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Analysing Open Access Uptake by Academic and Research Institutions in India

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ABSTRACT

The commitment to Open Access (OA) movement has started revolutionising the outline of conventional scholarly publishing practices and welcoming the new wind to scientific research across the world. Motivating by the changing scenario, the study strives to analyse OA uptake by the Indian academic and research institutions concerning their research productivity. Publication data of 36 universities have been retrieved from the 2020 record of CWTS Leiden Ranking database. Findings of the study show that around 23 per cent of all publications of these universities are openly accessible, and their median OA publications proportion is much lower (around half) than the median measure of universities worldwide (43 %). 'Green OA' reserved the first place with 17 per cent of occurrence, and Biomedical and Health Sciences have achieved the highest median (34.37 %). The study concludes with a vision towards increasing the global collaboration of the academic institutions regarding OA following the account of the Indian achievements.

Keywords: Open Access (OA); Gold OA; Green OA; Bronze OA; Hybrid OA; CWTS Leiden Ranking; Indian University

1. INTRODUCTION

Traditional publishing issues, including substantial increases in the subscription rates for conventional subscription-based journals, led to the movement for Open Access (OA) scholarly communication. The OA movement was rooted in two different initiatives; first, around three decades back. Paul Ginsparg had introduced a computerised bulletin board service (CBBS) to share unpublished theoretical high-energy physics among his colleagues working in the same field. In August 1991, access to this service extended to the broader community by creating a repository known as 'arXiv'[1]. Second, due to increasing subscription prices of journals in comparison to library budgets, many academicians and librarians pushed to think of an eccentric design of scholastic communication[2], which led to the emergence of OA journals. Consequently, the first open electronic peer-reviewed journal, namely '*Electronic Journal of Communication*' launched in September 1991[3]. These two initiatives significantly contributed to the creation and expansion of discipline-oriented IR systems and OA journals.

The drive towards OA to scholarly communication began with the 'Budapest Open Access Initiative' of 2002, the 'Declarations of Bethesda' and 'Berlin Declaration' in 2003, and the establishment of 'Creative Commons' in 2001. The principal objective of the OA movement was to enhance the system of scientific communication by optimising access to and maximising the impact of research results[4]. It seems logical that if a paper is publicly available, it would be more widely read and cited.

At present OA to scholarly communication has been widely accepted as a beneficial concept and adopted in many academic and research fields[5]. OA is an alternative to conventional publishing models, making research literature free to read, download, copy, and distribute without copyright restrictions. All kinds of scholarly publications can be OA, including, but not limited to, papers in journals, conference presentations, data sets, records, and research materials.

OA publications may be distinguished into four types as defined below:

- Green OA: The 'Green OA' publications are journaled works publicly available and accessible to everyone enabling writers to use the method of self-archiving their pre or post-print versions archived through a worldwide system of OA repository, publisher or associated firm of their organisations after the expiration of embargo period[6].
- Gold OA: The final and complete version of the research paper indefinitely available to everyone at free of cost on the web within a short period through OA journals and the authors are allowed to retain the copyright of the paper eliminating much of the approval barriers with the 'Gold OA' publications[6].
- Hybrid OA: The 'Hybrid OA' publications are publications in subscription-based (non-OA) journals that provide the choice of OA to the authors and accessibility to the readers in exchange for the Article Processing Charge (APC) to the corresponding publisher.

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- Bronze OA: The publications that are cost-free research papers available to everyone at free of cost on the web by the publisher without clear indication to any OA licence falls under the 'Bronze OA' type. Such publications are not regarded as genuinely OA since the publisher may at any time prohibit the publications from being publicly accessible[7].

Although researchers in India have examined different facets of OA scholarly communications, including growth in the number of OA journal publications and electronic databases and level of OA adoption among researchers in IITs, no study has examined OA adoption among researchers of Indian universities listed under the CWTS Leiden Ranking 2020. Therefore, this study aims to analyse OA uptake by academic and research institutions in India.

2. OPEN ACCESS INITIATIVES IN INDIA

India has a prosperous publishing industry with about 19000 registered publishing houses and around 90,000 titles published per annum[8]. Following the global tendency, in order to compose more e-books, about 70 per cent of Indian publishers have started digitising their materials[9]. The value of the Indian publishing industry estimated to be the US $6.7 billion, with an overall growth rate of around 15 per cent[10]. The statistics state that India holds the sixth position globally in terms of general publications and obtained the second rank explicitly for publications in English[11].

The Indian National Academy was the first institution, signed the Berlin Declaration in 2004. After that many other institutions, including the Council of Scientific and Industrial Research (CSIR), Indian Council of Agricultural Research (ICAR) and the University Grants Commission (UGC), have joined OA movement by formulating OA policies. Recently, the Department of Biotechnology (DBT) and Department of Science and Technology (DST) jointly issued a new OA policy for funded research under the supervision of the Ministry of Science and Technology. Researchers who receive findings from DST and DBT are bound to upload final draft of their papers on the institutional website or in the subject-based OA repositories within two weeks after acceptance by a journal[12].

Based on data obtained from the Directory of Open Access Journals (DOAJ) and OpenDoar[13] on 30 August 2020, India ranked at 16th place in both OA journal publishing and OA digital repositories, left behind the nations carrying leading research production viz. the Netherlands, China, Germany and France. India has achieved a milestone by providing impressive contributions to the development of OA publishing with approximately 286 OA journals and 94 OA repositories. Additionally, J-Gate database, maintained by Informatics India Ltd., featured with 341 'Hybrid OA' journals[14]. India has been ranked at the 13th place by Nature Index 2020 for its high-quality scientific publications in an independently selected group of 68 high-quality scientific journals[15].

According to the analysis of published data obtained from Scopus database for 2015-2019 periods, India ranked at 5th place in terms of overall publications and 6th in terms of OA publications in the world just after the US, China, UK, Germany, and Japan. India's share in the world's total research output was 5.3 per cent, with more than 0.8 million papers. Although India's contribution to OA publications was 21 per cent (4 % lower than the world average of 25 %), the annual growth rate of OA publications from India was approximately 12.5 per cent[14].

Over the last several years, the researchers have performed a large number of researches in India on diverse OA perspectives, few of which have investigated the growth in the number of OA journals and digital repositories[12-22]. The results of these studies showed that notwithstanding comparatively underneath performance in the proportion of OA journal publications, the number of OA journals and OA digital repositories are continually growing in India. However, it is fascinating to notice that OA repositories are mostly lacking enough quality contents, as 25 repositories, out of total 76, have less than 1000 items, and a few of them stand without any item[20]. Verdicts from another analysis indicate irregularity while adding items to the database of the most institutional repositories of India[23].

Some researchers have examined the citations influence of OA publications against the subscription-based non-OA publications across diverse disciplines employing bibliographic and citation databases in India [24-25-26]. Findings of these studies show a higher citation counts for OA publications than non-OA publications, and thus confer greater visibility on their authors. Extracting publication and citation data for the years 2011–2016 from Google Scholar with the aid of 'Publish or Perish' toolkit by Harzing, Nazim and Ashar[26] examined the varying citation impact of 79 OA and 61 non-OA Indian health and medical science journals indexed in Scopus. The results showed a higher citation counts for OA journals compared to non-OA journals.

Some studies have also analysed the level of OA adoptions and contributions of scholarly literature by Indian researchers in different OA outlets[6-14-27-28-29]. In accordance with the research publication data retrieved from Web of Science (WoS) database from 2014 to 2018 in India, Piryani, Dua, and Singh[29] examined the degree of OA adoption and trends of Indian research productivity. Their findings reported that 24 per cent of Indian publications are accessible openly in contrast to the international average, i.e. 30 per cent. Furthermore, the extent of OA adoption varied in various disciplines, with a higher percentage of their articles available as OA in medical science, physics and biology compared to those such as arts and humanities, social science and information science. Compared to the 'Green OA' and 'Bronze OA', more publications were found via the Gold route of OA. Nazim and Zia[27] evaluated the contributions of IIT's science research concerning the OA. According to their analysis, there are a total of 68.70 per cent OA articles, of which 10.26 per cent were 'Gold OA', and 58.44 per cent reserved for 'Green OA'. Nazim[6] in another study analysed the status of 'Gold OA' in India relying on the articles published in the WoS indexed journals from 2006 to 2015. The results showed that India ranked 10th amidst the first 20 publishing nations referring to overall research productivity, but was 8th in the matter of 'Gold OA' articles. Nevertheless, India ranked 3rd as to the OA publication's proportion, i.e.

the ratio of articles appeared in OA journals conditioned on the country's total research productivity and it is 2 per cent higher in comparison to the global average of OA production. However, in a 10-year long-term phase, the variance did not remain constant.

Although many studies have conducted in India on different aspects of OA publishing, till now, no study has investigated the distinctive patterns of OA adoption by the Indian universities. Hence, this study intends to determine the extent to which the journal publication output of Indian universities is OA.

3. RESEARCH OBJECTIVES

The major aim of the study is to ascertain the extent to which the research output of the universities in India indexed in the WoS for 2015–2018 periods is openly accessible. However, the specific objectives of the study are:

- To compare the patterns of research publications between OA publications and the overall research output of academic and research institutions in India
- To examine the proportion of OA publications by different OA types (Green, Gold, Hybrid and Bronze)
- To identify the prominent institutions in terms of both overall publications and OA publications
- To examine the distribution of OA publications by broad subject areas.

4. DATA AND METHODS

In this paper, different methods have been used to determine the OA publication's status and the level of OA adoption in Indian universities. The detailed methodology and used data sources discussed hereunder:

4.1 Selection of Sample Universities

36 Indian universities and research institutions listed under the CWTS Leiden Ranking 2020 were selected as sample universities in the study. This particular global ranking system utilises the bibliographic data from the WoS database generated through the Clarivate Analytics[30]. However, the Leiden Ranking 2020 comprises of the institutions that contributed at least 800 WoS indexed publications (i.e. only English language articles and reviews) during the 2015-2018 periods. The Leiden Ranking 2020 includes a total of 1176 universities from 65 different countries, of which 36 are from India[31]. A list of Indian universities included in the Leiden Ranking 2020 given in Appendix 1 with their publication details.

4.2 Extraction of Publication Data

Publication data of these universities retrieved from the official website of Leiden Ranking through their disambiguated institutional name records compiled by the Centrum voor Wetenschaps-en Technologischestudies, CWTS (https://www.leidenranking.com/ranking/2020/list). Since WoS includes articles and reviews, therefore, only these two document types are taken into consideration in its CWTS version. Leiden Ranking 2020 is based on publication data between 2015 and 2018; therefore, publications of Indian universities are also restricted to 4 years (i.e. 2015-2018). Publications included in the CWTS Leiden Ranking 2020 categorised into the five succeeding domains:

- Biomedical and Health Sciences
- Life and Earth Sciences
- Mathematics and Computer Science
- Physical Sciences and Engineering
- Social Sciences and Humanities

The extent of OA determined using data from the CWTS Leiden Ranking database in the above five fields.

4.3 Identification of Open Access Status of Publications

The CWTS Leiden Ranking 2020 used Unpaywall data (https://unpaywall.org/) for determining OA status and types of OA publications. Since data for this study taken from the CWTS the Leiden Ranking database, different OA indicators that have considered in the CWTS Leiden Ranking 2020 used in this study to determine the OA status of each publication. The following indicators of OA publishing used to determine the types of OA;

- Publications indicated by 'P' refer to the complete publications of an institute.

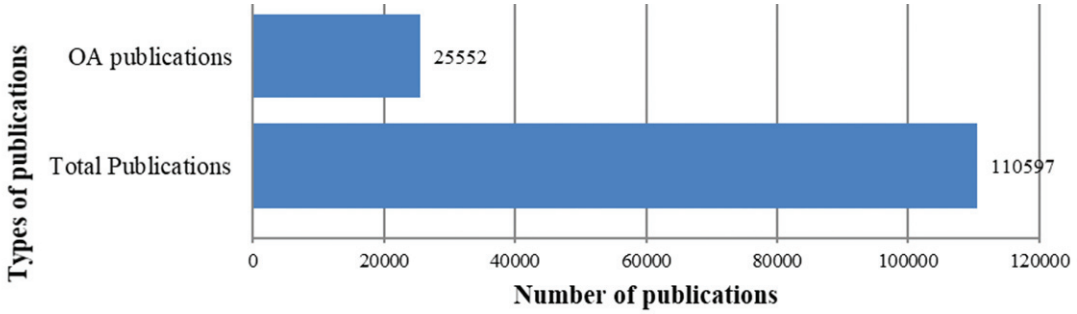

Figure 1. Overview of overall publications and OA publications.

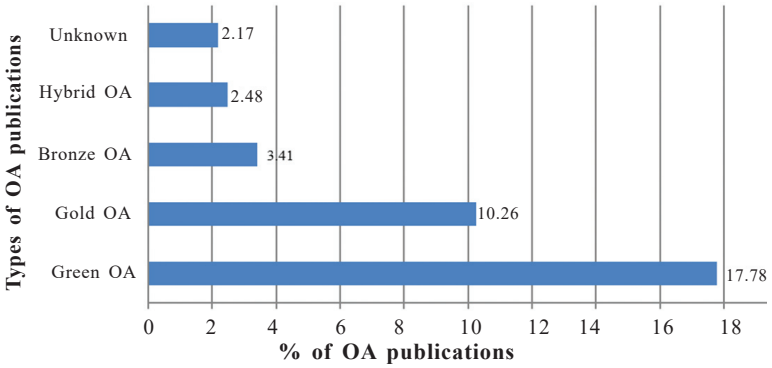

Figure 2. OA publication proportion by type.

2.17 2.17

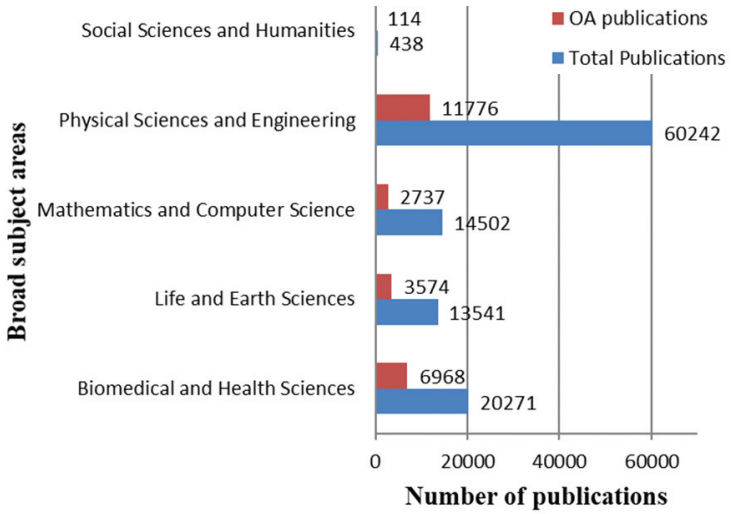

Figure 3. OA publications by broad subject areas.

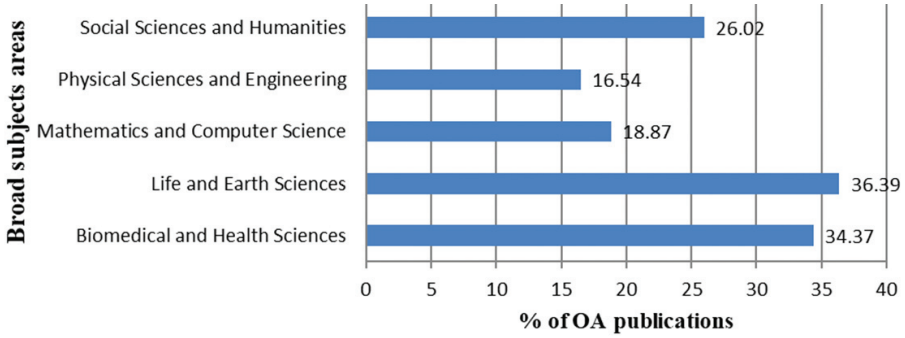

Figure 4. Overall OA publication proportion.

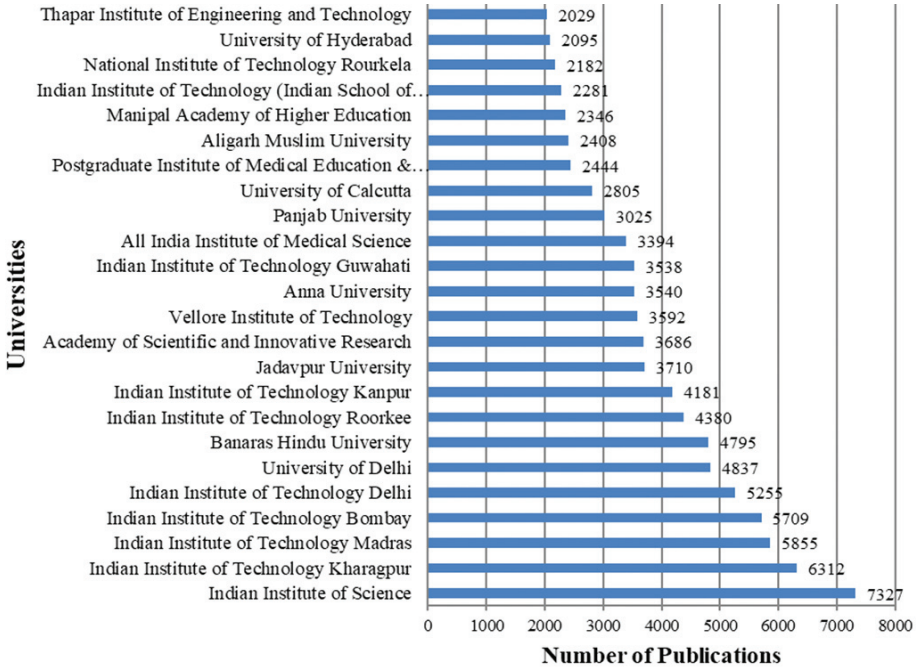

Figure 5. Overall publications by universities.

- OA Publications and OA Publication Proportion indicated by 'P(OA)' and 'PP(OA)' refers to the total publications and OA proportion by an institute.
- Gold OA Publications and Gold OA Publication Proportion indicated by 'P(Gold OA)' and 'PP(Gold OA)' refers to the total Gold OA Publications and its Proportion of an institute.
- Similarly, Hybrid OA Publications and Hybrid OA Publication Proportion indicated by 'P(Hybrid OA)' and 'PP(Hybrid OA)'.
- Bronze OA Publications and Bronze OA Publication Proportion indicated by 'P(Bronze OA)' and 'PP(Bronze OA)'.
- Green OA Publications and Green OA Publication Proportion indicated by 'P(Green OA)' and 'PP(Green OA)'.
- The uncertain OA publications and its proportion indicated by 'P(Unknown OA)' and 'PP(Unknown OA)' refers to the unclear status of OA Publications and its ratio of an institute without any digital object identifier (DOI) and listed in WoS database.

Now, when coming to the analysis part, various forms of OAs are notably imbricate with each other. At the same time, a publication falls under a single OA category (green, gold, hybrid, bronze) or two, or all of them. While the measurement of the 'P(OA)' and 'PP(OA)' indices, the publications regarded to be OA whether it is a type of green, gold, hybrid, or bronze OA[31] individually or collectively.

5. FINDINGS

As shown in Fig. 1, a total of 110597 apparent publications records from 36 Indian universities included in the Leiden Ranking 2020 are examined, out of which 25552 records identified as OA. The 23.1 per cent of Indian university's median publications portion openly accessible, which is much lower (around half) than the median share of universities worldwide (43 %).

Figure 2 illustrates the distribution of OA publications by their types. The maximum proportion of the publications occupied by 'Green OA' (17.78 %), followed by 'Gold OA' (10.26 %), 'Bronze OA' (3.41 %) and 'Hybrid OA' (2.48 %).

All OA publications of Indian universities categorised into five broad fields: Biomedical and Health Sciences, Life and Earth Sciences, Mathematics and Computer Science, Physical Sciences and Engineering, and Social Sciences and Humanities. Figure 3 shows the predominance of OA by subject fields. Out of total publications (110597), 1603 were multidisciplinary and remaining 108994 publications considered for subject-wise analysis, among which 25169 publications were OA.

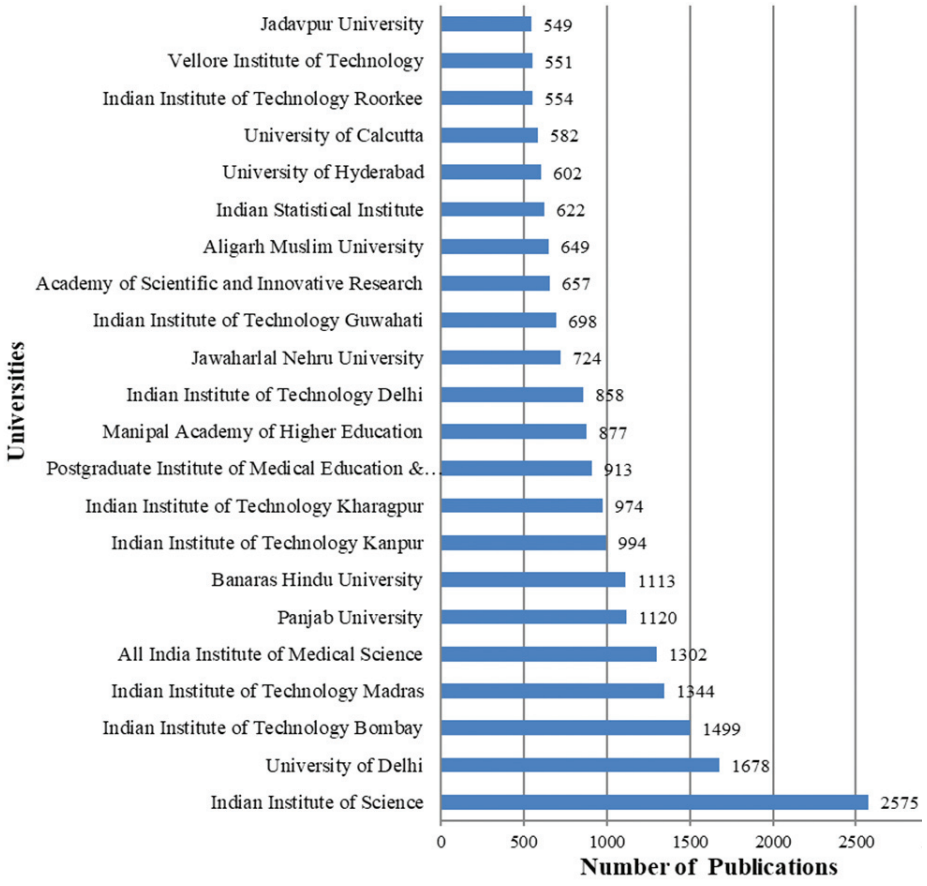

Figure 6. OA publications by universities.

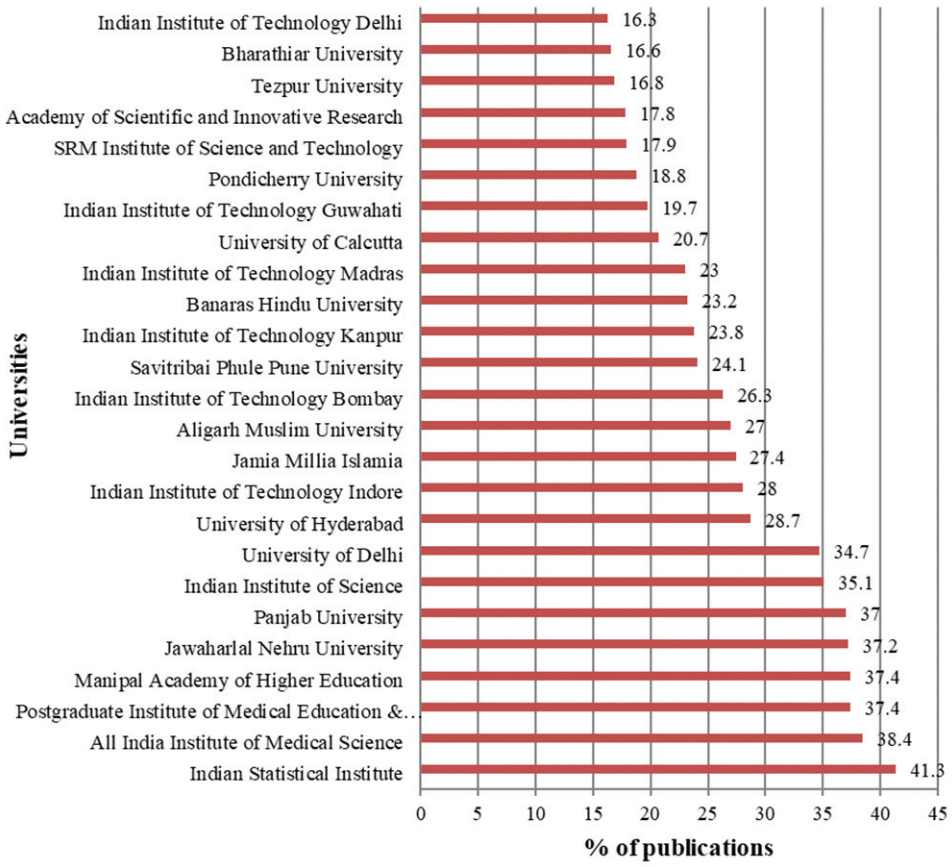

Figure 7. Proportion of OA publications by universities.

The maximum number of OA publications (11776) is appeared in Physical Sciences and Engineering, followed by Biomedical and Health Sciences (6968), and Life and Earth Sciences (3574). Social sciences and Humanities contributed the lowest number of general publications (438) as well as OA publications (114).

Figure 4 shows the proportion of OA publication by broad subject fields, in which the domain of Biomedical and Health Sciences has the most eminent median (34.37 %), and in contrast to the total OA Publications, Physical Sciences and Engineering presented the most inferior OA portion (15.54 %).

The overall publications of the universities taken into consideration, as showed in Fig. 5. Only universities with not less than 2000 publications reflected in the Fig. 5. Indian Institute of Science contributed the maximum number of publications (7327), followed by Indian Institute of Technologies viz. Kharagpur, Madras, Bombay, and Delhi with 6312, 5855, 5709 and 5255 total publications respectively. The Thapar Institute of Engineering and Technology ranked at 25th place with 2029 publications.

Figure 6 shows the number of OA publications by universities. Universities with not less than 500 OA publications are displayed. With 2575 OA publications, Indian Institute of Science again occupied the first place in terms of the total number of OA publications, followed by the University of Delhi, IIT Bombay, IIT Madras and All India Institute of Medical Science with 1678, 1499, 1344, and 1302 OA publications respectively.

In Fig. 7, the proportion of OA publications by universities are considered, and the top 25 universities have been displayed. The Indian universities possess 23.1 per cent of median share in OA proportion amongst which Indian Statistical Institute has owned the leading position (median=41.3 %), tailgated by All India Institute of Medical Science (median=38.4 %) and Postgraduate Institute of Medical Education & Research (median=37.4 %). It is

important to note that, some universities like Indian Statistical Institute and Jawaharlal Nehru University not even found a place in top 25 universities in terms of overall publications and number of OA publications, but secured top positions concerning the proportion of OA publications.

6. CONCLUSIONS

Over the two decades of continuous struggle for establishing the philosophy, the OA movement getting the worldwide recognition and the noble efforts (developing global collaborations, modular OA models and initiatives) of ingenious minds supported the scholarly community resolving the issues of access to research data, economic sustainability, and copyright to increase the feasibility and novelty of the work. The present study represents the Indian action of taking up the OA movement by its native institutions. In this process, 36 Indian universities selected, and their publication data retrieved from the 2020th edition of the Leiden Ranking database. Based on the shreds of evidence (OA presence), four varieties of OA versions (Gold, Green, Hybrid and Bronze) are listed. Overall, it has been seen that nearly 23 per cent of total publications by 36 Indian universities are openly accessible and the median fraction of published OA articles stands much lower (around half) than the median stake of universities worldwide (43 %). 'Green OA' reserved the first place with 17 per cent of occurrence, tailgated by 'Gold OA' (10 %). On the other hand, Biomedical and Health Sciences has achieved the highest median (34.37 %) whereas Physical Sciences and Engineering have the lowest OA proportion (15.54 %) in the measures of total OA articles.

Still, we find a notable difference between universities. For instance, In terms of overall publications, IITs show a higher number of publications than other universities and institutions. Similarly, Indian Institute of Science is a leading institute in both all-inclusive publications and number of OA publications but drooped at 7th place with reference to the OA proportion of publications. On the contrary, Indian Statistical Institute does not even get a place in the list of leading institutes in both overall publications and number of OA publications but secured first place for the OA proportion.

Despite the allocation about less than 1 per cent of the GDP for research, lack of APC funding provision and without consistent OA policies at the institutional and national levels, India appears to make a significant contribution to open access publishing[14]. The raising progress graph may be an inspiration for increasing the global collaboration of the academic institutions, scientists, researchers, librarians and publishing houses to making OA the new normal. Nevertheless, this descriptive study looking towards the construction of diverse and productive OA decrees and extending its limit across the nation to opens futuristic opportunities to the Indian universities, financial bodies and scientific policymakers.

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Appendix I

Indian Universities/Institutes included in the Leiden Ranking 2020

Universities/Institutes	Total publications	OA publications	Proportion of OA publications (OA %)
Indian Institute of Science	7327	2575	35.1
Indian Institute of Technology Kharagpur	6312	974	15.4
Indian Institute of Technology Madras	5855	1344	23
Indian Institute of Technology Bombay	5709	1499	26.3
Indian Institute of Technology Delhi	5255	858	16.3
University of Delhi	4837	1678	34.7
Banaras Hindu University	4795	1113	23.2
Indian Institute of Technology Roorkee	4380	554	12.6
Indian Institute of Technology Kanpur	4181	994	23.8
Jadavpur University	3710	549	14.8
Academy of Scientific and Innovative Research	3686	657	17.8
Vellore Institute of Technology	3592	551	15.3
Anna University	3540	451	12.7
Indian Institute of Technology Guwahati	3538	698	19.7
All India Institute of Medical Science	3394	1302	38.4
Panjab University	3025	1120	37
University of Calcutta	2805	582	20.7
Postgraduate Institute of Medical Education & Research	2444	913	37.4
Aligarh Muslim University	2408	649	27
Manipal Academy of Higher Education	2346	877	37.4
Indian Institute of Technology (Indian School of Mines)	2281	222	9.7
National Institute of Technology Rourkela	2182	276	12.6
University of Hyderabad	2095	602	28.7
Thapar Institute of Engineering and Technology	2029	241	11.9
SRM Institute of Science and Technology	1953	349	17.9
Jawaharlal Nehru University	1945	724	37.2
Bharathiar University	1835	304	16.6
Savitribai Phule Pune University	1739	419	24.1
Institute of Chemical Technology	1642	162	9.9
Jamia Millia Islamia	1582	433	27.4
Indian Statistical Institute	1507	622	41.3
Guru Nanak Dev University	1472	236	16
Indian Institute of Technology Indore	1435	402	28
Annamalai University	1309	185	14.1
Pondicherry University	1295	243	18.8
Tezpur University	1157	194	16.8