Is Open Science a Developed Countries' Phenomenon? A Case Study of Journals Registered in the DOAJ

Swapan Kumar Patra[1], Udita Roy[1]

1 Sidho-Kanho-Birsha University

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Abstract

The open science movement is a significant development recently that promotes equality, accessibility, and transparency in research. The program aims to improve the quality and significance of research while increasing public access to science. The open science movement advocates for free and open science using various means. This novel idea gained focus since its conception during the last decade. Open access to scholarly content is a prerequisite to excel in research. Open access to research through scholarly journals is a subset of open science. This paper is an attempt to analyse journals listed on the Directory of Open Access (DOAJ) repository. The study observed that there is growth in open access journals globally. However, most of the journals are from the high-income group of developed countries. This is due to the fact that high-income nations with superior facilities and infrastructure benefited from a variety of incentives to publish in open access journals or various modes of open access. So, it can be argued that open science is a developed countries' phenomenon. Middle and lower-middle groups of countries should encourage various forms of open science, including the open access of scholarly content through scholarly publications. Further insight into the scholarly publication patterns, including the subject coverage, citation analysis, and author-level collaboration analysis, will yield a better and holistic picture of the phenomenon.

Swapan Kumar Patra* & **Udita Roy**

Department of Library and Information Science

Sidho-Kanho-Birsha University, Purulia, West Bengal, India

**Email: skpatra@gmail.com*

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Introduction

"Open Science" is a disruptive phenomenon recently gaining global attention. The open science movement is predicted to transform the research study, design, methodology, data collection, and evaluation through openness and connectedness in every sphere. Above all, public access to scientific knowledge and its dissemination are the goals of the open science movement[1]. Moreover, the open scientific movement emphasizes transparency and accessibility of knowledge while promoting the growth and dissemination of research through collaborative networks[2]. The major principles behind open science include data sharing, open access to research findings, and the use of cooperative digital tools. This approach accelerates the rate of discovery, increases the repeatability of research, and motivates more people to pursue scientific endeavours[3] (Chakravorty et al., 2022). The United Nations Educational, Scientific and Cultural Organization (UNESCO) has also recommended open science practice, recognizing its importance in advancing research and knowledge dissemination globally[4]. Furthermore, establishments like the Organisation for Economic Co-operation and Development (OECD)[5], FOSTER[6], and others provide resources and guidelines to help individuals globally understand and engage with open science practices.

In academic research, the concept of open science and open access publications are almost similar. However, the concepts are different in many ways. Open science refers to a wide variety of methods intended to increase the openness and accessibility of the whole research process. On the other hand, open access journals can be seen as a subcategory of open science. Open Access is the term used for freely available online peer-reviewed scientific literature with limited licensing and copyright restrictions[1]. Open access journals, which are part of the open science movement, make research articles openly available to all irrespective of any barriers (Willinsky 2005).

As open access journals are an important component of open science, this paper is going to investigate the open access journals globally from the Directory of Open Access Journals (DOAJ) repository. This study is going to address the following research questions: What are the trends in the growth of open science journals globally? From which countries are open access journals generally published? What kind of licensing mechanisms do open access journals have, and so on?

While doing so, the paper is divided into the following sections: The following section deals with the literature review,

followed by the research objectives, research methods, results, discussion, and finally, the concluding remarks.

Literature Review

The open scientific movement is gaining momentum across the globe. With the growing awareness and discourse, there exist multiple interpretations, stances, and viewpoints about the definition of “open science.” Moreover, science is now more data-driven than ever before. Hence, open data initiatives are essential to promote and advance open science (Ramachandran, Bugbee & Murphy, 2021). Willinsky (2005) defines open science as “...a collaborative culture enabled by technology that empowers the open sharing of data, information, and knowledge within the scientific community and the wider public to accelerate scientific research and understanding” (Willinsky, 2005). Vicente-Saez & Martinez-Fuentes define open science as “Open Science is transparent and accessible knowledge that is shared and developed through collaborative networks” (Vicente-Saez & Martinez-Fuentes, 2018). According to Ramachandran, open science is “a collaborative culture enabled by technology that empowers the open sharing of data, information, and knowledge within the scientific community and the wider public to accelerate scientific research and understanding” (Ramachandran, Bugbee & Murphy, 2021).

As per the above definitions, open science encompasses the whole gamut of ideas, including accessibility and transparency of scientific knowledge from data generation to scholarly publication. Moreover, it includes the general idea of disseminating various aspects of scientific research to all segments of society. Nurturing such ideas requires incentives in various forms and building robust and forward-looking international networks of collaboration.

Although the open access movement is a crucial component of the “open science” movement, it is not the same as “open access.” It is better to view it as part of a bigger push to make scientific knowledge publicly available (Chakravorty et al., 2002). Proponents of the open science idea define it as science done in the right way for the public benefit. It ought to be carried out in harmony with society and its values. In this perspective, ethical science involves taking international human rights and social justice into account. To achieve the objective of open science, academics must give scientific culpability and scientific autonomy equal weight. Making the scientific literature openly accessible to everybody is one aspect of that duty, but open science involves more than just open access (Holbrook, 2019).

Journal articles are the primary means of disseminating scientific findings among researchers and to a wider audience. However, the cost of accessing journal articles has restricted access to scholarly articles, which are essential tools for conducting research. Open access literature helps overcome some of these barriers by making articles digitally available online, free of charge, and exempt from most copyright and license restrictions (Suber, 2012).

Directory of Open Access Journals (DOAJ)

The development of web technology, particularly the recent surge in the internet, has made it possible for academic publications to be published under Open Access (OA). The paradigm of open access and open peer review suggests that

content can be accessed without the need for subscription fees. Peer review is open, and readers are free to access the entire content (Laakso et al., 2011).

On one hand, the exorbitant journal subscription costs paid to commercial publishers, and on the other hand, the advent of the internet fuelled the open access movement globally (Guédon, 2004; Suber, 2012; Miguel et al., 2016; Mendes & Rodrigues, 2021). The three statements, Budapest Open Access Initiative[7] in 2002, and the Bethesda[8] and Berlin declarations[9] in 2003, charted the tenets of this global movement (Suber, 2009; BOAI, 2012).

A curated list of open access journals from all over the globe is hosted on the Directory of Open Access Journals (DOAJ) platform (https://doaj.org/). Since its inception in 2003, the portal has been maintained by Infrastructure Services for Open Access, comprising a dedicated group committed to maintaining the standard and quality of open access publications. Presently, DOAJ is an invaluable resource for scholars, students, and anyone else looking to access high-quality academic literature without any paywall restrictions. In October 2023, the DOAJ website shows that it covers publications from 135 countries, 80 languages, and a total of 20,008 journals. DOAJ is inclusive and has a well-designed web interface (Morrison, 2017; Mendes & Rodrigues, 2021). The DOAJ-listed journals include almost every topic of scholarly interest. Users can browse the current list by titles, alphabetically, or by subject (Grace, 2013).

Research Objectives

The objectives of this research are to find out the:

- Year-wise growth of open-access journals from the DOAJ database
- Year-wise growth of open-access journals categorized by economies as per the United Nations listing based on per capita GNI in 2012
- Country of open-access publishers based on the categorization of economies
- Types of licenses issued to the journals based on the categorization of economies
- Types of DOAJ seals issued to the journals based on the categorization of economies

Methods

The data for this study was downloaded from the DOAJ: Directory of Open Access Journals (DOAJ) website available at https://doaj.org/. The data was imported into an Excel file, and further processing was done to meet the research objectives stated above. The country of publishers is classified based on the United Nations (UN) classification of economies by per capita Gross National Income (GNI). It is an important measure for understanding the economic status of countries. The classification is available at https://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf (Please see appendix). This classification is typically updated annually and is based on GNI per capita. This scheme classifies countries into four categories based on GNI: High-income, Upper-middle-income, Lower-middle-income, and Low-income.

The study further analyses the growth of publications, the number of publications, etc., based on the above-mentioned four categories.

Results

The study is based on 18,532 journals listed in DOAJ until the year 2022. The following section will deal with the results obtained from the downloaded data from the DOAJ.

Growth of Open-Access Journals

It is observed from the data that the number of journals listed on the DOAJ portal is growing. From 21 journals listed in 2022 to 143 in 2003, the number of journals listed in DAOJ was highest (2,260) in 2017. In the years 2021 and 2022, there were 2,201 and 2,001 respectively listed on the website (Figure 1). From the trends of the last couple of years, it can be said that about 2,000 journals are enlisted on the DOAJ portal every year, and the number is expected to keep growing.

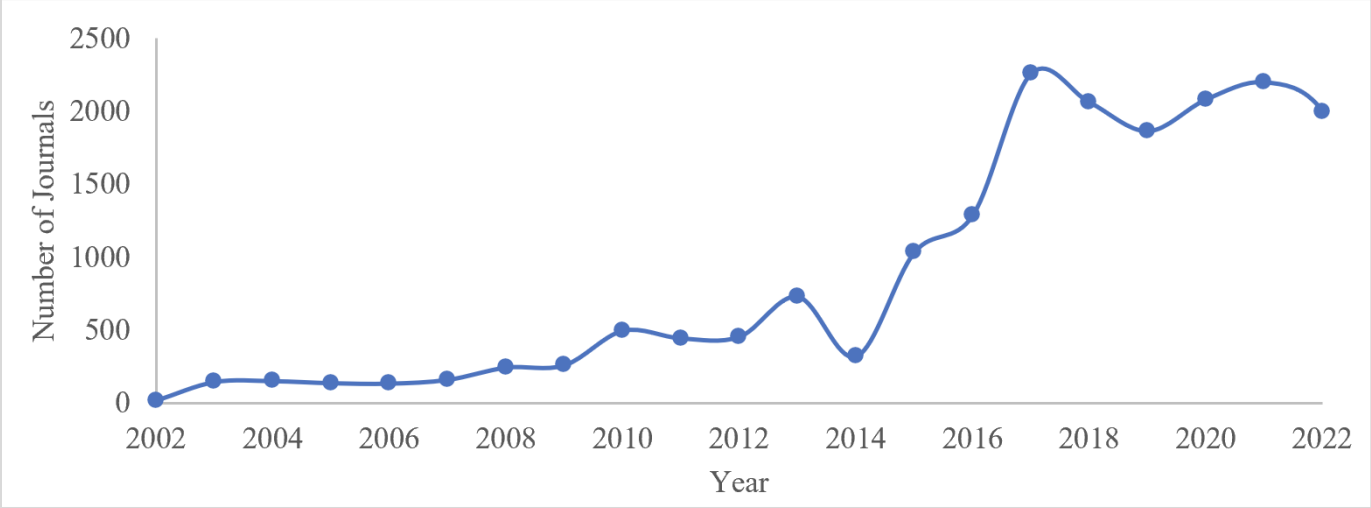

Figure 1. Growth of DOAJ listed journals

The further categorization of the growth of journals from the country divisions shows that there are 9,455 (51%) journals from High-Income, 5,650 (about 31%) journals from Upper Middle-Income, 3,327 (about 18%) journals from Lower Middle-Income, and only 78 (0.4%) are from Low-Income countries. Figure 2 shows the number of journals from each country category.

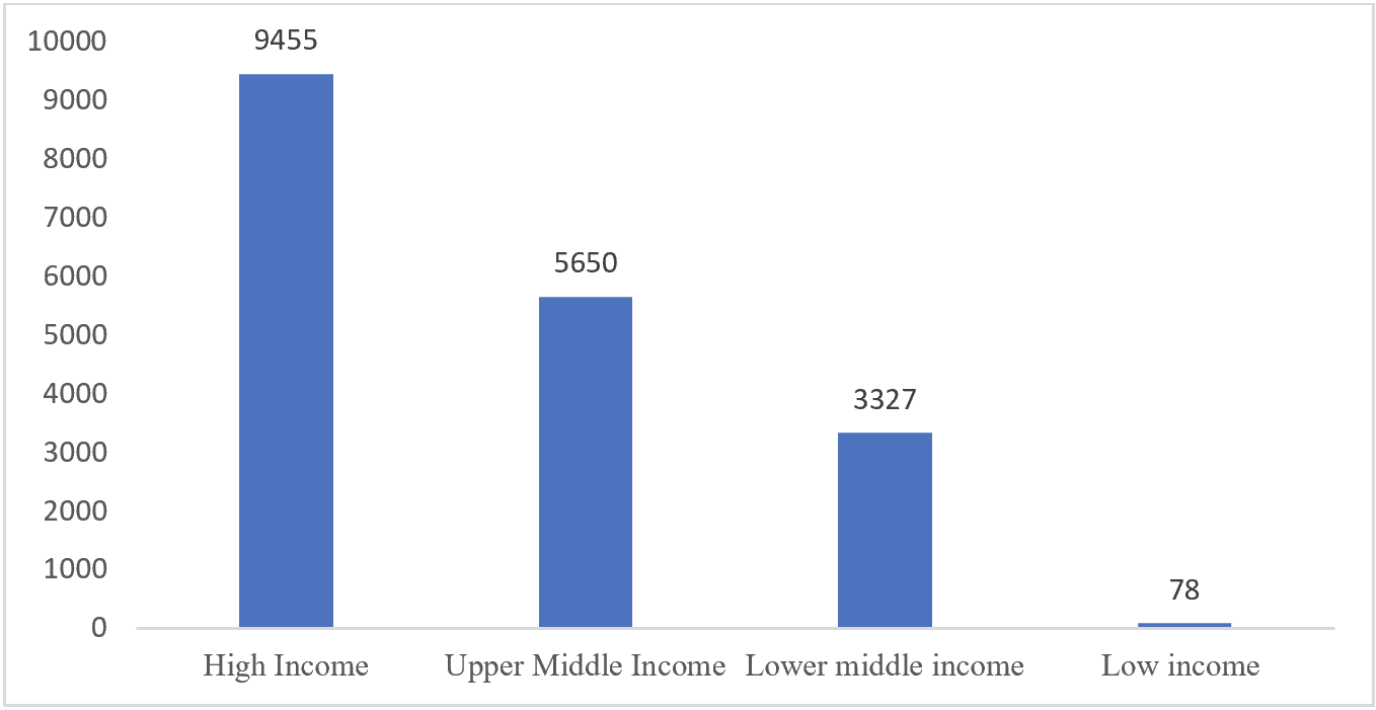

Figure 2. Number of journals listed from each economic category

Figure 3 shows the year-wise growth of journals from each economic category. The growth of journals listed in DOAJ from high- and upper-income countries is growing at a similar pace. The listing of journals from low-income countries is discontinuous. The first journals were listed from low-income countries in the year 2007, and no journals were included in DOAJ in 2014. From the trends of the last years, it can be observed that fewer than 10 journals are listed on DOAJ from low-income countries.

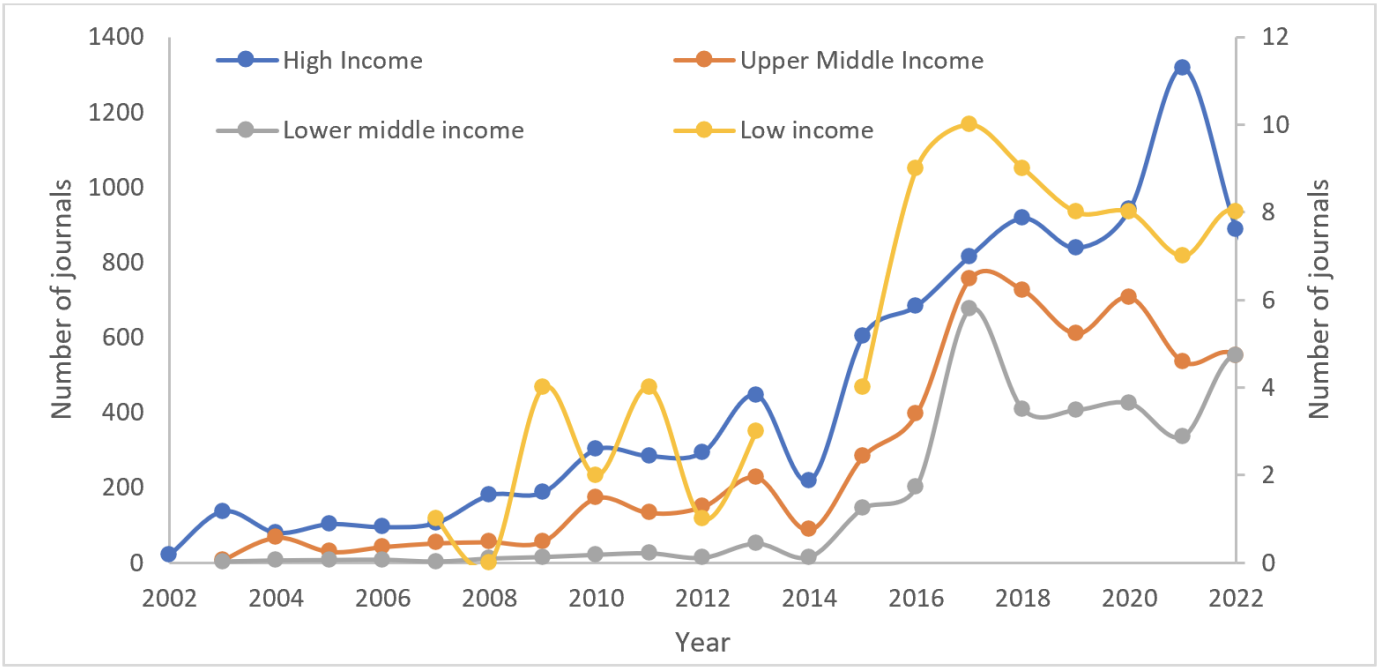

Figure 3. Year-wise growth of journals from each category

As discussed in the methods section, country of publishers' data is grouped according to the United Nations (UN) classification of economies by per capita Gross National Income (GNI). The country of publishers is grouped into four categories: High Income; Upper Middle Income; Lower Middle Income; and Low-Income (Table 1). In high-income nations, the United Kingdom (2,067) has the highest number of publishers followed by the United States (1,098). Brazil (1,650) and Iran (812) are the countries with the first and second-highest number of publishers from the upper-middle-income group. Indonesia (2,296) leads from the lower-middle-income group, and Nepal (29) is the top among the low-income category.

Table 1. The country of publishers

High Income	Number of journals	Upper middle income	Number of journals	Lower middle income	Number of journals	Low-income	Number of journals
United Kingdom	2067	Brazil	1650	Indonesia	2296	Nepal	29
United States	1098	Iran, Islamic Republic of	812	Ukraine	437	Bangladesh	23
Spain	977	Türkiye	459	India	336	Ethiopia	10
Poland	833	Colombia	438	Pakistan	133	Kenya	6
Switzerland	659	Argentina	375	Egypt	130	Congo, The Democratic Republic of the	3
Russian Federation	581	Romania	375	Moldova, Republic of	41	Kyrgyzstan	3
Italy	512	China	271	Morocco	31	Uganda	2
Netherlands	411	Mexico	214	Paraguay	27	Malawi	1
Germany	368	Serbia	211	Philippines	26	Mali	1
France	310	South Africa	134	Nigeria	23	Rwanda	1
Canada	213	Cuba	128	Sri Lanka	20	Tajikistan	1
Korea, Republic of	169	Peru	124	Viet Nam	16	Tanzania, United Republic of	1
Portugal	165	Iraq	98	Nicaragua	13	Zimbabwe	1
Chile	162	Malaysia	98	Armenia	12	Gambia	1
Croatia	156	Ecuador	96	Syrian Arab Republic	11		
Czechia	143	Bulgaria	87	Bolivia, Plurinational State of	8	Other countries	17
Australia	139	Costa Rica	75	Yemen	7		
Norway	126	Hungary	74	Ghana	6		
Lithuania	96	Bosnia and Herzegovina	43	El Salvador	4		
Japan	82	Venezuela, Bolivarian Republic of	41	Georgia	4		
Slovenia	72	Thailand	33	Honduras	4		

Finland	65	Algeria	29	Guatemala	3		
Austria	56	Kazakhstan	22	Côte d'Ivoire	3		
Sweden	56	Belarus	21	Uzbekistan	2		
Belgium	53	North Macedonia	15	Cameroon	1		
Denmark	51	Montenegro	9	South Sudan	1		
Slovakia	48	Dominican Republic	8				
Greece	44	Albania	5				
Singapore	42	Libya	5				
Estonia	35	Panama	5				
Taiwan, Province of China	35	Tunisia	5				
Uruguay	33	Angola	4				
Ireland	22	Jordan	3				
Saudi Arabia	21	Lebanon	2				
New Zealand	20	Azerbaijan	1				
Hong Kong	17	Turkmenistan	1				
Latvia	16						
Qatar	12						
Oman	7						
Iceland	6						
United Arab Emirates	6						
Israel	4						
Brunei Darussalam	2						
Cyprus	2						
Luxembourg	2						
Malta	2						
Bahrain	1						

Barbados	1						
Kuwait	1						
Trinidad and Tobago	1						

Journal License

The Directory of Open Access Journals (DOAJ) emphasizes open access and licensing practices for scholarly journals. It promotes open access and encourages journals to allow authors to retain their copyrights while using transparent licensing practices to make research widely accessible. DOAJ endorses the use of Creative Commons licenses to inform readers how published content can be used. Understanding these terms is crucial when using or sharing content under CC BY-SA to comply with its requirements and promote open collaboration and sharing of knowledge and creativity. Journal licenses can be categorized into the following nine types. The types of licenses are CC BY, CC BY-NC, CC BY-NC-ND, CC BY-NC-SA, CC BY-ND, CC BY-SA, CC0, Public domain, and finally Publisher's own license (Table 2).

Table 2. Journal license

Sl no	Licenses	All countries	High Income	Upper Middle	Lower Middle	Low Income
1.	CC BY	9873	6209	2329	1282	36
2.	CC BY-NC-ND	4224	2818	1234	153	15
3.	CC BY-NC	3814	1841	1434	501	28
4.	CC BY-NC-SA	1844	437	775	628	2
5.	CC BY-SA	1527	336	176	1012	2
6.	CC BY-ND	341	254	57	29	2
7.	Publisher's own license	279	185	80	13	1
8.	CC0	274	273	-	-	-
9.	Public domain	5	5	-	-	-

CC BY stands for "Creative Commons Attribution." It is a type of Creative Commons license that permits authors to share their work with third parties while maintaining their copyright. CC BY is the most popular license (9,873). Among the High-Income countries, there are 6,209; in Upper Middle countries, there are 2,329 licenses; among Lower Middle-income countries, there are 1,282 licenses, and from Low-Income countries, there are 36 licenses (Figure 4).

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needs to be utilized exactly as it is. The CC BY-NC-ND licenses total 4,224 licenses. There are 2,818 from High-Income countries, 1,234 from Upper Middle-Income countries, 135 from Lower Middle-income countries, and 15 from low-income countries.

CC BY-NC stands for “Creative Commons Attribution-Noncommercial.” It is a kind of Creative Commons license that allows you to utilize copyrighted content with specific rights. For example, if educators adhere to the license requirements, they can use CC BY-NC content for instructional purposes without breaching copyright in a learning environment. It is crucial to abide by these conditions and make sure that any usage of CC BY-NC material complies with the non-commercial limitation. The CC BY-NC licenses total 3,814 licenses. There are 1,841 from High-Income countries, 1,434 from Upper Middle-Income countries, 501 from Lower Middle-income countries, and 28 from low-income countries.

CC BY-NC-SA stands for “Creative Commons Attribution-NonCommercial-Share Alike.” For a work published under this license, the original author must always be properly credited. The content is meant for non-profit, educational, or private use only and cannot be used for commercial purposes. Others who remix or expand upon the work must grant the same licenses for their derivative works, guaranteeing that they are freely distributable. This license ensures that future users will have the same freedoms and encourages the sharing and modification of creative works in non-commercial and educational situations. For instance, if educational information is published under CC BY-NC-SA, people may use and adapt it for educational purposes if they give due credit and license their adaptations under the same terms. The CC BY-NC-SA licenses are as follows: a total of 1,844 licenses. There are 437 from High-Income countries, 775 from Upper Middle-Income countries, 628 from Lower Middle-Income countries, and 2 from low-income countries.

CC BY-SA, or Creative Commons Attribution-ShareAlike, is a type of license that allows individuals to share, copy, and redistribute a creative work in any format for any purpose, including commercial use. Additionally, it permits the adaptation, remixing, and transformation of the original work. The CC BY-SA licenses are as follows: a total of 1,527 licenses. There are 336 from High-Income countries, 176 from Upper Middle-Income countries, 1,012 from Lower Middle-Income countries, and 2 from low-income countries.

“CC BY-ND” stands for Creative Commons Attribution-NoDerivs. It is a type of copyright license that allows for the redistribution of a work, even for commercial purposes, but it must remain unchanged, and proper attribution to the original creator is required. The CC BY-ND licenses are as follows: a total of 341 licenses. There are 254 from High-Income countries, 57 from Upper Middle-Income countries, 29 from Lower Middle-Income countries, and 2 from low-income countries.

CC0 does not restrict who can use the work or impose any conditions or restrictions on its use. If a work is marked with CC0, it means the creator has effectively given up all their rights to the work to be placed in the public domain. There are 274 journals under the CC0 license, and all are from High-Income countries.

In addition to this, there are also journals under Publisher’s own license terms, and a few are available in the public domain (Figure 4).

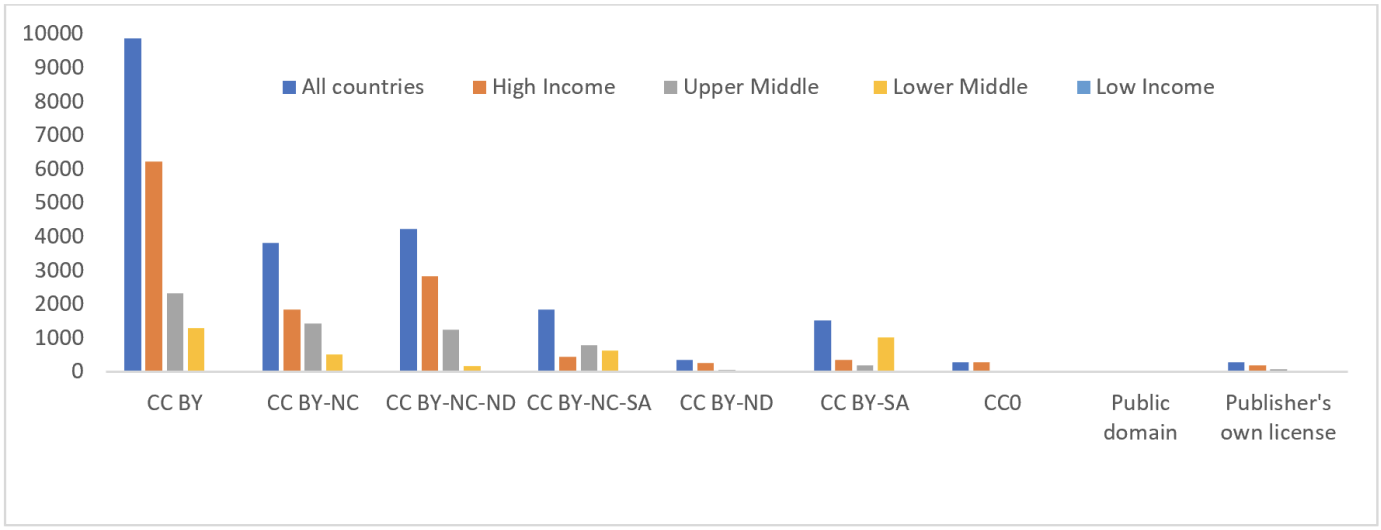

Figure 4. Types of licenses and their country-wise distribution

DOAJ Seal

The Directory of Open Access Journals (DOAJ) implemented new standards in December 2012 and plans to gather additional data about the journals it includes[10]. Journals that were already included in DOAJ were invited to reapply to be kept in the directory as part of this new certification process (Habibzadeh, 2019). Publications bearing the DOAJ Seal are thought to follow exceptional best practices for open-access publication. Acceptance of this honour demonstrates a dedication to maintaining open access scholarship's high standards of quality and accessibility. For researchers and readers looking for reliable open access publications, it is a useful signal[11].

Table 3. A critical analysis of DOAJ Seal issued to journals among various countries

	DOAJ Seal Yes	DOAJ Seal No	Total Journal
High-income	1,404 (14.04%)	8,596 (85.96%)	10,000
Upper middle income	117 (1.96%)	5,839 (98.04%)	5,956
Lower middle income	48 (1.34%)	3,545 (98.66%)	3,593
Low-income	1 (1.2%)	82 (98.80%)	83

A critical analysis of DOAJ Seal shows that the journals from the high-income countries have the maximum number of seals, followed by the upper middle-income countries. So, certainly, the journal publishers from lower and low-income groups of countries are lagging behind in obtaining the DOAJ Seal. Getting this approval certainly ensures credibility and best practices among journal publishers and publications.

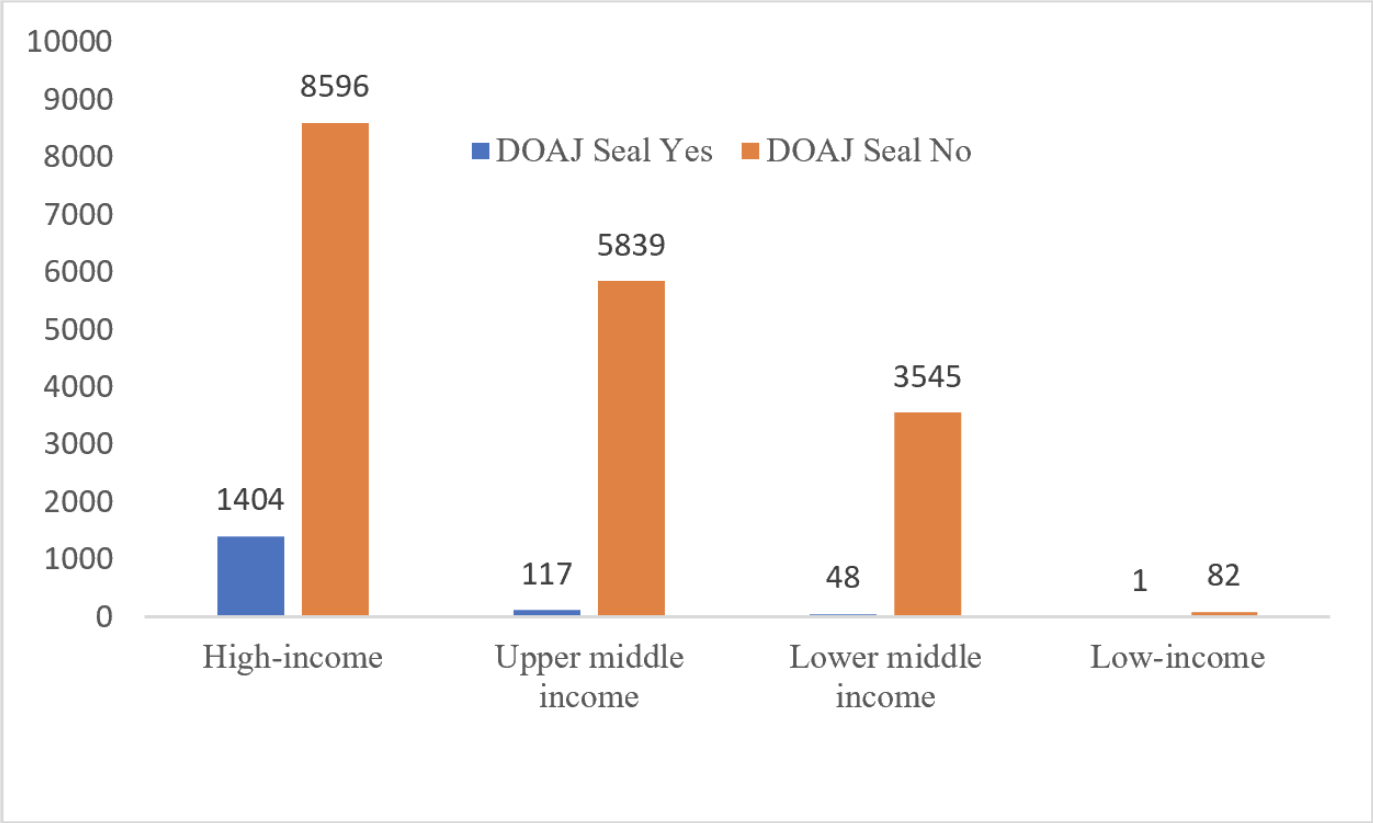

Figure 5. Graphical representation of DOAJ Seal received by open access journals

Discussion

"Open science" is becoming increasingly popular worldwide, especially in developed countries. It brings about changes in technology and socio-culture based on connectedness and openness. Open science is connected to the entire cycle of research planning, execution, and evaluation. A subfield of open science is known as "open access," which refers to peer-reviewed scientific material that is freely accessible online with few copyright and license constraints[1]. In a broader perspective, the phenomenon of open science is a global movement that affects the workflow in scholarly journal publication, their quality, reliability, and indexability (Gasparyan, Ayvazyan & Kitas, 2013). Open access to scholarly content is much more likely to be useful to poor and underdeveloped countries. With the advent of internet access, free scholarly content widens the circle of those who read and make use of scholarly research (Evans & Reimer, 2009).

This paper conducted a critical analysis of DOAJ listed journals. The analysis showed that cumulatively there is growth in open access scholarly journals as listed on the DOAJ website. However, the number of journals from high-income countries is higher than other economic groups. Even the number of journals originating from high-income countries is cumulatively much more than any other group of countries. In terms of licenses, CC BY type licenses are much more prominent than any other types of licenses. The DOAJ seal is one of the important indicators of the journals' reliability. As seen from the DOAJ data, most of the journals from high-income countries obtained the DOAJ seal than any other group of countries.

Concluding Remarks

Open access journals are a part of the global open science movement. Open access publishing has become a global movement with the aim of providing free access to knowledge worldwide. Developing countries often play a vital role in this process. Open science and open access journals, as represented by the DOAJ, are not limited to developed countries but are a global endeavour involving contributions from various nations. It is a comprehensive index of open access journals from around the world, encompassing all academic disciplines including science, social science, and arts and humanities. Many countries, regardless of their development status, actively contribute to open access publishing and open science initiatives. They recognize the importance of making research accessible to all. Open science and open access are particularly important for developing countries where access to quality publications is scarce due to the increasing prices of journals. It is difficult for many research organizations, universities, and other institutes of higher learning to access quality publications.

However, DOAJ data shows that most of the journals are from high-income countries, while lower and upper middle-income countries have yet to catch up. It is evident that high-income countries with better infrastructure and facilities are ahead of the upper and lower middle-income countries. A proper incentive mechanism and journal patronage are required.

This is a preliminary study of the DOAJ listed journals. Further analysis of the subject coverage, citation analysis, and other aspects of open access journals will perhaps provide a better and more holistic picture of this phenomenon.

Appendix

Economies by Per Capita GNI in 2012

High-income	Upper middle income	Lower middle income	Low-income
1. Australia	1. Albania	1. Armenia	1. Bangladesh
2. Austria	2. Algeria	2. Bolivia	2. Benin
3. Bahrain	3. Angola	3. Cameroon	3. Burkina Faso
4. Barbados	4. Argentina	4. Cape	4. Burundi
5. Belgium	5. Azerbaijan	5. Congo	5. Central African Republic
6. Brunei Darussalam	6. Belarus	6. Côte d'Ivoire	6. Chad
7. Canada	7. Bosnia and Herzegovina	7. Djibouti	7. Comoros
8. Chile	8. Botswana	8. Egypt	8. Democratic Republic of the Congo
9. Croatia	9. Brazil	9. El Salvador	9. Eritrea
10. Cyprus	10. Bulgaria	10. Georgia	10. Ethiopia
11. Czech Republic	11. China	11. Ghana	11. Gambia
12. Denmark	12. Colombia	12. Guatemala	12. Guinea
13. Equatorial Guinea	13. Costa	13. Guyana	13. Guinea-Bissau

14. Estonia	14. Cuba	14. Honduras	14. Haiti
15. Finland	15. Dominican Republic	15. India	15. Kenya
16. France	16. Ecuador	16. Indonesia	16. Kyrgyz Republic
17. Germany	17. Gabon	17. Lesotho	17. Liberia
18. Greece	18. Hungary	18. Mauritania	18. Madagascar
19. Hong Kong SAR	19. Iran, Islamic Republic	19. Moldova	19. Malawi
20. Iceland	20. Iraq	20. Morocco	20. Mali
21. Ireland	21. Jamaica	21. Nicaragua	21. Mozambique
22. Israel	22. Jordan	22. Nigeria	22. Myanmar
23. Italy	23. Kazakhstan	23. Pakistan	23. Nepal
24. Japan	24. Lebanon	24. Papua New Guinea	24. Niger
25. Kuwait	25. Libya	25. Paraguay	25. Rwanda
26. Latviab	26. Malaysia	26. Philippines	26. Sierra Leone
27. Lithuaniab	27. Mauritius	27. São Tomé and Principe	27. Somalia
28. Luxembourg	28. Mexico	28. Senegal	28. Tajikistan
29. Malta	29. Montenegro	29. Sri Lanka	29. Tanzania
30. Netherlands	30. Namibia	30. Sudan	30. The
31. New Zealand	31. Panama	31. Syrian Arab Republic	31. Togo
32. Norway	32. Peru	32. Ukraine	32. Uganda
33. Oman	33. Rica	33. Uzbekistan	33. Zimbabwe
34. Poland	34. Romania	34. Verde	
35. Portugal	35. Serbia	35. Vietnam	
36. Qatar	36. South Africa	36. Yemen, Rep.	
37. Republic of Korea	37. Thailand	37. Zambia	
38. Russian Federation	38. The former Yugoslav Republic of Macedonia		
39. Saudi Arabia	39. Tunisia		
40. Singapore	40. Turkey		
41. Slovak Republic	41. Turkmenistan		
42. Slovenia	42. Venezuela, RB		
43. Spain			
44. Sweden			
45. Switzerland			
46. Taiwan Province of			

China			
47. Trinidad and Tobago			
48. United Arab Emirates			
49. United Kingdom			
50. United States			
51. Uruguay			

Source: https://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf

Notes

[1] "The future of science is Open" – available at:https://www.fosteropenscience.eu/. A two-year EU-funded project called FOSTER Plus (Fostering the practical implementation of Open Science in Horizon 2020 and beyond) is being carried out by eleven partners in six different countries. This project's main goal is to help European researchers make a genuine, long-lasting change in their practices so that Open Science (OS) becomes the standard.

[2] "What is Open Science?" – available athttps://www.orion-openscience.eu/resources/open-science. ORION Open Science is a collaborative European project focused on promoting open, responsible research and innovation. The project seeks to drive evidence-based changes in Research Funding and Performing Organizations (RFPOs) by fostering a culture of openness and accountability in research and innovation.

[3] "Open Science Helps Move Your Research Forward" – available at:https://theplosblog.plos.org/2021/08/open-science-helps-move-your-research-forward/

[4] "Certified Copy of the Recommendation on Open Science" – available at: https://unesdoc.unesco.org/ark:/48223/pf0000381148

[5] "Open Science" – available at:https://www.oecd.org/sti/inno/open-science.htm. OECD defines open science as "Open science encompasses unhindered access to scientific articles, access to data from public research, and collaborative research enabled by ICT tools and incentives. Broadening access to scientific publications and data is at the heart of open science, so that research outputs are in the hands of as many as possible, and potential benefits are spread as widely as possible."

[6] "The future of science is Open" – available at:https://www.fosteropenscience.eu/

[7] "Budapest Open Access Initiative" – available at:https://www.budapestopenaccessinitiative.org/. The initiative is to promote the sharing of knowledge with a worldwide audience. It was essential in forming the open access movement. It continues to be a crucial point of reference in conversations on free and open access to scholarly research.

[8] "Bethesda Statement on Open Access Publishing" – available at: https://dash.harvard.edu/handle/1/4725199. The statement is one of the key documents that popularized and defined the idea of open access in scholarly publication. It demonstrates the academic community's dedication to granting everyone fair and open access to research findings.

[9] "The Berlin Declaration on Open Access" – available at: http://www.berlin9.org/about/declaration/. The declaration was released in English on October 22, 2003. It was the result of a conference held in Berlin, Germany, when important global academic, scientific, and cultural organizations convened to discuss free access to knowledge.

[10] "The DOAJ Seal" – available at: https://doaj.org/apply/seal/. The DOAJ Seal is awarded to journals that demonstrate best practice in open access publishing.

[11] " 'Indexed in DOAJ' versus 'the DOAJ Seal' " – available at: https://blog.doaj.org/2015/11/03/indexed-in-doaj-versus-the-doaj-seal/

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