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An Investigation of Open Access Availability of Library and Information Science Research

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ABSTRACT

The study aims to investigate the Open Access (OA) availability of Library and Information Science (LIS) research and determine the extent to which research published in high-impact LIS journals is openly available to researchers via different OA routes. Using Google Scholar Metrics, ten core high-impact LIS journals were selected to collect the required data for the study. Bibliographic and citation details of each article published in these journals during 2016-2020 were extracted by searching the ISSN of each journal in the document search option of the Scopus database. The OA status of each article (Gold, Hybrid Gold, Green, and Bronze) was determined by querying the DOI API using the Simple Query Tool of Unpaywall. The findings show that LIS journals reviewed in this study demand $2500 to $3500 as an Article Processing Charge (APC). Almost all the journals have explicit self-archiving policies and lenient restrictions for making articles OA. However, accepted articles can be made available OA at designated Web locations after an embargo of 12months. The study's findings indicate that 36.5 % of the total 5029 articles published during 2016-2020 in selected LIS journals were OA. Of the total OA articles, around 29 % were available through the publishers' Website (Gold or Bronze OA), and 71 % were available through the repositories (Green OA). The average citation rate for OA articles is 13.37, which is higher than that of non-OA articles, showing a clear citation advantage for OA articles over non-OA articles.

Keywords: Open access; OA policies; LIS research; Citations impact; Article processing charges (APCs)

1. INTRODUCTION

Open Access (OA) is an alternative scholarly communication model that arose from a meeting in Budapest by the Open Society Institute in 2001 to speed up progress at the global level to make research literature in all scholarly fields openly available on the internet (Budapest Open Access Initiative, 2022; Swan, 2012).[1-2] OA scholarly literature is described as literature that does not require payment for use other than the Internet service provider fee.[3] Scholarly publications can be made openly accessible by one of three OA routes: Gold, Green, or Hybrid.

All stakeholders in scholarly communication, including funding institutions, researchers, publishers, and librarians, showed interest in OA publishing during the last two decades. Several studies have examined the OA availability to research globally, as well as by country or institution type and discipline. Based on the published research during 2007 in 20 selected Library & Information Science (LIS) journals, Way (2010)[4] investigated the ratio of OA publishing in the field of LIS. Since significant changes have occurred over the past 15 years, a study is required to examine the current trends of OA publishing in LIS, and as a result, this study explores the trends of OA publishing in LIS.

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2. OBJECTIVES OF THE STUDY

The study's primary goal is to investigate the OA availability to LIS research and determine the extent to which research published in high-ranked LIS journals is openly available to researchers via different OA routes. The specific aim is to respond to the following questions:

(a) Do LIS journals offer OA publishing options for researchers?
(b) How much research published in the LIS is OA?
(c) What versions of the articles are provided by OA?
(d) Where can OA copies of articles be found (publishers Websites/OA repositories)?
(e) What are the leading repositories where LIS researchers archived their research?
(f) Do OA articles have a significant citation advantage over non-OA articles?

3. LITERATURE REVIEW

3.1 Quantification of LIS Literature

Pandita[5], *et al.* conducted a study to find India's global contribution to the LIS during 2011-2020. The

study's findings revealed that Indian LIS researchers contributed 4.59 % of total publications from 2011 to 2020. In terms of country-wise contribution, India secured 5th rank. Twenty leading research scholars from India contributed 12.85 % of the articles. Indian researchers published 18.10 % of research articles in Indian-origin journals indexed in Scopus. Barik and Jena[6] examined the publishing pattern of growth rate, leading countries, prolific authors and institutions, research collaboration, and academic impact by analysing articles published in 10 OA journals in the field of LIS. Throughout the investigation, the constant growth of the literature in OA journals of LIS has been noted. These journals have received contributions from 990 institutions worldwide, representing 83 countries. The United States of America is the most productive country worldwide. Single authorship is the predominant authorship pattern in papers in OA LIS journals.

3.2 OA Policies

Kale[7] carried out a study to examine the self-archiving policies of LIS journals listed in the UGC CARE list. The findings of the study indicated that 85 % of the journals have self-archiving policies where authors can deposit a copy of preprints and post prints of their articles. Gadd[8], *et al.* conducted a study on the UK JISC-funded RoMEO Project to analyse copyright agreements of 80 scholarly journal publishers and their impact on authors' self-archiving practices. The findings of the study show that nearly 49 % of journal publishers have explicit self-archiving policies. Miguel[9], *et al.* investigated the self-archiving policies of OA journals indexed in the Scopus database. The results show that 32 % of journals allowed authors to self-archive the preprints of their articles. Gadd & Troll Covey[10] analysed the historical development of self-archiving policies of 107 publishers during the last 12 years. Based on data from the SHERPA/RoMEO publisher policy database, the study's findings indicate a 12 % growth in journal publishers' self-archiving policies that allow authors some form of Green OA over 12 years.

3.3 Progress in OA Publishing

Narayan[11], *et al.* conducted a scientometric study to analyse the quantitative output of OA literature on LIS education. The study findings indicate that academics and working professionals have published many OA publications on LIS education. With 1642 papers and 2321 citations, this study also discovered that 2019 was a prolific year. The USA had the most publications worldwide. For ten years, the degree of collaboration was 0.634. With 24 articles, the USA and Canada have the most collaboration. A recent study by Althini[12] examined a global OA journal publishing trend. According to the study, Europe is the leading continent in OA journal publishing, and the authors from European institutions have contributed to most OA journal articles. The number of OA journals in Europe is significantly higher among APC-funded journals. South America publishes a small proportion of the world's APC-funded OA journals but far more OA publications without an APC. In a study, Piwowar[13], *et al.* found that nearly 28 % of the global research literature is openly accessible. The OA ratio led by mostly Gold and Hybrid OA is constantly increasing as 47 % of OA articles are available via the Bronze mode of OA (articles freely available at publishers' Websites without a clear indication of open license). OA articles received 18 % more citations compared to the overall citation rate. Bosman & Kramer[14] compared OA levels (pure Gold, Hybrid, and Bronze) across research fields, languages, countries, institutions, funders, and topics over time using data from the oaDOI in WoS. There are various levels of OA in Portuguese as a language, in Astronomy & Astrophysics as an area of study, in nations like Peru and Latvia, and the subject of Zika. The study looked at methodological issues and suggested tracking the OA status of research outputs. Findings from the survey also suggest future research and policy applications.

3.4 OA Availability of Literature on a Specific Subject

Laakso & Lindman[15] used Google and Google Scholar to track the availability of all articles published in journals between 2010 and 2014. Each article's Web address and document version were manually categorised for up to three OA copies per article. Around 60 % of all published articles had an OA version. The study found that copyright restrictions have little effect on author-side dissemination practices. Academic and social networks are becoming increasingly popular as authors are making their use for providing research OA.

Ashby[16] estimated the prevalence of OA in criminal justice by examining 12541 journal articles published during 2017-2019. Despite explicit self-archiving policies of 95 % of journals, only 22 % of the articles were OA. OA was even less common in many prestigious journals and among researchers in the United States than in Europe. Scholars' rights to freely distribute their submitted or accepted articles on the Internet are rarely exercised. According to the findings, access to criminological research can only be achieved through policies encouraging authors to make their work OA.

Laakso & Polonioli[17] conducted a study on ethical research and discovered that just more than 50 % of the latest journal articles are available to access freely, mainly through PhilPapers and academic, social networking sites like acadmia.edu and ResearchGate. Way[4] conducted a study on the top 20 journals of LIS to examine the OA availability of LIS literature. The findings showed that depositing articles in repositories is not happening regularly in LIS. Research articles are not being archived in the subject or institutional repositories at a large scale, and overall findings revealed that the OA availability of LIS literature is similar to other subjects in earlier studies.

3.5 OA Availability of Literature via Institutional Repositories (IRs)

Simms[18], using content analysis of repositories housing academic scholarship, journal archives, and other collections, examined the status of IRs in law schools and quantified the different categories of materials collected. These collections were located via web searches, commercial and AALL directories, and direct website searches of law schools. The findings revealed that around 66 % of law schools maintain IRs containing faculty publications, journal archives, and other documents.

Shajitha and Abdul Majeed[19] analysed the content growth of IRs in South India using data gathered from OpenDOAR. They also examined the type-wise growth of the documents available in these IRs and explored their characteristics and trends. Twenty-two operational IRs at 21 institutions were chosen for the study out of a total of 39 repositories located in South India. Data from the 22 IRs were collected twice over 15 months to track content growth. Over the 15 months, the content of almost all IRs has increased, with a 7.82 % overall growth rate. The most significant category of IR content was journal articles, followed by theses and conference papers. Indian repositories actively participated in data curation activities and deposited various items in their respective IRs. Due to the lack of IRs in most South Indian Universities, English-language content predominated in these IRs. Ifijeh[20], *et al*. investigated the connection between libraries and IRs, and the results showed that the emergence of IRs has significant advantages for academic institutions. Ukwoma & Okafor[21] studied the acquisition and management of content in IRs of five Nigerian universities. Results showed that the university of Niger Nsukka contained the maximum contents. On the other hand, the University of Nigeria Nsukka and the Federal University of Technology Akure are hosting a variety of content.

Singh[22] investigated the growth of IRs in India. The study's findings revealed that repositories in India are represented in the ranking of Web Repositories, development of OA IRs is increasing significantly in research and higher institutions. Nurdin and Mukhlis[23] conducted a study to find the proper implementation of IRs as a channel for scholarly communication. The study identified four main aspects of implementing IRs in Indonesia: development of scientific works, acquisition of scientific work through Green OA, digitisation, advertisement of IRs to accelerate their visibility, and dissemination of local scientific research works by libraries. Ukwoma and Okafor[21] researched five Nigerian universities' IRs and found that these IRs have OA policies and a maximum number of documents contributed by Postgraduate schools. Lee[24], *et al.* examined how IRs provide access to papers housed in DigiNole commons on the open web at Florida state university. The study found that Google and Google scholar provides metadata for 85.3 % of 170 documents and full text for 96 (96 %) of 100 items.

In a study of academic staff in Tanzania, Mbughuni[25], *et al.* found that 46.2 % of respondents had self-archived their research work in OA IRs. Zhang and Watson[26] examined self-archiving policies and citation rates. The study found that only 14 % of research articles were deposited through self-arching despite journals having policies related to self-archiving. In a study, Laakso & Polonioli[17] found that IRs play a less critical role in providing OA research literature than academic social network sites. Ukwoma & Okafor[21] surveyed five Nigerian universities and found that one of the most archived types of documents in IRs by academics is journal articles. Abrizah[27], *et al.* conducted a study to identify motivational factors and resistance regarding self-archiving. The study identified different motivational factors, including social influence, visibility advantages, quality research, and career benefit related to Green OA. On the contrary, significant resistance to sharing research works through self-archiving is mainly concerned with a lack of technical infrastructure, self-efficacy, time and effort, and fear of plagiarism and insularity.

3.6 Citation Advantage of OA Publications

Miller[28], *et al.* examined OA availability and citation impact of anatomy papers. The study discovered that OA research papers' citations are significantly higher than non-OA papers. On average, OA publications received 18.95 citations per paper, while non-OA papers received 15.14 citations per paper. Cintra[29], *et al.* conducted a study to assess the advantages of OA availability to information science research. The study found that OA increased the number of citations, especially when the author paid APC and made their research paper available immediately after publication. Sotudeh[30], *et al.* conducted a comparative study to investigate the citation advantages of the OA model against the non-OA model. The findings indicated that the OA papers have obvious citation advantages over the non-OA research articles, despite their lower number. Gaule and Maystre[31] conducted a cross-sectional study and found a typically positive correlation between the free availability of scientific papers and their citations. Xia[32], *et al.* studied the relationship between multiple OA journal article's availability and citation advantage in the top 20 LIS journals. The study's findings revealed that multiple availabilities in the OA domain correlate as it positively impacts citation count.

4. METHODOLOGY

4.1 Selection of Journals

There are many ways of identifying top journals in a specific subject area. Metrics like journal impact factor and SJR score may be considered for selecting leading journals. However, applying these metrics to LIS journals resulted in the appearance of many non-core journals of LIS on the list. Google Scholar Metrics also provides an easy way for researchers to quickly

Table 1. OA policies of the high-impact LIS journals

Name of journal	Publishers	Impact factor (JCR) (2021)	Authors' self-archiving rights for different manuscripts versions (as of July 2022)			OA publishing options (Hybrid OA/ APC)
			Submitted Version	Accepted Version	Published Version	
Information Development	SAGE Publications	2.049	Anytime at the following locations: Any Repository; Any Website	Anytime at the following locations: Author's Homepage; Institutional Repository; Institutional Website; Named Repository (PubMed Central); Non-Commercial Social Network; Non-Commercial Subject Repository	Anytime at the following locations: Author's Homepage; Institutional Repository; Institutional Website; PubMed Central; Journal Website	Yes/($3250)
Scientometrics	Springer	3.238	Anytime at the following locations: Author's Homepage; Preprint Repository	Anytime at Author's Homepage; 12 months after publication to Funder Designated Location or Institutional Repository	Anytime at the following locations: Any Website Institutional Repository Named Repository (PubMed Central) Subject Repository Journal Website	Yes/($2780)
Journal of Academic Librarianship	Elsevier	1.533	Any Website Named Repository (arXiv, RePEC)	Anytime at Author's Homepage; 12 months after publication to Non-Commercial Institutional Repository Subject Repository	Institutional Repository Named Repository (PubMed Central, Research for Development Repository, ESRC Research Catalogue) Subject Repository Non-commercial Repository Journal Website	Yes/($3530)
Journal of Documentation	Emerald	1.819	Anytime at: Academic Social Network; Author's Homepage; Institutional Repository; Institutional Website; Non-Commercial Subject Repository	Anytime at: Academic Social Network; Author's Homepage; Institutional Repository; Non Commercial Subject Repository	Anytime at: any Website; Journal Website with the conditions Published source must be acknowledged with citation	Yes/ ($3,370)
Journal of Information science	SAGE Publications	3.282	Any Repository Any Website	Author's Homepage Institutional Repository Institutional Website Named Repository (PubMed Central) Non-Commercial Social Network Non-Commercial Subject Repository	Author's Homepage Institutional Repository Institutional Website Named Repository (Europe PubMed Central, PubMed Central) Journal Website	Yes/($3250)

Journal of Informetrics	Elsevier	4.153	Any time at any Website; Named Repository (arXiv, RePEC)	12 months after publication to Institutional Repository; Subject Repository	Any time at any Repository Institutional Repository Named Repository (PubMed Central, Research for Development Repository, ESRC Research Catalogue) Subject Repository Journal Website	Yes/($3840)
Journal of Librarianship and Information Science	SAGE Publications	1.992	Any time at any Website Named Repository	Any time at: any Author's Homepage Institutional Repository Institutional Website Named Repository (PubMed Central) Non-Commercial Social Network Non-Commercial Subject Repository	Any time at: any Author's Homepage Institutional Repository Institutional Website Named Repository (Europe PubMed Central, PubMed Central) Journal Website	Yes/($3250)
"Journal of the Association for Information Science and Technology"	Wiley	3.275	Any time at any Author's Homepage; Institutional Repository	Any time at any Author's Homepage; Institutional Repository	Any time at: any Repository; Any Website; Named Repository (PubMed Central); Journal Website	Yes/($3000)
Learned Publishing	Wiley	2.711	Any time at: Author's Homepage Institutional Repository Named Repository (arXiv, AgEcon, PhilPapers, PubMed Central, RePEc, SSRN) Preprint Repository Subject Repository	24 months after publication to: Author's Homepage Institutional Repository Named Repository (arXiv, AgEcon, PhilPapers, PubMed Central, RePEc, SSRN)	Any time at: any Repository Any Website Named Repository (PubMed Central) Journal Website	Yes/($3000)
Online Information Review	Emerald	2.325	Any time at: Academic Social Network Author's Homepage Institutional Repository Institutional Website Non-Commercial Subject Repository	Any time at Academic Social Network Author's Homepage Institutional Repository Non-Commercial Subject Repository	Any time at any Website Journal Website	Yes/($3,370)

browse the hundred leading journals arranged according to their five-year h-index. Google Scholar Metrics also provides a browsing facility for identifying high impact journals in a specific discipline or subject. Therefore, we retrieved a list of 20 high-ranked LIS journals from Google Scholar. Of the 20 journals, 5 were OA journals and were removed from the list. Among the 15 journals, 10 high-ranked journals were selected.

4.2 Collection of Article Metadata

Articles published in 10 high-ranked LIS journals during 2016-2020 were searched from the Scopus database. ISSN of each journal was searched in the document search option of the Scopus database for retrieving articles published in these journals. The search results were confined to journal articles from 2016 to 2020. The details (bibliographic and citation) of retrieved articles for each journal were exported in a CSV file. After exporting article details of all journals, CSV files were merged into a single MS Excel file for analysis.

4.3 Discovering the OA Status of Articles

The Scopus, a subscription-based citation database developed and maintained by Elsevier, provides information about OA publications using article-level information from oaDOI. Using oaDOI data, Scopus currently labels OA articles 'Gold', 'Hybrid Gold', 'Green', and 'Bronze'. Articles labelled as Gold OA in Scopus are all articles

in journals that only publish OA. Articles labelled as Hybrid Gold in Scopus are articles in journals that provide authors with the choice of publishing OA. Articles labelled as Bronze in Scopus have published versions of records or manuscripts accepted for publication. The publisher has chosen to provide temporary or permanent free access. Articles labelled as Green in Scopus are published versions or manuscripts accepted for publication, available at the repository.

However, to investigate the OA status (Gold, Hybrid Gold, Green, and Bronze), the DOIs from each set of records were extracted and used to query the oaDOI API using the Simple Query Tool of Unpaywall.

5. RESULTS

5.1 Overview of Journal Copyright Policies

Table 1 summarizes the key elements gathered based on information available in June 2022 to provide an overview and comparison of the copyright policies of the ten high-ranked LIS journals in focus in this study and what these journals permit and limit when it comes to OA. Submitted versions typically have very lax constraints or no explicit policy. Accepted manuscripts can often be distributed at designated Web locations after a 12-month embargo. Almost all of the journals examined in this study have explicit self-archiving policies and lenient restrictions for making articles OA. The LIS journals reviewed in this study charge an APC between $2500 to $3500.

5.2 Overall Status of OA Availability to LIS Research

The quantum of LIS literature published in ten high-ranked LIS journals during 2016-2020 and the ratio of its availability via different OA routes is displayed in table 2. Of the total 5029 articles, 1836 (36.5 %) were OA. Of the 1836 OA articles, 540 (29.41 %) are available on the publishers' website, whereas 1296 (70.58 %) were hosted by repositories' websites. As shown in Table 2, different versions of OA articles were available that include the submitted version (n=645; 35.13 %), accepted version (n=336; 18.3 %), and published version (n=855; 46.56 %). Of the total OA articles (1836), 716 (around 40 %) OA articles mentioned the detail of Creative Common licenses, while the remaining 1120 (61 %) did not mention any types of licenses. Around 21 % (n=394) of OA articles were available through the cc-by license, followed by cc-by-nc-nd (n=183; 10.53 %) and cc-by-nc (n=51 (2.77 %). Data from the Scopus database shows that OA articles were available via different OA routes. However, OA articles were mostly available via Green OA (self-archiving) (n=1293;70.38 %), followed by Hybrid Gold Green OA (n=284; 15.45 %), Hybrid Gold OA (n=112;6.09 %), Bronze OA (n=102; 5.55%), and Bronze, Green OA (n=46;2.5 %). The status of the OA availability to LIS literature via different OA routes was also examined using the Unpaywall database. Of the total 1836 OA articles, 1296 (25.77 %) were available via Green OA routes, followed by Hybrid (n=396; 7.87 %) and Bronze OA routes (n=144; 2.86 %).

5.3 Year-wise OA Availability to LIS Research

Table 3 indicates the year-wise OA availability to LIS research. As shown in Table 3, a total of 5030 articles were published during five years (2016-2020); out of that, 3193 articles required subscriptions for access, while 1837 (36.52 %) were OA. In the year 2016, 350 (32.89 %) articles were published. As shown in Table 3, research production in ten high-ranked LIS journals during 2016-2020 remained almost constant. However, the OA ratio is highest for the articles published in 2019.

5.4 Journal-level OA Availability of LIS Research

OA availability at the journal level is shown in Table 4. Of the 5069 articles published in 10 high-ranked LIS journals, 36.5 % (n=1836) were OA. The ratio of OA articles published in the journal 'Learned publishing' is high, as 63.73 articles are OA. 'Learned publishing' is followed by the 'Journal of Informetrics' and 'Journal of the Association for Information Science and Technology with 53.78 % and 43.57 % of OA articles. Other journals that include more than 40 % of OA articles are the 'Journal of Documentation' (42.56 %) and 'Scientometrics' (41.79 %). The lowest OA ratio is observed for the articles published in 'Information Development' and 'Online Information Review', with 10.22 % and 13.98 % OA articles, respectively.

5.5 Articles Archived in Repositories

Of the total OA articles (n=1836), 70.58 % (n=1296) articles were available via repositories. The domain names of the repositories were analysed to identify the most prevalent repositories where authors self-archived their research to make it OA. Table 5 lists the top ten repositories based on the number of articles archived by the LIS researchers. As shown in table 5, Arxiv, developed by Cornell University (United States), is the leading repository hosting 270 articles. Arxiv is followed by the Springer link (Germany), and WIRE (hosted by the University of Wolverhampton, United Kingdom) contains 149 and 54 articles, respectively.

Other leading repositories containing sufficient articles include WRRO (developed by the University of Leeds), Sheffield, and York (England), which host 25 articles. Handle.Net repository maintained by Corporation for National Research Initiatives (United States) freely provides access to 18 articles. The OpenAIR@RGU developed by Robert Gordon University (United Kingdom) has 18 OA articles. CURIS repository (Kentucky) provides access to 15 articles. Digital commons, a repository of EMBL's European Bioinformatics Institute, provides access to 15 research articles, and Librias developed by KU Leuven Association (Belgium) contains 15 OA articles.

Table 2. Overall status of OA availability to LIS research

		Frequencies	Percentages
Publications	Open Access	1836	36.50
	Non Open Access	3193	63.49
Total		**5029**	
Open Access Host	Publisher	540	29.41
	Repository	1296	70.58
Total		**1836**	
Open Access Version	Submitted	645	35.13
	Accepted	336	18.30
	Published	855	46.56
Total		**1836**	
Open Access License	cc0	11	0.59
	cc-by	394	21.45
	cc-by-nc	51	2.77
	cc-by-nc-nd	199	10.83
	cc-by-nc-sa	11	0.59
	cc-by-sa	2	0.10
	Elsevier specific	3	0.16
	implied oa	2	0.10
	Pd	23	1.25
	publisher specific	20	1.08
	With specific license	**716**	**38.99**
	No license	**1120**	**61.00**
OA routes via Scopus	All Open Access, Bronze	102	5.55
	All Open Access, Green	1293	70.38
	All Open Access, Hybrid Gold	112	6.09
	All Open Access, Hybrid Gold, Green	284	15.45
	All Open Access, Bronze, Green	46	2.50
Total		**1837**	
OA routes via Unpaywal	Bronze	144	2.86
	Gold		
	Green	1296	25.77
	Hybrid	396	7.87
	Total	1836	36.50
	Closed	3193	63.49
Total		**5029**	

5.6 Citations Analysis of OA Vs. Non-OA Articles

An analysis of citations received by OA and Non-OA articles was carried out to investigate the impact of OA availability of articles on the number of citations over five years (2016-2020). As shown in Table 6, OA articles are cited more frequently than non-OA articles, as the average citation rate for OA articles is higher than for non- OA articles. OA articles (n=1837) received 24819 citations with an average citation rate of 13.37. On the other hand, non-OA articles (n=3193) received 31285 citations with an average citation rate of 9.79.

Journal-wise citation rate for OA and non-OA articles is shown in Table 7. As shown in Table 7, OA articles in almost all the journals received more

Table 3. Year-wise OA availability of LIS research

Year	Total articles	OA articles	OA ratio
2016	1064	350	32.89
2017	970	357	36.8
2018	978	335	34.25
2019	905	421	46.51
2020	1113	374	33.6
Total	**5030**	**1837**	**36.52**

Table 6. Citations to OA Vs. Non-OA articles

Types of articles	Number of articles	Number of citation	Average citation rate
OA articles	1837	24819	13.37
Non-OA articles	3193	31285	9.79

Table 4. Journal-level OA availability of LIS research

Name of journal	Total articles	OA articles	% of OA articles
Scientometrics	1695	708	41.79
'Journal of the Association for Information Science and Technology'	739	322	43.57
Journal of Informetrics	396	213	53.78
Online Information Review	336	47	13.98
Journal of Information Science	312	61	19.55
Information Development	313	32	10.22
Journal of Academic Librarianship	450	105	23.33
Journal of Documentation	343	146	42.56
Learned Publishing	182	116	63.73
Journal of Librarianship and Information Science	264	86	32.57
Total	**5029**	**1836**	**36.5**

Table 5. Ten leading repositories archiving LIS literature

S. No.	Name of the repository	Host organisation	URL	Country	No. of articles
1	Arxiv	Cornell University	http://arxiv.org	United State	270
2	Springer Link	Springer	https://link.springer.com	Germany	149
3	Wolverhampton Intellectual Repository and E-Theses (WIRE)	University of Wolverhampton	https://wlv.openrepository.com	United Kingdom	54
4	White Rose Research Online (WRRO)	Universities of Leeds, Sheffield and York.	http://eprints.whiterose.ac.uk	England	25
5	Handle.Net Registry	Corporation for National Research Initiatives	http://hdl.handle.net	United State	18
6	OpenAIR@RGU	Robert Gordon University	https://rgu-repository.worktribe.com/	United Kingdom	
7	Copenhagen University Research Information System (CURIS)	University of Copenhagen	https://research.ku.dk	Denmark	15
8	Digital Commons	Butler University	https://digitalcommons.butler.edu/	United State	15
9	Europe PMC	EMBL's European Bioinformatics Institute	https://europepmc.org/	United Kingdom	15
10	Lirias	KU Leuven Association	https://www.kuleuven.be/english/research/scholcomm/lirias	Belgium	15

Table 7. Journal-level citation analysis of OA vs. non-OA articles

Name of journal	No. of OA articles	No. of citations to OA Articles	Average citation rate for OA articles	No. of Non-OA articles	No. of citations to Non-OA Articles	Average citation rate for Non-OA articles
Information Development	32	307	11.59	281	2319	8.25
Journal of Academic Librarianship	105	747	7.11	345	2059	5.96
Journal of Documentation	146	969	6.63	197	1125	5.71
Journal of Information Science	61	700	11.47	251	2597	10.34
Journal of Informetrics	213	4324	18.71	183	3256	17.79
Journal of Librarianship and Information Science	86	626	7.27	178	937	5.26
'Journal of the Association for Information Science and Technology'	322	5316	16.50	417	5736	13.75
Learned Publishing	116	1071	9.23	66	411	6.22
Online Information Review	47	386	8.21	289	2777	9.60
Scientometrics	709	10373	14.63	986	10068	10.21
Total	**1837**	**24819**	**13.37**	**3193**	**31285**	**9.79**

citations than non-OA articles. However, the "Online Information Review" journal is an exception as the citation rate of the non-OA articles is higher than that of OA articles.

6. DISCUSSION AND CONCLUSION

All the journals included in the present study provide an option for publishing an article via the Gold OA route and have well-defined OA policies for shelf-archiving. However, this trend was not the same around 10 to 15 years ago, as the finding of previous studies depicted a different trend. Kale[7], in a study, found that 85 % of LIS journals included in the UGC CARE list have self-archiving policies. In their research, Gadd[8], *et al.* found that 49 % of journals examined did not allow authors to self-archive their work accepted for publication. Another study by Miguel,[9] *et al.*indicated that only 32 % of journals had explicit OA policies, including self-archiving.

According to the study's results, 36.5 % of the LIS literature examined was OA, indicating a higher OA ratio than the OA ratio of the global scholarly literature as a study by Piwowar[13], *et al.* discovered that 28 % of the global scholarly literature is OA. However, the OA ratio is varied across disciplines, as the OA availability of published literature in the field of information systems is around 60 % .[15] In criminal justice, it is about 22 % [16], whereas, in ethics, it is 50 % .

The present study's finding indicated that OA articles are cited more frequently than non-OA articles, as the average citation rate of OA publications is 3.58 % higher than thatof non-OA publications. This finding is in line with the findings of other studies. A study by Miller[28], *et al.* discovered a 3.81 % higher citation rate of OA publications than non-OA publications in Anatomy. Other similar studies by Sotudeh[30], *et al.* and Cintra,[29] *et al.* reported similar findings on the citation advantage of OA publications.

The main objective of the present study was to determine the extent to which research published in high-ranked LIS journals is openly available to researchers via different OA routes. The study analysed the OA availability of articles published in the high-ranked LIS journals during 2016-2020. The study's findings indicated that of the 5029 articles published during 2016-2020 in the selected LIS journals, 36.5 % were OA. Of the total OA articles, around 29 % were available through the publisher's Website (Gold or Bronze OA), and 71 % were available through the repositories (Green OA). Arxiv is the most popular repository among LIS authors. Around 39 % (n=716) of OA articles included an open license, whereas the remaining 61 % (n=1120) articles did not indicate any open license. The average citation rate for OA articles is higher than for non-OA articles, meaning that OA articles have a citation advantage. OA articles from almost all the journals included in the study received more citations than non-OA articles, except the "Online Information Review" journal, where the citation rate of non-OA articles is higher than that of OA articles. The study findings have significant academic and practical implications. The researchers may adopt the study's methodology to conduct a similar study on other subjects to investigate the OA availability of the research. The study findings may motivate researchers to make their research OA as OA articles have a greater citation rate.

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