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Open Access Computer Science Journals in the DOAJ: An analytical study

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1. Introduction

Open access (OA) refers to free, unrestricted online access to research outputs such as journal articles and books. It includes the practice of making peer-reviewed scholarly research and literature freely available online to the readers. The open access movement started with several declarations provided in the early 2000s:The Budapest Open Access Initiative (2002),the Bethesda Statement on Open Access Publishing (2003),and The Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003) .According to **the Budapest Open Access Initiative (2002)** "Open access to the literature means free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited." This definition of OA is widely accepted. Stevan Harnad, the open access expert, describes the term OA as: Information which is free, immediate, permanent, full text, online and accessible **(Khatun, 2016).** OA mainly aims to make the intellectual output of researchers and their institutions more visible, accessible, harvestable, searchable, and usable by any potential user having access to the Internet **(Loan, 2014).** Open access proves fruitful for its users including students, researchers, publishers and other professionals to read, download, copy, distribute, and print the full texts of the literature freely available on the internet. "OA removes *price barriers* (subscriptions, licensing fees, pay-per-view fees) and *permission barriers* (most copyright and licensing restrictions)" **(Suber, 2015).** Authors in the present age can make their newly published literature available through two routes of OA namely OA journals and OA repositories. These two routes are known as "GOLD" and "GREEN" routes respectively **(Pinfield, 2009)**. In "Gold Open Access or Open access journal", the author(s) or researchers can publish their articles in scholarly journals which will be freely accessible to all in the web. Publisher of the journals can charge article processing charges (APC) while as in "Green Open Access or self- archiving", the author(s) or researchers can submit a copy of their published article or work into a subject based or an institutional repository to archive the document for open access. This is also called self-archiving. The most academic journal publishers also place a copy of articles of their author's in archive for open access copy **(Khatun, 2016)**. The concept of OA led to the publication of research literature through a number of open access resources. Among these resources OA journals are gaining huge importance. The emergence of open access journals in huge quantities led to the formation of directory of open access journals (DOAJ).

2. The Directory of Open Access Journals (DOAJ)

The idea of creating DOAJ developed during the first Nordic Conference on Scholarly communication held at Lund University in 2002 and the directory was launched in 2003 at Lund University, Sweden. A small grant from the Scholarly Publishing and Academic Resources Coalition (SPARC) and the Open Society Institute provided initial capital for the development of DOAJ **(Adams, 2005)**. It was originally hosted on the servers of Lund University in Sweden, and is currently managed by the independent Community Interest Company, Infrastructure Services for Open Access (IS4OA) located in the UK **(Olijhoek, Mitchell and Bjornshauge, 2015)**.DOAJ is a community-curated comprehensive online directory that indexes and provides access to high quality, open access, peer-reviewed journals, periodicals, and their articles' metadata. Its funds come from donations, sponsors funding 40% and the rest 60% by general members and publisher members. All the data in DOAJ is freely available to the users. It contains 13,113 journals covering a large number of subject areas (science, technology, medicine, social science and humanities) out of which 10,131 are searchable at article level, covering 3,939,984 articles from 130 countries. The DOAJ members include Libraries, Library associations, Consortia, Universities and Research centers throughout the world. The main objective of the DOAJ is to maintain and improve the source of reliable information about peer reviewed open-access journals on the Internet, monitor compliance of the journals presented on the website to adequate quality standards, increase accessibility, assist in distributing and detecting the content of open-access journals, notify the scientific community, and provide access to these journals. The Directory sees its objective in supporting publishers and their journals in meeting the high quality standards of open access electronic scientific journals and thus helping to transform the scientific communication system into a model that would serve science, education, development of technologies and innovations, and society as a whole (https://doaj.org). Since 2014, in connection with the development and ubiquity of the open-access movement, its functions have expanded. The Directory began to provide detailed information about publishers and journals, authors' expenses for publishing papers, types of reviews, copyrights, used licenses, etc**. (Domnina, 2018)**.

3. Review of Literature

A number of studies have been carried on the different subjects present in DOAJ. These studies highlight the importance and significance of free literature provided by open access journals. **Kristin Antelman (2004)** studied the research impact of different articles across a variety of disciplines, and indicated that open-access articles have a greater research impact than articles that are not freely available. **Nicholas, Huntington and Jamali (2007)** analyzed one of the prestigious journals namely Nucleic Acids

Research(NAR) after it was moved to a full open access in 2005 and deduced that it grew rapidly in terms of use and users. Article download in the NAR rose from 132,000 articles in early 2003 to 321,000 in January 2005 with an increase of 143%. **Laakso, Welling, Bukvova, Nyman, Björk & Hedlund (2011)** stated that the emergence of DOAJ met the needs of the open-access movement and the growth of its volume reflects the worldwide trend of development of the movement for open science.

DOAJ contains a number of E- journals related to various disciplines. These journals were periodically examined to see the growth of the directory and get information about the country of journal published, language of journal published, year of journal addition to the DOAJ, journal license etc. **Choudhary & Khode (2010)** reported that 144 OA computer science journals were available in the DOAJ and majority of these journals (21%) 6 were published in the USA and in the English language. In 2013, there were 106 open access journals in media & communication published from 34 different countries of the world. **Kumar and Jain (2013)** carried out a study of OA journals accessible from DOAJ in the subject of Library Science. Their analysis indicated that there was only one open access journal available before 1990 in the field of library and information science and one-fourth journals were publishing on half yearly basis. **Lihitkar, & Waghmare (2013)** analyzed Zoology journals in DOAJ and found that English was the most common communication language used by all 105 E-journals. Out of these 105 E-journals on Zoology 26 E-journals were published in Spanish language and 12 were published in Portuguese language. **Kuri (2014)** analyzed DOAJ for the OA availability of the Library and Information Science discipline and found that 150 OA e-journals were published in the area of Library and information Science by various publishers of the world. These e-journals were further examined to get information about the country of journal published, language of journal published, and year of journal addition to the DOAJ. **Nisha & Ahmad (2014)** analyzed the OA journals indexed in the DOAJ in the field of Chemistry and reported that 33 countries around the world contributed 164 journals in chemistry in which Egypt contributed the highest (29, 17.68%) followed by India (24, 9 14.63%) and the United States (17, 10.36%) respectively. **Das (2016)** examined OA journals in Mathematics were published in 22 languages from 64 countries by 394 publishers across the globe. It was seen that mathematics OA journals started appearing in DOAJ during 2002; afterwards there had been incessant flow of new titles; 96 new titles were added in 2011. Developing countries like India, Egypt, and Brazil have embraced OA and English was the most preferred language. Hindawi Publishing Corporation (9%) was the leading contributor in terms of OA publishing in mathematics. Further, majority of journals (67%) did not charge any fees, about 4% (23) journals imposed some charges (APC/ handling charge/ processing charges, etc.); about 9% journals imposed conditional article processing charges which varied considerably. **Shah, Loan & Jan, (2018)** carried out their study on legal studies and found that DOAJ contains 10,177 Journals from different subject areas out of which 369 (3.63 %) belong to the field of Legal Studies. They further

deduced that 77.24% of journals (285) deal with General Law (including comparative law and uniform law), 7.86% (29) Social Law, and 4.61% (17) with Criminal Law respectively. **Domnina (2018)** carried out a study of Russian Scientific periodicals and concluded that in terms of the number of journals presented in the DOAJ, the UK ranked first (12%) followed by Indonesia (11%) ,Brazil(10%),Spain (5%) ,United States (5%) and Russia (2%). **Jan, Loan and Kumar(2018)** analyzed various aspects of OA journals in the field of computer science and technology registered in DOAJ and their results revealed that 256 OA journals were registered in the DOAJ in the discipline of computer science and technology published by 162 publishers in 13 languages from 46 countries of the world. The majority of the journals were published from Indonesia in the English language and most of them had no article processing charges. Further, almost all the journals use creative common (CC) licenses for the maximum copyright freedom and adopt peer-review systems for quality control and improvement.

4. Purpose

The study aims to identify the publishing trends of the Open Access Journals (OAJS) in Computer Science registered in the DOAJ.

5. Methodology and scope:

To accomplish the present study, data was collected from DOAJ. A total of 168 journals were identified in the field of Computer Science. The scope of the study is limited to the OAJs in the field of Computer Science. These journals were thoroughly examined for further analysis.

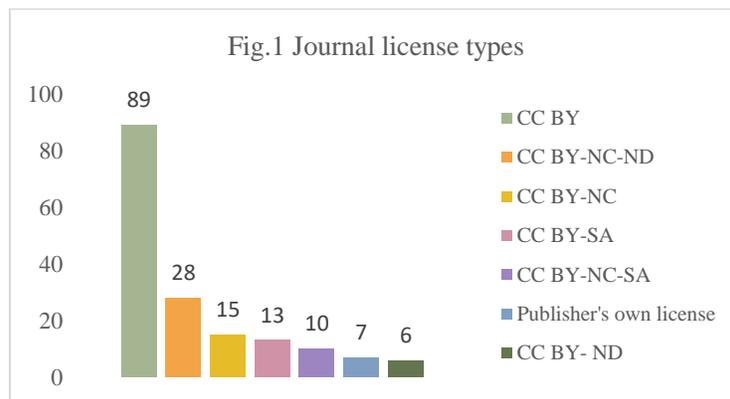## 6. Data analysis and interpretation:

6.1 Leading Publishers

Table 1 presents the distribution of the 168 journals across different types of publishers. OA journals in the field of Computer Science have been found to be published by a number of publishers across globe. Springer Open forms the largest category (6.55%, 11 journals) followed by Hindwani limited (4.17%,7 journals), Sciendo (3.57%,6 journals) and MDPI AG (2.98%,5 journals) respectively. 8 publishers had double journal publications and 120 publishers (71.43%) had a single publication of journals.

Table-1 Leading Publishers

Publisher	Journals	Percentage
Springer Open	11	6.55
Hindawi limited	7	4.17
Sciendo	6	3.57
MDPI AG	5	2.98
Frontiers Media S.A.	3	1.79
Universitas Ahmad Dahlan	2	1.19
Soegijapranata Catholic university	2	1.19
SAGE Publishing	2	1.19
European Association for signal Processing(EURASIP)	2	1.19
European Alliance for Innovation(EAI)	2	1.19
Elsevier	2	1.19
Atlantis Press	2	1.19
Dunarea de Jos University of Galati	2	1.19
Others	120	71.43
Total	168	100

6.2 Licenses adopted for open access

Creative Commons (CC) licenses have been a great platform for guiding the open access content in renowned levels according to the publishers/authors' accessibility. The creative commons licenses are flexible licenses that help in free distribution of copyrighted works. A creative common license provides a standard way for authors to provide users approval to read, use, share, and cite their works. A Creative Commons license grants author flexibility and protects the users from concerns of copyright violation under rules. The journals approve various forms of CC Licensing. The CC Licenses contain BY, NC, SA, and ND features. The most common license adopted by the open access journals is the CC-BY which is the least restrictive among all. The maximum number of journals (52.98%,89) use CC BY licensing, followed by CC BY-NC-ND (16.67%,28), CC BY-NC (8.93%,15) and CC BY-SA(7.74%,13) respectively. Few publishers (4.17%, 7) have produced their own licenses as well. Fig.1 provides the rest details regarding the other licenses used.

Fig.1 Journal license types

- CC BY: 89
- CC BY-NC-ND: 28
- CC BY-NC: 15
- CC BY-SA: 13
- CC BY-NC-SA: 10
- Publisher's own license: 7
- CC BY- ND: 6

6.3 Peer reviewed processes of journals

Peer review is designed to evaluate the validity, quality and the originality of articles for publication. Peer review is important as it improves the quality of published papers by motivating authors to submit good quality work and helping to improve that work through the peer review process. DOAJ aims to maintain and improve the source of reliable information about peer reviewed OA journals. DOAJ provides detailed information on the types of reviews. The following types of reviews are used in Computer Science journals:

- Blind peer review: the names of reviewers are hidden from the author, 51.19%;
- Double blind peer-review: both the author and the reviewer remain anonymous, 25%;
- Peer review: the reviewer and the author are known to each other, 23.21%
- Editorial review process is least (0.60%) preferred.

Thus, the study shows that blind and double blind peer reviews are widely accepted processes because they help a reviewer to be honest without fear of criticism from an author and research is judged fairly without any bias.

Table-2 Peer review types

Review type	Journals	Percentage
Blind Peer Review	86	51.19
Double blind peer review	42	25.00
Peer review	39	23.21
Editorial review	1	0.60
Total	**168**	100

6.4 Country–wise distribution of journals

Table 3 reveals that publishers from 51 countries have registered their journals in DOAJ in the field of computer science. Among the 168 journals of Computer Science, 29 journals (17.26%) have Indonesia as their publisher country followed by UK (13.69%), Romania (8.33%) and Poland (5.95%) respectively. Switzerland and Russian Federation have 8 (4.76%) journals each. The other contributing countries are USA (3.57%), Spain(2.98%), Germany and France (2.38% each).Hence, it is clear that developed countries (like Indonesia, UK, Romania) excel in publication of OA journals in Computer science while as developing countries (like China, India, USA) lag far behind in this field.

Table-3 Country-wise distribution of journals

Country	Journals	Percentage
Indonesia	29	17.26
UK	23	13.69
Romania	14	8.33
Poland	10	5.95
Switzerland	8	4.76
Russian Federation	8	4.76
USA	6	3.57
Spain	5	2.98
Germany	4	2.38
France	4	2.38
Others	57	33.93
Total	**168**	100

6.5 Language Diversity

Scientific journals have a practice of publishing articles in various languages which help to increase the scope of research globally. The study reveals that all the 168 OA journals in the field of computer science have been published in different languages with English being the most widely used mode of knowledge communication followed by Indonesian and Russian languages. There are 6 languages each having a single publication of journals. The journals published in the languages other than English should keep the abstract of papers available in the English language as well (Table 4).

Table-4 Language diversity of journals

Language	Journals
English	142
Indonesian	23
Russian	10
Spanish; Castilian	8
Portuguese	5
Ukrainian, French	3
Slovak, Lithuanian, German	1

6.6 Article Processing Charges (APC's)

OA does involve any cost for the review and processing of publication. Similarly, in case of OA journals of Computer Science in DOAJ, it has been found that among 168 journals almost 114 (67.86%) journals

have no APC while as 53(31.55%) journals ask for an APC. Meanwhile, only 1 journal has no information regarding APC. The results show a positive sign that the journals which do not charge any APC to authors may increase the interest of authors for publishing in OA journals (Table 5).

Table-5 Article processing charges

Processing charge	Journals	Percentage
Yes	53	31.55
No	114	67.86
No information	1	0.60
Total	**168**	100

6.7 DOAJ Seal

"The DOAJ seal is a mark of certification for open access journals, awarded by DOAJ to journals that achieve a high level of openness, adhere to best practice and high publishing standards" (https://doaj.org). The findings of the study reveal that 134 (79.76%) journals lack DOAJ seal and 34 (20.24%) journals are marked with a DOAJ seal (Fig.2).

FIG.2 DOAJ SEAL
No, 34
Yes, 134
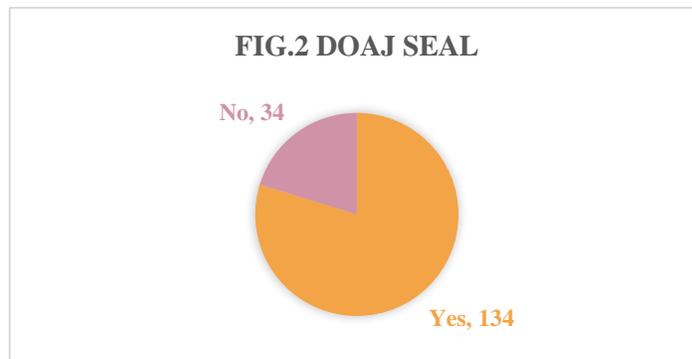
CONCLUSION:

OA journals have shown a widespread growth in different disciplines worldwide. The publishing of new OA journals and transformation of commercial journals to OA model has increased their access. Publishers have also shown increased positive attitude towards OA practice. The number of OA journals are increasing day by day showing a positive sign towards this concept. DOAJ has registered almost 168 journals in the field of Computer Science/Electronic Computers which are published by the academic institutions, different organizations, varied societies, renowned research centers and also by commercial publishers. Prominent publishers have taken part in OA publication of journals which belong to 51

countries of the world and Indonesia tops the list followed by United Kingdom and Romania respectively. The journals in Computer science are published in 7 languages with English language being the most preferable one. OA journals are either published after receiving requisite publication charge from the authors or they are published free of cost by some publishers. In Computer Science journals, one-third of the journals are published free of cost and rest of them require an article processing fee before their publication. The authors should be aware of predatory publishers and must be able to identify predatory journals before paying any publication charge for their publications. DOAJ adopts a standard form of peer review process before publishing a journal. In case of Computer Science journals, it has been found that blind peer- review and double blind peer-review process is duly followed because they ensure bias-free and authentic review of the publications. These also provides author and reviewer protection against criticism. DOAJ seal is a mark of certification of open access journals in the directory. Only the journals which have been indexed in DOAJ are considered for seal. DOAJ seal is awarded by DOAJ to the journals that achieve high level of openness, follow best practices and high publishing standards. About three-fourths of the journals in computer science are awarded with DOAJ seal and a few lack the same. Creative Commons (CC) licenses is the best and validate license for users to read, share, use and cite their copyrighted work. 99% of the journals in the computer science field have CC license which is a positive indication of extension of the horizons of OA computer science journals in DOAJ.

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