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Global Patterns and Trends in Open Access Journal Publications

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The main rationale of this research study was to explore the global patterns of and trends in Open Access Publications. The Directory of Open Access Journals (DOAJ) is an online database that indexes open access journal articles and makes them available to the public. This research is a comprehensive study of that particular dataset that is provided for free by DOAJ. The dataset has information on all the journals listed in it and is updated every week. A total of 20, 015 open access journals are indexed in the DOAJ database until December 2023. The results of the study show that Indonesia is on the top in terms of the number of open access journal publications globally. It would be pertinent to mention that Subject-wise, most of the publications are made on the subject of medicine. English is the language that is used the most in these publications. "Sciences" is the most commonly used keyword in the journal titles, although it is often found associated with other terms such as "Social" and "Health". The results demonstrate that the copyright is often held by the authors yet its ownership with the authors has increased or decreased depending on the timeline. Around 89.39% of the publications have the Creative Commons (CC) Licences. When contrasted to other publishers, Elsevier has delivered the most open access journals. Among the different peer-review processes, a total of 59.7% of the journals go through the double-blind peer-review process. Only 8.03% of all journals have the DOAJ Seal because of its strict qualifying rules. Intellectuals and scholars should be encouraged and supported by publicly financed organizations to publish their findings in open access journals. While a large number of open journals are published worldwide, only DOAJ listed or indexed journals were used for analysis in this research study. Several previous studies have been conducted in various countries regarding open access journals, but this study is unique in terms of coverage and time.

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0 INTRODUCTION

The mechanism of creation, dissemination and integration of innovative scientific knowledge is crucial to human growth and the stability of both national and international economies. This mechanism is supported by the higher educational establishments around the globe from the laboratory to classroom to business and ultimately to the community. Knowledge progression is a persistent cycle enabled by creativity, invention, research and higher education systems. Conventional scholarly communication is a system by which recently discovered information is processed, validated, transmitted and preserved for use by research scholars, professors, pupils, and the common population.[1] Academic communication is simply a mechanism adopted by researchers to communicate the discoveries of their study. Besides publishing or using peer-reviewed research papers, scientists often use numerous other communication methods such as letters, research notes, articles, and review articles.[2]

In an academic career, the value of a journal extends further than just being a form of communication. A journal is mainly considered to consist of academic papers; however, an extensive variety of articles can fulfil the role of communication and present society with supportive knowledge. For researchers, media, editorials, emails, reviews, photographs, audio recordings, and other types of records may be similarly valuable.[3]

1 OPEN ACCESS: DEFINITION AND CONCEPT

Since the inception of journals in 1665, researchers have published their works without monetary compensation in exchange for intrinsic rewards like credibility, citations, and benefits, which boost their careers. Over the last twenty-two years, the cost of scientific publishing has grown numerous times compared to the inflation and has ended in a turmoil, with most institutions being unable to afford the purchase cost of such journals. Consequently, several librarians have cancelled journal subscriptions, and researchers have sought new means to communicate their research findings.[4]

The Open Access Movement is a movement in the scholarly community devoted to the ideology of Open Access, which intends at exchanging knowledge for the greater good of the community. The campaign traces its roots back to the mid-1950s, but it really propagated during the 1990s. Since then, it has become a matter of conversation among scholars, educators, librarians, scholarly publishers, and others alike.[5] Open and closed access imply "free access" and "paid access", respectively, in the modern world, where people speak of e-journals and e-books. Open Access allows

for the unrestricted dissemination of scholarly papers online. According to the Budapest Open Access Initiative (BOAI), it is the global electronic dissemination of peer-reviewed journal material, of entirely unrestricted access for all scientists, academics, instructors, students, and other interested minds.[6] Data can now be communicated internationally, instantly, and reliably with the introduction of the Internet and digital publishing. The ever-increasing Open Access movement intends to facilitate access to knowledge that is open to everyone and free of technical and financial restrictions.[7] The availability of materials on the web results in enhanced usage, which increases citation numbers` .[8]

2 OPEN ACCESS STRATEGIES

Open Access can be accomplished through two methodologies: publishing in Open Access journals and Self-archiving in libraries or institutional repositories. The former is the foremost method of publishing of academic and research papers in Open Access publications and is regarded as the golden path. Self-archiving of electronic information in publicly available institutional or subject-based libraries is called the green path to Open Access. Pre-prints and post-prints are the most common self-archived documents, with monographs, academic papers, and conference papers rounding out the list. The green road gives writers more independence and influence, while the golden road puts them at the mercy of the publishers' regulations. The two routes to Open Access are inter-dependent, with the green route being the quicker and the safer path to instantaneous Open Access. To define the various forms of open access, some organizations use a more diverse quantity of colours. For instance, apart from green, gold, hybrid, bronze, diamond, and platinum, the Repositories Support Project (RSP) uses blue, yellow, and white colours' .[9]

3 LITERATURE REVIEW

In 2011, Laakso et al.[10] stated that Open Access is a publication model for peer-reviewed scholarly publications made available on the web. The paper employed a systematic approach to analyse the growth of open access publications from their emergence in the early 1990s to 2009. The authors recognized three varied phases which were based on the sampling and qualitative evidence findings: the pioneering years, which was the period from 1993 to 1999; the innovation years, which was the period from 2000 to 2004; and the consolidation years, which was the period from 2005 to 2009.

In a 2013 study, Solomon, Laakso, and Björk[11] discovered that between 1999 and 2010, the total number of Open Access articles and journals being published heavily increased, as did the citation frequency of Open

Access journals reported in the Scopus bibliographic database. The quantity of Open Access journals and articles escalated significantly faster than paid journals, but they only accounted for less than 12% of the journals available in Scopus. In 2014, Bjork et al. established that there were two fundamental approaches to Open Access for peer-reviewed journal articles: publishing in Open Access journals (Gold Open Access) or storing journal copies at other web locations (Green Open Access). In their study, Laakso and Björk[12] described delayed open access, which refers to the scientific publications in paid journals that are made freely accessible on the world wide web after a certain restricted period has passed. Although countless publications have used delayed open access since they began publishing electronic versions, academic reviews on open access have often ignored this area.

Martín-Martín et al.[13] investigated Open Access levels in all nations and academic subjects using Google Scholar as the database. The researchers examined all papers and reports with a DOI (Digital Object Identifier) written between 2009 and 2014 and were shielded by three key citation indexes in WoS (Web of Science). This helped the authors differentiate the number of publications rendered open access by the publishers (23.1%, namely Hybrid, Gold, Bronze, and Delayed open access) from those published as Green open access (17.6%) and those published by other outlets (40.6% of ResearchGate). Piwowar et al.[14] commented that despite the increasing importance of Open Access in research papers, large-scale studies examining the significance and features of Open Access remain few and far between. It is reported that about 28% or 19 million of all research articles are now exist in Open Access. This number has been increasing due to the rise in Gold and Hybrid open access. Open Access publications earn 18% higher citations than average, with Hybrid and Green open access having the maximum impact. The authors urged for more studies to be conducted using the unrestricted OADOI platform to help familiarize researchers with Open Access practices and procedures.

Pinfield[15] offered an analysis of open access publication and distribution of research findings. The researcher examined and lectured the current developments and potential issues in providing open access to academic research for various people. The researcher remarked that the existing challenges concentrate on how Open Access should be permitted to operate and made successful in practice, rather than whether it can be implemented. In another research study, Pinfield et al.[16] reviewed the data from the OpenDOAR initiative to examine the global development of open-access (OA) databases from 2005 to 2012. During this time, certain nations, such as France, Spain, and Italy, witnessed a steady growth, while others, most noticeably Russia and China, experienced slow growth. Since 2010, there has been an increase in repositories in East Asia, Eastern Europe, and South America, notably in

Taiwan, Poland, and Brazil.

Atchison and Bull[17] observed that political scientists are able to conveniently upload and access high-quality research studies due to the technological revolution. On the other hand, numerous publications are held behind a paywall, which specific organizations cannot bear financially. Theoretically, high-quality, top-tier, peer-reviewed journal publications, which have been deemed open access must be easier to read and quote than publications of equivalent content, which are only accessible to paid users.

Gargouri et al.[18] demonstrated that most discussed journal publications are published in subscription-based journals that are only available to the subscribing universities, resulting in a significant loss of research impact. Making publications freely available publicly increases their influence. Publications can be made open access in two ways: by self-archiving articles on the Internet or Green open access and by releasing them in open access publications or Gold open access. The rate of the total open access growth, however, remains very slow, about 1% per year. Making self-archiving compulsory in research institutions can boost the rate of Green open access.

In a 2013 study, Pandita[19] elaborated how technology has transformed all aspects of human functioning, including the publishing industry. Publishing scholarly articles in the digital form has advanced further by transitioning from restricted access to open access. The study was grounded on the basis of data collected over a 10-year period from the Directory of Open Access Journals or DOAJ, which is one of the best open-access databases in the world and listed 8518 open access journals all across the globe on its site in various languages and domains on the date of data retrieval, that is, 31st December 2012.

In a 2019 study, Hugar[20] discovered that education and medicine journals ranked the highest in DOAJ list and that 11% of the 12065 publications in DOAJ received a DOAJ exclusive label. In comparison to other publications during the research time, BioMed Central, Sendo, and Elsevier contributed the greatest number of journals.

Iyandemye and Thomas[21] observed that the number of open access publications has slowly increased over time, however despite this progress, researchers in low-income settings keep struggling to obtain access to all publications. Although several open access repositories and service providers are located in high-income nations, the geographical trends of open access publishing are incomprehensible. Interestingly, an evident negative relationship was discovered between a nation's per capita income and the proportion of OA publications. The Sub-Saharan Africa had the highest level of OA publication, whereas North and Middle East Africa, East Asia, and South Asia, and the Pacific had a much lower rate. Certain applied areas in medical science, especially medicine, surgery, and environmental fields, tend to have a

higher percentage of paid access publications, potentially creating obstacles that discourage low-income researchers from reading information pertaining to those subject domains.

Pandita and Ramesha[22] attempted to examine the global development of open access journals over a period of ten years, from 2003 to 2012, using the data collected from DOAJ, which, at that time, hosted over 9700 journals from 120 countries representing all the major languages around the globe. It was observed that at the global scale, Europe dominated the tally with 3140 OA journals, the largest of any continents.

Nashipudi and Ravi[23] alculated the academic publications that added to the world of information through complete and instantaneous Open Access from 2003 to 2013. It found that India's output of 649 open access publications was vital in terms of expanding the universe of knowledge. Singh[24] assessed India's contribution to the open-access domain through DOAJ. The researcher commented that open access has proven to be a revolutionary platform that significantly benefits the scholarly world in the middle of the escalating prices of journal subscriptions. Sahoo[25] provided a systematic insight of the Indian contribution to the open-access journal movement, specifically journals listed in DOAJ. Their study brought out India's role in open access publishing and identified India as one of the most active nations that promote free access to information.

A comprehensive review of the extant literature revealed a paucity of studies investigating recent trends and developments in open access journal publications. Consequently, an exploratory study was undertaken, utilizing datasets from the Directory of Open Access Journals (DOAJ), the largest open access directory.

4 OBJECTIVES

Open Access, although it has gained near popularity, it has yet to become mainstream. Several ingenuities are being taken up to promote Open Access. The major research objectives of this study are:

- To explore the global trends and developments in open access journals publications.
- To study which countries, have the highest number of open access journal publications.
- To study which subjects, have the most open-access journal publications.
- To explore the distribution of open journals in terms of languages and licensing.
- To understand the review process followed by major publishers in open access.

5 METHODOLOGY

DOAJ is a public repository of peer-reviewed scientific and academic publications that are open access, with a quality management framework like editorial standards management across all the major subject domains. DOAJ publications are those whose material readers can view, download, copy, share, publish, scan, or connect to in its entirety. DOAJ offers accessibility to quality-controlled Open Access journals, thus facilitating their expanded usage and impact. The database is managed, controlled, and maintained by Infrastructure Services for Open Access (IS4OA). DOAJ is registered in the United Kingdom and with a branch in Denmark. The DOAJ home page summarises the DOAJ facility, includes an updated count of journals, and provides several other information. The "Find Open Access Journals & Articles" page is DOAJ's key search interface, and it exemplifies the simple, clean lines, and design that render DOAJ simple to comprehend and access.

This research was conducted on the tendencies, patterns, and other indicators pertaining to Open Access publishing. DOAJ provides the complete metadata on the articles and journals in the directory and is updated every week. The data for this research work was downloaded from DOAJ on December 31, 2023. No data was eliminated from the downloaded file, thus making this research knowledgeable enough to project the interpretation from the time DOAJ was created. While creating an interpretation on the number of subjects, however, the researcher kept the subject phrase and eliminated the rest of the term for better data projection. This was also done keeping in mind the visual neatness of the data analysis. Software applications that were used to analyze and visualize the data are Tableau, OpenRefine, and Voyant Tools.

6 LIMITATIONS

There were considerable problems in the derivation of results from countless variables since the dataset was extremely large. An attempt was made to find out the APC amount, but that could not be done due to variations in currencies. Since there were more than 9000 publishers, only the top 20 were included in the report. There was a partially filled up column of License Attributes, which made it difficult to derive any data from it and thus hampered one aspect of the research. The dataset only had publications listed from 2002 to 2023, which made it time-bound.

7 RESULTS AND DISCUSSION

As of December 31, 2023, a total of 20,015 open access journals were listed in the Directory of Open Access Journals (DOAJ) database. This study delved into the open-access publications of the database extracted from DOAJ.

There was a perceptible growth in the open access publication of DOAJ, with a fall only during the COVID-19 pandemic. The study was conducted to observe out the properties and contributions of the journals of DOAJ. The literature on this topic has revealed that the concept of Open Access (OA) is fairly recent and is gaining significant popularity. The transition from paid journals to OA journals is on the rise and will continue to rise.

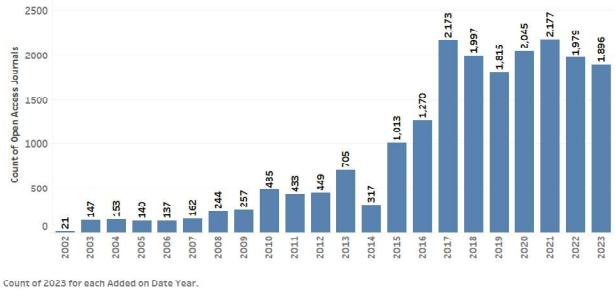

Fig.1 Trends in Publication of Open Access Journals

COUNTRY-WISE PUBLICATION

It can be seen that Indonesia had the highest number of open access journal publications indexed in DOAJ. It had a contribution of 11.67% of the total number of journals, with 2,335 journals in totality. The country in the second place was the United Kingdom, with a publication percentage of 10.47%, comprising 2095 journals. Brazil was in the third place with a total of 1635 or 8.17% journals. Other noteworthy contributing countries were the United States, Spain, the Islamic Republic of Iran, and Poland, and they contributed 5.60%, 4.88%, 4.22% and 4.20% journals, respectively.

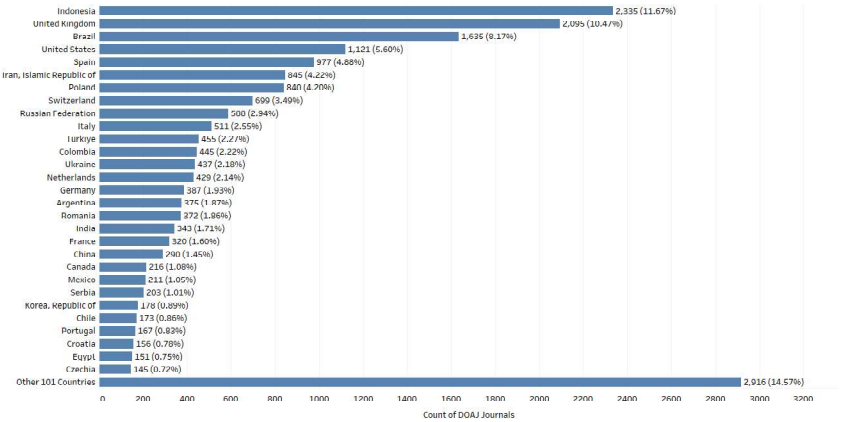

Fig.2 Country-wise Publication of Open Access Journals

SUBJECT-WISE DISTRIBUTION

The Figure 3 exhibits that the most common subject for publication was medicine, with 20.32% journals. Second to medicine was social sciences with 11.21% journals. Technology (10.73%) was third and was followed by science (10.3%). Education (7.77%) and language and literature (7.12%) which were the next most common subjects. Almost all the subjects had detailed sub-divisions, but only the primary subjects were considered and analysed due to limitations.

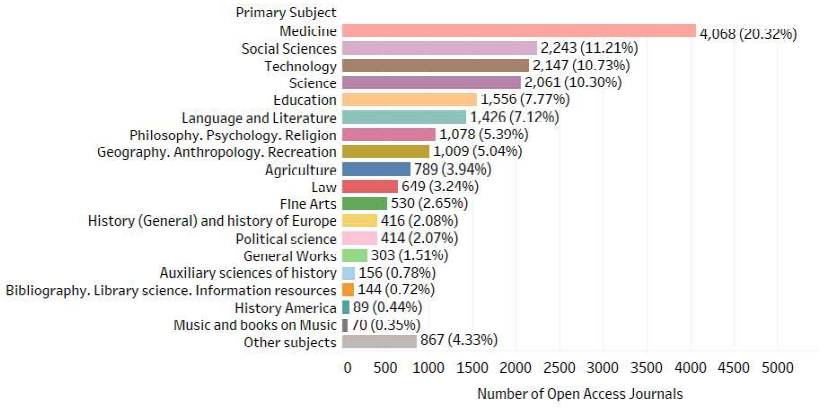

Fig. 3 Subject-wise Distribution of Open Access Journals

JOURNAL IN VARIOUS LANGUAGES

The dataset contains a total of 87 languages, including both individual languages and combinations thereof in the context of open access journal publications. It was discovered that the language with the highest number of open access publications was English, with 80.66% of all journals being in the English language. At 18.90%, Spanish was a distant second. Next was Portuguese, which had 12.12% journals to its credit. Indonesian, French, Russian, Italian were next in line with 8.83%, 7.64%, 4.85%, and 3.92% journals, respectively, to their credit. Thus, it can be concluded that English is the most popular language and the preferred choice for publication of open access journals worldwide (Figure 4).

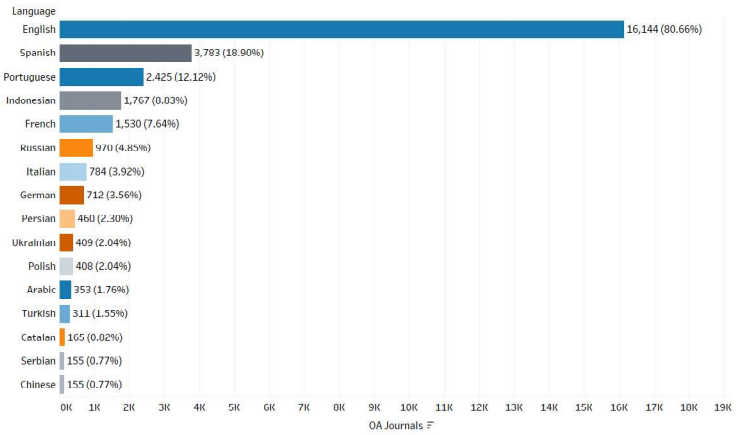

Fig.4 Open Access Journal in Various Languages

The result reveals an encouraging trend towards linguistic diversity in open access journals, which is crucial for broadening the reach of scientific knowledge and fostering inclusivity in academic research. While English remains predominant, the openness to a multitude of languages and language combinations highlights the global nature of scientific discourse and the importance of accommodating linguistic diversity in scholarly communication.

MOST POPULAR KEYWORDS IN THE TITLES

The titles of all the journals were analysed and it was found that the most used keywords were education (2750), science (2110), and sciences (2025) (Figure 5). However, it was noticed that "sciences" was quite frequently clubbed with other terms such as "health", "social", "earth", etc. Other terms worth mentioning are: health (1980), studies (1840), social (1748), history (1660), engineering (1548), management (1467), medicine (1460), law (1288), technology (927), literature (877), public (873), economics (864), research (769), philosophy (739), language (734), psychology (723), linguistics (704), biology (698), development (664), information (634), environmental (622), theory (592), systems (553), culture (551), international (546), policy (536), sociology (536), teaching (530), learning (523), communication (517), chemistry (511), cultural (510), business (504), islamic (488), human (487), political(482), clinical (477), medical (472), humanities (465), mathematics (446), diseases (432), applied (428), surgery (424), art (420), food (403), educational (390), geography (380), care (370), media (368), anthropology (367), physics (367), finance (366), computer (364), animal (354), energy (354), and materials (353).

COPYRIGHT LICENSES

Copyright refers to a person's sole privilege to permit such actions regarding his or her actual work of authorship like copying, publishing, modification, etc. Copyright is usually owned by the work's author, at least at first. On the other hand, it is often sold or transferred, partly or fully, to a commercial publisher, who can commercially use the work. As a result, copyright frequently favours moneyed interests over individual authors. The Copyright Law has always emphasized that copyright protection functions to serve the general interest. The larger public good is achieved in two ways: first, by paying the writers to create, and second, by promoting the distribution of fresh ideas[27'] .

It was found that authors holding the copyright of their publication fluctuated a lot. From 2002 to 2003, it increased, whereas the following year, it was seen to have decreased. A gradual increase was seen from 2004 to 2008, and then, there was again a decrease in the following year. From 2009 to 2011, it increased, whereas in 2012, it decreased. The year 2012-2013 saw a precipitous rise, and then, a steep fall was seen in 2013-2014. From 2014 to 2018, there was a perceptible rise in the authors being the copyright holders. 2018-2019 saw a fall, 2019-2020 saw a rise, and 2020-2023 again saw a fall (Figure-6). There was also a decrease in the number of journals in 2020-2023 (Figure- 1).

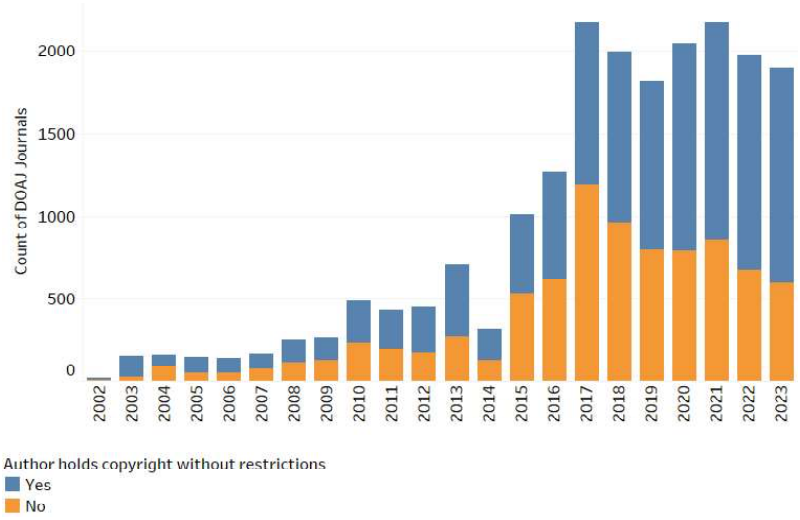

Fig.6 Copyright Held by the Authors

CREATIVE COMMONS LICENSE

A Creative Commons (CC) license is one of several public copyright licenses used to share resources freely or with certain restrictions in the public

domain. The Creative Commons website provides a total of six licenses in a combination of four licenses (https://creativecommons.org/). All four creative commons licenses are described below in Table-1.

TABLE-1 61 Description of Creative Commons Licenses

TABLE-1
61Description of Creative Commons Licenses

Creative Commons (CC) license	**Description**
CC-BY (Attribution)	This license allows people to share, modify, alter, and build upon their work, even commercially, as long as they are credited as the real author. It is the most lenient creative commons license available. It is recommended for optimum authorized content circulation and use. It is considered that the entire monetary and scientific advantage of published material will be recognized only when accessibility to and re-use of this material is not constrained.
CC-SA (Share-alike)	This license allows people to modify, change, and grow upon content for financial interests as long as they acknowledge the original author and license their new materials under the same conditions as the original author. This license is frequently equated to unrestricted and open-source licences. All new creations made are subject to the same license; thus, any modifications are commercially permissible as well.
CC-NC (Non-Commercial)	This license allows people to adapt, alter, and build upon an intellectual output in a non-commercial manner, and while their new works must also recognize the original author and be non-commercial, they are not required to license their works on the same conditions. This license, if provided, must include the author's and accrediting parties' names, a copyright symbol, a license notice, a cautionary notice, and a reference to the work.
CC-ND (No Derivative Works)	This license permits for business and non-commercial reproduction provided it is handed forward unaltered and, in its entirety, with acknowledgement to the original author. A work registered in this manner enables the following freedoms: the liberty to utilize and operate the work; the independence to start making usage, publicly or privately, of the work; the liberty to research the work and implement the insight; the freedom to investigate the work and then use the information acquired from work in just about any way; and the liberty to allocate copies.

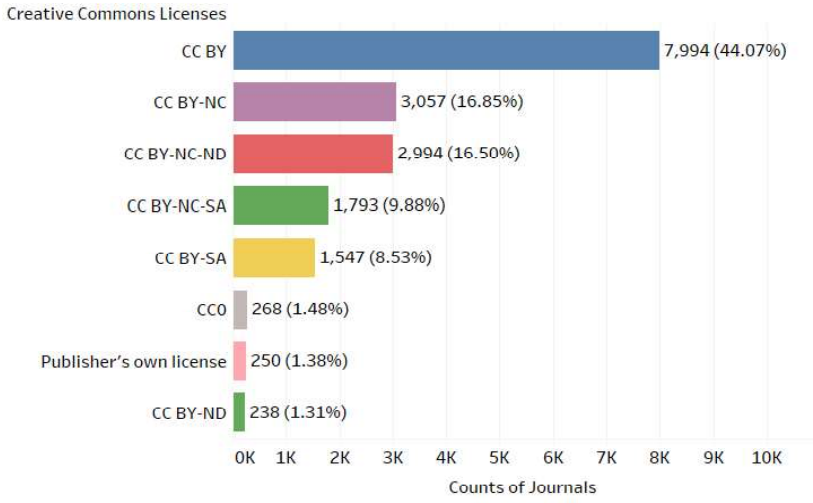

Fig.7 Journals' Use of the Creative Commons Licenses

TOP PUBLISHERS OF OPEN ACCESS JOURNALS

The top twenty publishers of the DOAJ repository are listed in Table 2. There were a total of 20,015 publications, with 9,066 unique publishers of open access journals. Since it was not feasible to put in the data of so many individual publishers, only the top 20 publishers and all the other publishers in a single table were grouped together. It was found out that Elsevier was the top publisher, with a contribution of 3.58% or 716 publications. In the second place was MDPI, with a contribution of 1.99% journals. The third and fourth biggest publishers were BMC (BioMed Central) and Wiley, with contributions of 1.53% and 1.17%, respectively. Other open-access journal publishers were Wolters Kluwer Medknow Publications (1.12%), Taylor & Francis Group (1.1%), Hindawi Limited (1%), and Sciendo (0.99%).

TABLE-2

62 Top Publishers of Open Access Journals

	Count of Open Access Journals	% of Total Open Access Journals
Elsevier	716	3.58%
MDPI AG	398	1.99%
BMC	306	1.53%
Wiley	235	1.17%
Wolters Kluwer Medknow Publications	224	1.12%
Taylor & Francis Group	220	1.10%
Hindawi Limited	201	1.00%
Sciendo	199	0.99%
SpringerOpen	171	0.85%
SAGE Publishing	171	0.85%
Frontiers Media S.A.	165	0.82%
Oxford University Press	100	0.50%
Universitas Negeri Semarang	95	0.47%
KeAi Communications Co., Ltd.	89	0.44%
De Gruyter	78	0.39%
Dove Medical Press	76	0.38%
Emerald Publishing	58	0.29%
Springer	52	0.26%
Cambridge University Press	51	0.25%
University of Bologna	49	0.24%
Other publishers	16,361	81.74%

PEER REVIEW PROCESS

Peer review is the process of research assessment by one or more domain experts. It serves as a means of self-regulation for qualified field members in the subject area ("What is peer review?" 2024)` . A large variety of methodologies of peer review are employed to uphold the professional consistency, increase results, and ensure integrity. Scholarly peer review is normally used in academics to assess the appropriateness of a research article for publication. The process is intended to determine the authenticity, accuracy, and, in some cases, the originality of articles submitted for publishing. Its primary goal is to ensure quality by screening out invalid or low-quality papers. Peer review

serves as a quality conduit for publishers, steering higher quality articles to better quality journals and establishing journal brands. Through the peer review process, running papers are established with an enduring and superior quality. As a result, publishers must ensure that the process is comprehensive` .[27] There are three most popular forms of peer review, which include Single-blind, double-blind, and open peer-review. The clear, collective, and post-publication peer review is a critical deviation from the conventional practice that has emerged over time. The process of peer review is continually changing, with new frameworks emerging and modifications made to conventional models ("Types of Peer Review," 2024)` .

Figure-8 shows the review process that the journals go through. Around 59.7% of the journals go through a double-blind peer-review process, 28.56% go through an anonymous peer-review process, 11.05% go through a peer review, 1.35% go through an open peer-review, and 1,14% goes through an editorial review.

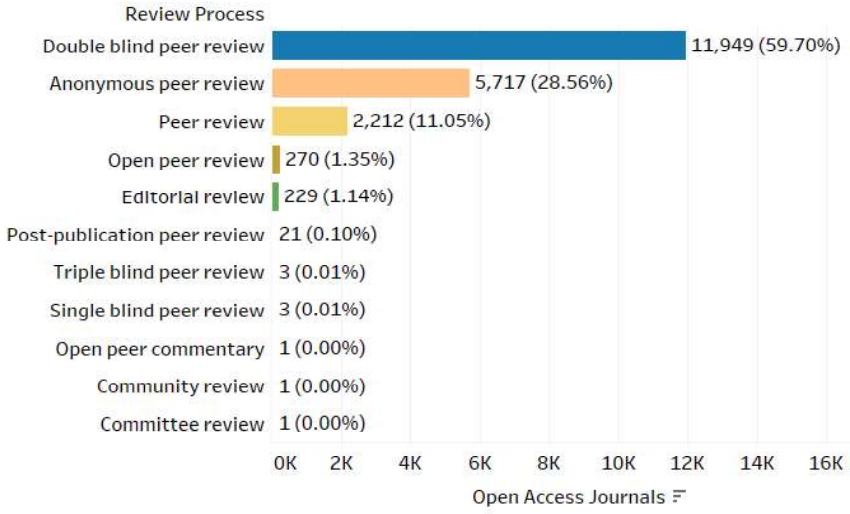

Fig. 8 Peer-review Process Followed by Journals

ORCID METADATA

ORCID is an acronym that stands for Open Researcher and Contributor ID. **ORCID** is a non-profit organization backed by scientific institutions, publishers, investors, professional associations, and government agencies all around the globe. The organization's mission is to identify people by their research, development, and creative projects. It offers tools that allow the relations between research, research input, and allegiances to be transparent and trustworthy. It provides this feature to enable users to find factual data

and make analysis and research simpler. ORCID distinguishes one's research from the research of those with the same or a related identity.

Moreover, names are not necessarily nonspecific. Persons may use nicknames as well. ORCID is identical to a permanent identifier. It binds all of one's works regardless of which name has been used. It saves time as well as easily describes one's research. "Enter once, reuse often" is ORCID's mantra. One can use the ORCID URL to post their ORCID log. In an ORCID record, monitoring the privacy of each content is possible. The content can be kept confidential, be shared, or be made public with trusted people and organizations` .[28]

On January 29, 2020, it was published in the DOAJ News Service that, from February 3, 2020, articles with metadata with ORCID IDs would be provided with provisions to be uploaded (DOAJ, 2020). The ORCID would be displayed according to the display guidelines of the same. To make these IDs retrievable and searchable, changes would be made in the searching interface. While analysing the dataset, it was found that 8795 (43.94%) of it was null or had no ORCID. Only a meagre 6752 (33.73%) of the dataset was filled with ORCID. 4468 (22.32%) of it had not been filled.

DOAJ SEAL AND ITS CRITERIA

The DOAJ seal is conferred upon publications that exhibit the best practices in open access publishing. It was found that the seal has been awarded to approximately 10% of DOAJ-indexed journals. A journal should follow seven parameters to be qualified for the DOAJ seal‘ . These apply to long-term conservation guidelines, permanent tags, visibility, reusable policies, and author's rights protection. The criteria are:

1. Digital Preservation: The article's content must be systematically stored in one of the following archives: any archiving organization mentioned in the Keepers Registry, PubMed Central, and Internet Archive.
2. Persistent article identifiers: Continual article identifiers must be used. The most popular are DOI, ARK, and Handle.
3. Metadata supply to DOAJ: DOAJ requires the article metadata to be uploaded frequently.
4. License type: The journal is required to support a Creative Commons license to create derivatives.
5. Article licensing information: The Creative Commons license information must be displayed in all full-text article variants.
6. Copyright and publishing rights: Authors must retain free copyright and other publication rights when publishing with any license accepted by the journal.

7. Self-archiving policy: Copies of a journal must be deposited in the authors' academic or subject library. A restriction cannot be levied on it (https://doaj.org/apply/seal/).

After analysing the data, it was found that only 1607 (8.03%) of the publications had the seal, and the rest, 18408 (91.97%), did not have it. This shows that the majority of the publications did not fulfil the seven criteria.

ARTICLE PROCESSING CHARGES (APCS)

Article Processing Charges (APCs) are the most often utilized method of supporting open access publication. APCs can be charged by both Open Access Publications and Commercial Publications. Open Access journals do not always charge APCs; and mostly publish 'no charge' articles. The publication of scientific papers would most certainly include APCs; contributions from institutions and incentives fund classic journal publications. The method of APCs was created since charges were largely determined by the quantity of consumers: production and transportation expenses were profoundly influenced by the distribution rate. With the advent of Internet and further advancements of the technology, the cost of producing papers has transferred to rely purely on the quantity of articles or volumes of published information and is no longer affected by the number of downloads or views.

In the recent years, academic writing has shifted away from subscribing and toward Open Access. Publishers are experimenting with various funding models for open access' .[29] APCs are paid in two different ways: one, for Open Access Journals, where writers are liable for publishing; and two, for subscription-based journals, where writers pay to make their research Open Access in an archive that is often subscription-based. This is called the hybrid system' .[30]

Publishers' use of APCs remains varied and is often hidden. While APCs may be a bureaucratic and financial strain on both researchers and publishers, they offer a influential tool to guarantee that researchers are mindful of costs associated with the publication process. Furthermore, the supply-side approach requires a full accounting of the costs per paper at the start, which adds accountability to the method of charging for publishing research on the part of the publishers' .[31]

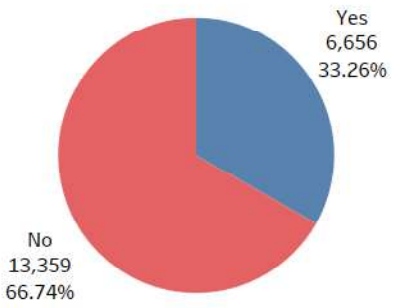

Fig.9 Article Processing Charges (APCs)

In this research paper, a great effort was expended to discover the journals' Article Processing Charges (APC). However, due to the significant differences in the currencies worldwide, it was impossible to ascertain it despite the availability of the data. However, it was seen that the APC was applicable and charged by 6656 (33.26%) journals, and APC was not applicable to 13359 (66.74%) open access journals (Figure 9).

8 CONCLUSION

The Open Access Movement is an effort to make academic research and publications freely available and accessible to anyone, rather than being restricted behind paywalls or subscriptions. The inconceivable usefulness of open access and its benefits across the world has been a motivating factor. The study explained in detail the various open access initiatives in the world. Open Access documents possess all the advantages of electronic documents, including being easily accessible and usable around the clock, being readily saved, reproduced, distributed, printed, and utilized as a source for future documents, not subjected to space constraints. It is evident that open access publishing has manifold benefits, such as providing frictionless access to scientific knowledge, wider audience reach, increased citation rates, and the elimination of financial barriers for researchers.[32,33,34]

Consequently, this paradigm shift towards open access has the aptitude to foster a more equitable and inclusive scientific landscape, where the dissemination of knowledge transcends geographical and economic boundaries. The results indicate that the publication of research in open access journals is gaining an increasing international importance, and the identity of science, technology, engineering, and mathematics journals is becoming more distinct over time. A perceptible trend towards a greater number of research publications in open access journals, particularly by authors from the Global South, suggests a shift in the representation and dissemination of research findings.[35]

Research studies investigating open access journal publishing and charging

trends have revealed several key findings. Most notably, while the majority of journals do not charge article processing charges (APCs), the global average per-journal APC has slightly increased over the past decade.[36] This increase suggests that authors are opting to publish in more expensive journals, potentially driven by factors such as perceived prestige or impact metrics. Moreover, the research indicates that charging tendencies, average APC, and pricing trends are influenced by variables such as publisher size, type, impact metrics, and subject area.

In a similarity to traditional printed publications, some open access documents are protected by copyright. This means the authors or publishers retain certain legal rights over how the work can be used and distributed. Additionally, to ensure these open access documents remain available and accessible long into the future, they are archived or preserved in digital repositories or libraries. Guaranteed connectivity to the document is ensured by assigning constant identifiers unrelated to the initial location where the original document is stored. The time lag between paper submission and publishing is lower in open access publications in comparison to traditional publications. Likewise, as these publications are fully electronic, there is a minimal gap of time between publishing and dissemination. Open access allows papers to be easily accessible and searchable for authors, attracting the reader base closer to the journal and enhancing its credibility for good research writing'.

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