape in the United Arab Emirates (UAE) based on the local and international databases in terms of research productivity, distribution, and access [18] and laid the foundation for the relevant study of the UAE in the future. In addition, Sathish analyzed the research output contribution among India OA journals and listed the statistical data country-wise, year-wise, subject-wise, APCs, and licensing [19]. Based on this, Nazim et al. comprehensively analyzed the overview of India OA publishing from the dimensions of OA journals, OA repositories, and OA mandates and policies by gathering information through multiple databases, such as DOAJ, SCImago, WoS, OpenDOAR, and ROARMAP [20].

3 | Methodology

This study employed a quantitative descriptive research method (simple percentage method) to analyze data from different sources.

To obtain the whole picture of the status and the trends of open access in Singapore, including OA journals, OA repositories, and OA mandates and policies, the data was extracted from DOAJ, OpenDOAR, and ROARMAP. DOAJ is an online directory that indexes and makes freely accessible data from quality-assured peer-reviewed OA journals [21], which is also regarded as a whitelist to confront supposed predatory publications. OpenDOAR is the reliable and quality-guaranteed international directory of scholarly OA repositories. It gathers and stores institutional, governmental, or subject-based materials in digital form, making it searchable and free to access [22]. ROARMAP is a constantly updated international registry that charts the growth of OA mandates and policies adopted by universities, research institutions, and research funders [23].

Journal data was downloaded from the DOAJ official website and saved as a CSV file. A total of 20,294 journals are included in DOAJ as of 1st January 2024. The specific objectives are: 1) To understand the overview of OA journal publishing in Singapore, this study refined the sample data by country of publication-wise (Singapore); fifty journals were finally obtained and will be analyzed from the dimensions of trends, subjects, languages, publisher, editorial process, publication fees, copyrights and licensing and best practices. 2) To evaluate the overall level of 50 Singapore's OA journals by examining their performance of that also in WoS (i.e., "Impact factor," "JCI Quartile," "1st Electronic JCR Year") and Scopus ("CiteScore 2022", "Rank," "Index time") database. 3) To investigate the situation of Singapore's OA repositories by looking into Open DOAR. 4) To investigate Singapore's OA mandates and policies by searching through ROARMAP.

4 | Results

4.1 | The growth trends of Singapore journals indexed in DOAJ

As presented in Figure 1, it was observed from the year-wise distribution of Singapore journals indexed in DOAJ, which presents a general growth of OA journals in Singapore. DOAJ included a journal from Singapore for the first time in 2010. Open access developed very slowly in Singapore before 2018, especially since no new journal was included in DOAJ in 2011, 2012, and 2014. However, the number of Singapore journals included in DOAJ has steadily increased from 2019 till now, which to some extent signifies that the attention of Singapore journals on open access has been improved, and the international influence of Singapore journals has gradually increased.

As exhibited in Table 1, six journals never upload an article to DOAJ, occupying 12.0% since it is not mandatory for journals to upload articles to DOAJ. Around 72.0% of journals uploaded 1-500 articles to DOAJ, and only one journal includes more than 1000 articles in its journal records in DOAJ, accounting for 2.0%. DOAJ promotes an open-access model, meaning that articles are freely available to anyone, removing financial barriers for readers. Uploading articles to DOAJ ensures that research can be accessed by a wider audience, including those in low-income regions or institutions.

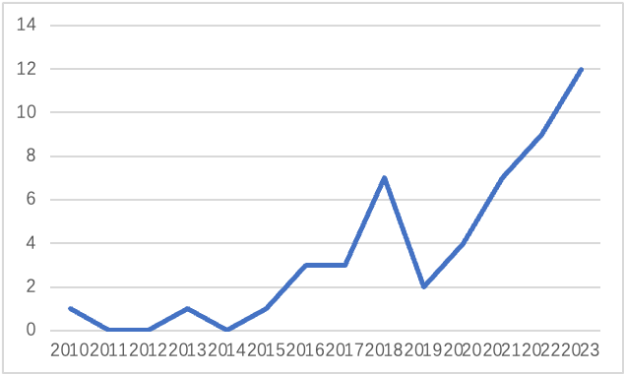

FIGURE 1 | 2006-2023 Trends in the number of Singapore journals indexed in DOAJ.

TABLE 1 | Journal article records

Number of Article Records	Journal Count
0	6
1-500	36
501-1000	7
More than 1000	1

4.2 | Characteristics of Singapore journals indexed by DOAJ

4.2.1 | Subject Classification

Detailed specifications of indexed journals are needed for better illustration. DOAJ adopts the Library Congress Classification system, which currently contains 20 main subjects and 529 sub-subjects in the database [24]. A meaningful finding is that the topical breakdown of Singapore journals in DOAJ is relatively narrow, only covering 11 subjects out of the 20 primary subjects. Among the 50 journals, there are 15 journals simultaneously covering two subjects, and only one covers three subjects. According to Table 2, most of Singapore's journals are in the Science, Medicine, and Technology category, while journals are in Agriculture, Fine Arts, and Bibliography. Library science. Information resources account for the least. Aside, there are still nine blank subjects: Auxiliary sciences of history, History (General) and history of Europe, History of America, Language and Literature, Law, Military Science, Music, and books on Music, Naval Science, Philosophy. Psychology. Religion. This shows that although the number of OA journals in Singapore is increasing, there are still problems such as uneven disciplinary development. From a global view, medicine, social science, technology, and science are the most developed subjects (n>2000) (Table 2). By comparing Singapore's OA journals with the global composition, this study found that they both show the unbalanced subject distribution as well as generally similar distribution of key

subjects, which is possibly due to the development of different subjects in each country.

TABLE 2 | Subject classification

No.	Subjects	Main sub-subjects	Journals count in Singapore	Journal count worldwide
1	Science	Physics: Atomic physics. Constitution and properties of matter. Microbiology. Biology (General). Chemistry: Organic chemistry: Biochemistry. Reproduction. Mathematics: Instruments and machines: Electronic computers. Computer science: Computer software. Geophysics. Cosmic physics.	20	2112
2	Medicine	Surgery: Anesthesiology. Other systems of medicine. Internal medicine: Specialties of internal medicine: Immunologic diseases. Allergy. Internal medicine: Specialties of internal medicine: Diseases of the circulatory (Cardiovascular) system. Neurosciences. Biological psychiatry. Neuropsychiatry. Medicine (General): Computer applications to medicine. Medical informatics. Therapeutics. Pharmacology. Nursing.	11	4185
3	Technology	Chemical technology: Low temperature engineering. Cryogenic engineering. Refrigeration. Electrical engineering. Electronics. Nuclear engineering: Production of electric energy or power. Powerplants. Central stations, Geography. Anthropology. Recreation: Environmental sciences. Mechanical engineering and machinery: Renewable energy sources. Technology (General): Industrial engineering. Management engineering: Management information systems. Quantitative methods. Computer engineering. Computer hardware. Optics. Light.	10	2249
4	Social Sciences	Social sciences (General). Education. Commerce: Business. Economic theory. Demography: Economics as a science. Communities. Classes. Races: Urban groups. The city. Urban sociology: Urbanization. City and country, Geography. Anthropology. Recreation: Environmental sciences. Industries. Land use. Labor: Special industries and trades: Energy industries. Energy policy. Fuel trade. Finance. Social sciences and state - Asia (Asian studies only).	9	2367
5	Geography. Anthropology. Recreation	Environmental sciences, Agriculture. Human ecology. Anthropogeography: Settlements: Cities. Urban geography	5	1049
6	Education	Education (General). Theory and practice of education, Language and Literature.	3	1755
7	Political science	Political institutions and public administration - Asia (Asian studies only). International relations.	3	468
8	Agriculture	Plant culture	2	858
9	Fine Arts	Arts in general: History of the arts. Drawing. Design. Illustration.	2	572
10	Bibliography. Library science. Information resources	/	1	162
11	General Works	/	1	324

4.2.2 | Languages

The data in Table 3 demonstrate that 100 percent of journals in Singapore accept English-language manuscripts, and the vast majority of Singapore journals (49) contain articles exclusively in English, accounting for 98.0%. Only one journal, the Electronic Journal of Foreign Language Teaching (e-FLT), accepts manuscripts in eight languages: Chinese, English, French, German, Indonesian, Japanese, Thai, and Vietnamese.

TABLE 3 | Languages in which the journal accepts manuscripts

Languages	Journal count
English	50
Chinese	1
French	1
German	1
Indonesian	1
Japanese	1
Thai	1
Vietnamese	1

4.2.3 | Publisher

The publishers among the 50 Singapore journals indexed in DOAJ can be classified into two sections: commercial publishers and university publishers. Table 4 shows commercial publishers dominated Singapore's OA journals (46/50), accounting for 92.0%. Meanwhile, only 8 percent of publishers are from public universities, such as the National University of Singapore (n=3) and Nanyang Technological University, Singapore (n=1). Among these publishers, most of them are Singapore's local companies, occupying 64.0%, and there were only three international commercial publishers, including 18 journals (36.0%), which are Springer from Berlin, Springer Open from the United Kingdom, Elsevier from the Netherlands, and World Century Publishing Corporation from the United States.

TABLE 4 | Publishers distribution of Singapore's OA journals indexed in DOAJ

Publisher	Journal count	Country
World Scientific Publishing	18	Singapore
Springer	13	Berlin

(To be continued)

(Continued)

Publisher	Journal count	Country
IMR Press	5	Singapore
SpringerOpen	3	United Kingdom
National University of Singapore	3	Singapore
APD SKEG Pte Ltd.	2	Singapore
Elsevier	1	Netherlands
Innovation Publishing House Pte. Ltd.	1	Singapore
International Institute of Knowledge Innovation and Invention, Pte. Ltd. (IIKII PTE LTD)	1	Singapore
Bon View Publishing	1	Singapore
Nanyang Technological University, Singapore	1	Singapore
World Century Publishing Corporation	1	United States

4.2.4 | Copyright issue and licensing agreement

Seventy-eight percent of Singapore journals indexed in DOAJ agree that authors hold copyright without restrictions, and only 11 journals choose to retain copyright by themselves, accounting for 22.0%, as shown in Table 5. Compared to the global composition, 57.3% of journals agree that authors hold copyright without restrictions (n=11628), and 42.7% of journals choose to retain copyright (n=8666). According to the best practice criteria posted on the DOAJ website, that authors hold copyright without restrictions is strongly encouraged since authors can disseminate their research without legal barriers, leading to greater visibility and enhanced impact in their fields. It also empowers authors to choose how their work is used, promoting ethical sharing and facilitating access for a diverse audience. Hence, the data on copyright holding reflects that copyrights held by authors are highly supported by Singapore's journals than the world average, demonstrating Singapore's commitment to advancing open access that prioritizes equitable access to research, fostering an environment that promotes knowledge sharing and collaboration.

Creative Commons licenses (CC licenses) give everyone, from individual creators to large institutions, a standardized way to grant the public permission to use their creative work under copyright law [25]. CC licenses consist of four essential elements (i.e., Attribution (BY), Noncommercial (NC), No Derivative Works (ND), and Share Alike (SA)), which also constitute the six core licensing forms of Creative Commons (i.e., CC BY, CC BY-SA, CC BY-NC, CC BY-ND, CC BY-NC-ND, CC BY-NC-SA). As exhibited in Table 5, all Singapore journals indexed in DOAJ adopt CC licenses. Among them, 76.0% of journals adopt CC BY, and another 16.0% adopt CC

BY-NC. The number of journals adopting CC BY-NC-ND and CC BY-SA is much less. From the global view, 50.2% of journals adopt CC BY, and CC BY-NC and CC BY-NC-ND are adopted by around 15% of journals respectively. CC BY is one of the most open and flexible licenses available, since it allows others to use, share, and adapt the work as long as proper credit is given to the original author, as well as permits commercial use and derivative works, promoting wider dissemination while still recognizing authorship [26]. From the above information, although the volume of Singapore's OA journals indexed in DOAJ is not that large, only 50 journals, their openness level towards realizing the best practice criteria of DOAJ is generally relatively high.

TABLE 5 | Copyright and licensing

Author holds copyright without restrictions	Journal count in Singapore	Journal count worldwide
YES	39	11628
No	11	8666
Journal license		
CC BY	38	10197
CC BY-NC	8	3147
CC BY-NC-ND	3	3063
CC BY-SA	1	1567
CC BY-NC-SA	0	1814
CC BY-ND	0	243
Public domain	0	3
Publisher's own license	0	260

4.2.5 | Editorial quality control

Half of Singapore journals indexed in DOAJ adopt double anonymous peer review (Table 6) because it can better protect the privacy of both reviewer and author, ultimately ensuring the review fairness and enhancing the review efficiency. In addition, journals' processing time is a key factor that affects the timely dissemination of academic findings and the influence and competitiveness of academic journals, which would influence authors' submission willingness. Article processing time between 10 weeks and 20 weeks accounts for 64.0%. Although the article processing time of a journal cannot directly measure its academic quality, the shorter processing time of journals can reflect the higher efficiency of peer review.

TABLE 6 | Review process & processing time

Review process	Journal Count	Percentage
Double anonymous peer review	25	50
Anonymous peer review	21	42
Peer review	4	8
Article processing time (Average weeks)		
Less than 10 weeks	8	16
10 weeeks-20 weeks	32	64
More than 20 weeks	10	20

4.2.6 | Business model

The results of analyzing APCs information on the 50 Singapore journals indexed in DOAJ show that only 40.0% have APCs. In contrast, two-thirds of Singapore journals do not charge fees from authors for publishing their articles. Besides, the DOAJ metadata includes fees other than APCs, including submission fees, additional fees for images and colors, language editing fees, types and lengths fees, and so on. Only two Singapore journals ask for other fees, and the remaining 48 publish articles without other fees. Taking such data on APCs and other fees to compare with the global composition, the proportions are around the same as those in Singapore. As for journal waiver policy, 36.0% of Singapore journals implement publication fee waivers for authors from low-income economies, discounts for authors from lower-middle-income economies, and/or waivers and discounts for other authors with demonstrable needs. However, from the global view, only around 22.2% of journals have waiver policies, so the percentage in Singapore is not low, from which we can see the sense of responsibility of Singapore journals. They encourage knowledge dissemination and try to resist the limit of academic communication brought by poverty.

TABLE 7 | Journal charge policy

Charge policy	Option	Journal count in Singapore	Journal count worldwide
APCs	YES	20	6677
	No	30	13617
Has other fees	YES	2	710
	No	48	19584
Journal waiver policy	YES	18	4498
	No	32	15796

This study also investigated the comparison between APCs of Singapore's OA journals and other journals of the same publishers. For example, totally eight journals are run by IMR Press, and they all charge APCs including the one included by DOAJ. Similarly, Bon View Publishing totally publishes nine journals, and all journals run by it charge APCs as well. So do APD SKEG Pte Ltd., Innovation Publishing House Pte. Ltd. and International Institute of Knowledge Innovation and Invention, and all the journals run by them charge APCs from authors. Besides, for the journals run by World Scientific Publishing, four of them charges, but other fourteen do not charge APCs. Likewise, five journals run by Springer (including SpringerOpen) do not charge APCs, but another eleven journals charge APCs.

Based on the data, this study found that generally APC policy is vary depending on journals' financial structure and publishing model, rather than publisher. For instance, differnt journals might operate under different publishing models (i.e. OA model, subscription model or hybrid model) or have different funding sources, such as institutional support or sponsorship, which allows them to provide access without charging APCs [27].

4.2.7 | Best practice

DOAJ Seal is to identify the most prominent journals "that achieve a high level of openness, adhere to Best Practice and high publishing standards" (DOAJ) (i.e., use of DOI, metadata in the articles, preservation policy, whether author holds copyright, whether reuse of content is allowed, etc.) [28]. Until 1st January 2024, 1,620 journals have been awarded the DOAJ Seal, occupying around 8.0% of the total volume. Cho revealed the Seal award statistics among Asian countries; it was found that only 0.6% of Asian journals have been awarded the DOAJ Seal [16]. Two journals were granted the DOAJ Seal in this study, accounting for 4.0% of Singapore's total volume. After comparing all the above-mentioned information, we can see that such a percentage of DOAJ Seal volume in Singapore can rank in the middle among journals worldwide. Still, it is superior in Asian journals.

4.3 | Journal indexed in DOAJ also indexed in Web of Science & Scopus

4.3.1 | Web of Science

Looking at the 50 Singapore journals in WoS, we found that 19 were also indexed in WoS, accounting for 38.0%. Meanwhile, seven were indexed by the Science Citation Index (SCI), and twelve were indexed by the Emerging Sources Citation Index (ESCI). The highest impact factor among these journals is 12.7, and the lowest impact factor is 0.2. The average impact factor is 2.342. From the perspective of the JCI Quartile, the number of journals in Q1 and Q2 was two, respectively; eight journals were in Q3 and seven journals were in Q4. Aside from this, the earliest time Singapore journals were indexed in DOAJ and WoS was in 2000. Six journals started to be indexed in WoS before 2000 (around 31.6%), and the rest began to be indexed after 2000 (around 68.4%).

4.3.2 | Scopus

Compared with WoS, the Scopus database contains more Singapore journals indexed in DOAJ. Twenty-nine Singapore journals indexed in DOAJ can also be indexed in Scopus, accounting for 58.0% of the total volume. Among them, 24 journals have CiteScore 2022; the average CiteScore 2022 was 3.042. The other five journals were newly included in Scopus in 2021 and 2022, so they still do not have CiteScore and rank. From the view of respective field rankings, there were five journals ranking in the top 25 percent, and only two of the five journals ranked in the first three percent. Nine journals (around 31.0%) ranked ranging between 25 percent and 50 percent. Ten journals rank between 50 percent and 75 percent, and the remaining 1 journal ranked in the last 25 percent among the 25 journals. Furthermore, from the view of index time, 4 journals started to be indexed by Scopus before 2000, and the earliest one started in 1987. Meanwhile, the data found that of the six journals included in Scopus between 2000 and 2010, and fourteen journals included in Scopus between 2011 and 2020. However, another five journals have been included in Scopus from 2021 till now.

4.3.3 | Characteristics of Singapore's journals included in DOAJ, Web of Science and Scopus

By looking through Singapore's journals included in DOAJ, WoS and Scopus at the same time, we found the total number is 18, and all of them are published in English. They cover 8 subjects, with four journals in Medicine, Science and Technology respectively, two journals in Social science, and one journal in Bibliography. Library science. Information resources, Fine arts, Geography. Anthropology. Recreation and Political science respectively. It is worth noting that 13 of the 18 journals have a society or institution to support them, accounting for around 72.2%. and 8 of the 13 journals are supported by Chinese society or institutions; the other five journals are supported by the society or institution from Singapore, Korea, Japan, Philippines and Abdullah Sulayman each. Furthermore, from the view of publisher distribution, World Scientific Publishing contributes the most (n=7), followed by Springer, including SpringerOpen (n=5) and IMR Press (n=3), and one for each of Elsevier, Nanyang Technological University and World Century Publishing. Besides, 10 journals do not charge APCs, and all 18 journals do not charge any other fees. In addition, among these journals, CC BY is the most frequently used license (n=13), accounting for around 72.2%. Fourteen journals' policy states that author holds copyright without restrictions, accounting for around 77.8%. The above analysis also proved that DOAJ has been pursuing transparency and OA quality standards beyond other criteria, which is a remarkable difference from the journal citation metrics and impact that WoS and Scopus prioritize.

4.4 | Open access repositories

As of 1st January 2024, the OpenDOAR lists 5,876 OA digital repositories worldwide and among them, only 8 OA digital repositories are from Singapore (Table 8). There are 15 countries and regions with above 100 repositories and another 14 with 50-100

repositories. The number of OA digital repositories in Singapore does not account for a large share compared to that in those countries with high levels of OA development. Meanwhile, the host organization of all Singapore repositories are university, which signifies that universities are the main contributors and promoters of Singapore's OA movement.

TABLE 8 | Singapore's open access repository indexed in open DOAR

Name	Software	Organization Name	Content Types	Subjects	Date Created
DR-NTU	DSpace	Nanyang Technological University (NTU)	Journal Articles; Conference and Workshop Papers	Science; Technology; Engineering; Mathematics; Health and Medicine; Arts; Humanities; Social Sciences	2008
DR-NTU (Data)	Other (Dataverse Network)	Nanyang Technological University (NTU)	Datasets; Other Special Item Types	Arts; Engineering; Health and Medicine; Humanities; Mathematics; Science; Social Sciences; Technology	2017
InK	Other (Digital Commons)	Singapore Management University	Journal Articles; Conference and Workshop Papers; Theses and Dissertations; Reports and Working Papers; Books, Chapters and Sections; Other Special Item Types	Social Sciences	2011
NIE Data Repository	Unspecified	Nanyang Technological University, National Institute of Education (NIE NTU)	Datasets	Arts; Engineering; Health and Medicine; Humanities; Mathematics Science; Social Sciences; Technology	2023
NIE Digital Repository	DSpace	National Institute of Education, Nanyang Technological University (NIE NTU)	Journal Articles; Conference and Workshop Papers; Theses and Dissertations; Reports and Working Papers; Books, Chapters and Sections; Other Special Item Types	Arts; Engineering; Health and Medicine; Humanities; Mathematics; Science; Social Sciences; Technology	2019
SIT Institutional Research Repository	Other (Figshare)	Singapore Institute of Technology	Conference and Workshop Papers; Theses and Dissertations Reports and Working Papers; Books, Chapters and Sections; Datasets; Learning Objects; Software; Other Special Item Types	Health and Medicine; Science; Social Sciences; Technology	2023
SMU Research Data Repository	Other (Figshare)	Singapore Management University (SMU)	Journal Articles; Datasets	Social Sciences	2021
ScholarBank@NUS	DSpace	National University of Singapore (NUS)	Journal Articles; Conference and Workshop Papers; Theses and Dissertations Patents; Other Special Item Types	Arts; Humanities; Health and Medicine; Social Sciences; Technology	2013

4.5 | Open access mandates and policies

ROARMAP database was applied to investigate the situation of OA mandates and policies adopted in Singapore. As presented in Table 9, ROARMAP listed 86 policies of different Asian countries, of which 27 policies are classified in Southeast Asian countries. Singapore has two of the 27 policies classified in South-eastern Asia till 1st January 2024. An attempt is made to examine the characteristics of Singapore's OA policies included in ROARMAP. Nanyang Technological University was the first organization that adopted the OA policy on 13 February 2009. Then, on 24 October 2013, Singapore Management University started to adopt the OA policy. We also noticed that these two OA policies were created by Singapore's research organization (e.g., a university or research institution). The volume of OA mandates and policies in Singapore is minimal, and all of them are from universities, which signifies that OA development has not yet received widespread attention from all levels of the country.

TABLE 9 | Situations of the OA policy in number situations of the OA policy in number

Situation worldwide	Situation in Asia	Situation in Southeast Asia
Europe (710)	Eastern Asia (31)	Indonesia (22)
Americas (242)	Southeast Asia (27)	Malaysia (2)
Asia (86)	Southern Asia (22)	Singapore (2)
Oceania (42)	Western Asia (5)	Viet Nam (1)
Africa (36)	Central Asia (1)	

5 | Discussions

The number of Singapore's OA journals indexed in DOAJ is not so high, with only 50, though overall, it shows an upward trend. Aside from this, journals being indexed in WoS represent the high quality of their publications. Thirty-eight OA journals being indexed by WoS means Singapore's OA journals are very promising. However, the percentage of top journals in each subject was still low; most stayed in Q3 and Q4. In recent years, an increasing number of Singapore's OA journals have started to be indexed in WoS, which signifies that OA journals' performance is very active and the quality keeps improving.

Meanwhile, fifty-eight percent of Singapore's OA journals are indexed by Scopus. Most journals stay in the middle ranking percentage (25%-75%) in the Scopus database. Only one journal remains in the last 25%, and the ranking is 77.4%, just beyond the 75% threshold. The information above indicates that the quality of these journals can generally be assured. However, analysis of subject distribution demonstrated an unbalanced development across different disciplines, and there were still nine blank subjects. Ninety-two percent of publishers of Singapore's OA journals are commercial publishers, and only eight percent of those were from universities, which signified that university publishers still have space to improve and promote the OA movement.

Regarding the degree of openness of Singapore OA journals, this study found that the vast majority of Singapore's OA journals permit authors to retain copyright (78.0%) and choose relatively loose CC licenses (CC BY-76.0% & CC BY-NC-16.0%), which is higher than the world average. Besides, most of Singapore's OA journals are free to publish, with two-thirds charging no APCs. Additionally, 36.0% of Singapore's OA journals provide publication fee waivers/discounts for authors from low-income economies, which shows Singapore's OA journals care about the visibility and accessibility of research output worldwide as well as sparing no effort to promote it. Furthermore, 4.0% of Singapore's OA journals are granted the DOAJ Seal, which takes the leading position among Asian journals. All the above information indicates that Singapore's OA journals' overall degree of openness and sense of social responsibility is relatively high. From the perspectives of Singapore's OA repositories and OA mandates and policies, the volume is still very limited. The only two OA mandates and policies are both granted by universities, which means OA development in Singapore has not received widespread attention from the country level and needs more policymakers to promote the OA movement.

After analyzing the data of Singapore's OA journals, OA repositories, and OA mandates and policies, we can see the development status of open access in Singapore and suggest keep building on the strengths and improving the disadvantages. Promoting OA development needs the joint efforts and attention of policymakers at the national level and researchers themselves to design a sustainable OA policy that can better serve researchers and the OA environment.

6 | Conclusion

This study provided a comprehensive overview of OA publishing in Singapore from the trends and policy perspectives, including OA journals, OA repositories, and OA mandates and policies. It not only analyzed the characteristics of Singapore's journals in DOAJ, WoS and Scopus, but also compared Singapore's journals with the global, which ensures the audiences with more profound understanding of Singapore's OA development. However, this study is limited to Singapore but offers theoretical implications for extending its scope to other countries. The study findings are meaningful in understanding the comparative status of OA development across countries and being an indispensable part of painting the OA global map. Simultaneously, this study will help policymakers identify the problems while promoting open access and thus help formulate and implement effective policies at the national level. Aside from this, it will encourage all the stakeholders in the OA wave to promote OA development from separate aspects that they can reach.

Acknowledgement

Not applicable.

Author Contributions

Jinjin Liu contributed to the conceptualization, methodology, investigation, writing, and validation of the study. Jinjin Liu reviewed and approved the final manuscript

Ethical Statement

This study does not contain any studies with human or animal subjects performed by any of the authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

Not applicable.

References

[1] UNESCO. (2023). What is open access? [online]. Available at: https://www.unesco.org/en/open-access#:~:text=Open%20access%20(OA)%20means%20free,video%2C%20and%20multi%2Dmedia. >[assessed on 13th December 2024]

[2] Public Library of Science. (2021). Why open access? [online]. Available at: <https://plos.org/open-science/ why-open-access/>[assessed on 19th December 2024]

[3] Nobes, A., & Harris, S. (2023). Open access in low- and middle-income countries: attitudes and experiences of researchers. Emerald Open Research, 1(2), 1-24.

[4] BOAI. (2002). [online]. Available at: <https://www.budapestopenaccessinitiative.org/>[assessed on 19th December 2024]

[5] The Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities. (2003). [online]. Available at: <https://openaccess.mpg.de/Berlin-Declaration>[assessed on 19th December 2024]

[6] Springer Nature. (2021a). Green or gold routes to OA. [online]. Available at: <www. springernature.com/gp/open-research/about/green-or-gold-routes-to-oa>[assessed on 22nd December 2024]

[7] Crawford, W. (2021). Gold open access 2015–2020. Cites & Insights Books. [online]. Available at: <https://waltcrawford.name/goa6.pdf>[assessed on 17th November 2024]

[8] Druelinger, D., & Ma, L. (2023). Missing a golden opportunity? An analysis of publication trends by income level in the Directory of Open Access Journals 1987–2020. Learned Publishing, 36, 348-358.

[9] Björk, B.C. (2017b). Open access to scientific articles: a review of benefits and challenges. *Internal and Emergency Medicine*, *12*(2), 247-253.

[10] Edanz-learning Lab. (2023). What is Hybrid Open Access (and why choose it)? [online]. Available at: <https://learning.edanz.com/why-hybrid-open-access/#:~:text=The%20main%20criticism%20of%20the,twice%20for%20the%20same%20content>[assessed on 13th November 2024]

[11] World Economic Outlook Database. (2022). IMF.org. International Monetary Fund. [online]. Available at: <https://www.imf.org/en/Publications/WEO/weo-database/2022/October/weo-report?c=576,&s=NGDPD,PPPGDP,NGDPDPC,PPPPC,&sy=2022&ey=2027&ssm=0&scsm=1&scc=0&ssd=1&ssc=0&sic=0&sort=country&ds=.&br=1>[assessed on 17th November 2024]

[12] Sciencenet.cn. (2017). Comparison on the scientific research level in Shanghai, Hong Kong and Singapore. [online]. Available at: <https://www.sohu.com/a/148825744_675656/>[assessed on 13th November 2024]

[13] Chakravarty, Rupak. (2020). Status of Open Access LIS Journals: An Empirical Study of DOAJ. *Journal of Indian Library Association*, *56*(3), 88-99.

[14] Rathinasabapathy, G., & Veeranjaneyulu. (2022). Open Access Journals in Agriculture and Allied Sciences: A Study based on Directory of Open Access Journals (DOAJ). *Library Philosophy and Practice (e-journal)*, 6815.

[15] Rodrigues, R., Abadal, E. & Araújo, B. (2020). Open access publishers: The new players. *PLOS ONE*, *15*(6), e02334310.

[16] Cho, J. (2023). Analysis of DOAJ-Registered Open Access Journals in Asian Countries. *International Journal of Knowledge Content Development & Technology*, *13*(3), 31-45.

[17] Tang, S., Cao, B., Ji, S.J., & Jiang, W. (2023). Statistical analysis of Chinese open access journals included in DOAJ. *Science-Technology & Publication*, *337*(1), 124-133.

[18] Boufarss, M. (2020). Charting the Open Access scholarly journals landscape in the UAE. *Scientometrics*, 122, 1707-1725.

[19] Satish, S. (2019). An Analysis of Indian Research Output in Open Access Journals (DOAJ) From 2003 to 2019. 3rd International Conference on Library and Information Management, Department of Library and Information Science, Faculty of Social Sciences, University of Kelaniya, Sri Lanka, 264.

[20] Nazim, M., Bhardwaj, R.K., Agrawal, A., & Bano, A. (2022). Open access publishing in India: trends and policy perspectives. *Global Knowledge, Memory and*

Communication, *72*(4/5), 437-451.

[21] Author, A. (2021). What is the directory of open access journals (DOAJ)? [online]. Available at: <https://predatory-publishing.com/what-is-the-directory-of-open-access-journals/>[assessed on 17th November 2024]

[22] OpenDOAR. (2023). [online]. Available at: <https://www.jisc.ac.uk/opendoar>[assessed on 5th January 2025]

[23] ROARMAP. (2023). [online]. Available at: <https://roarmap.eprints.org/>[assessed on 5th January 2024]

[24] Liu, J.J., Shen, C.Y., & Xu, J.Y. (2023). Criteria for Inclusion in Directory of Open Access Journals: A Case of Malaysian Journals. 9th International Conference on Libraries, Information and Society, 12-21.

[25] Creative Commons. (2023). About CC Licenses. [online]. Available at: < https://creativecommons.org/share-your-work/cclicenses/#:~:text=Creative%20Commons%20licenses%20give%20everyone,creative%20work%20under%20copyright%20law>[assessed on 5th January 2025]

[26] Sheikh, A., Zahra, A.Q. & Richardson, J. (2022). Scholarly open access journals in medicine: A bibliometric study of DOAJ, 48, 102516.

[27] Pinfield, S., Salter, J. and Bath, P.A. (2016). The "total cost of publication" in a hybrid open-access environment: Institutional approaches to funding journal article-processing charges in combination with subscriptions. *Journal of the Association for Information Science and Technology*, *67*, 1751-1766.

[28] DOAJ. [online]. Available at: <https://doaj.org/faq#sealedJournals>[assessed on 10th January 2025]