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An empirical analysis of open access citation advantages in library and information science

Sunwoo Lee and Wonsik Shim

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Abstract

Introduction. This study examines the citation impact of open access (OA) articles in library and information science (LIS). Given limited OA research in LIS compared to other fields, it contributes by examining OA citation advantages over time, journal quartile, OA type, and discipline.

Method. Using a dataset of 109,759 LIS journal articles (2001–2024) from WoS, the study classified articles by OA status and type, then applied statistical analyses, including t-tests, ANOVA and time-series analysis.

Analysis. Both parametric and nonparametric tests compared citation impacts across OA types, disciplinary scope, publication years, and journal quartiles. Effect sizes were calculated to assess practical relevance.

Results. Non-OA articles received slightly more citations (mean 18.83) than OA articles (mean 17.9), though the difference was minimal. Green OA showed the largest citation advantage (28.55 average). OA citation advantages declined from 9.75 citations (2001–2004) to 0.74 (2020–2024). Multi-disciplinary articles fared better than single-discipline articles.

Conclusion(s). The study reveals that OA citation advantages in LIS are conditional, varying by OA type, discipline, and period. These findings caution against generalizing the OA citation benefits observed in other fields.

Introduction

Research background

Open Access (OA) has fundamentally reshaped the paradigm of knowledge dissemination by enabling unrestricted access to scholarly information. Proponents of OA consistently underscore its ability to increase the visibility of research outputs and provide a '*citation advantage*' (Borgman, 2019; Karlstrøm et al., 2024). This claim is further supported by empirical evidence, as demonstrated by the continual growth and increasing impact of OA publications being documented by Piwowar et al. (2018).

In the early stages of the OA movement, studies such as Eysenbach's (2006) emphasized the distinct citation advantages of OA publishing. However, more than two decades after its introduction, results concerning the universality of this advantage have become conflicting (Langham-Putrow et al., 2021). While some studies report positive effects of OA, many other studies suggest inconsistent results, showing differences depending on the field or methodology or failing to find clear benefits.

Discussions on the benefits of OA citations have mainly focused on the fields of medicine and life sciences (Clark et al., 2024; Yi et al., 2024), where relatively positive effects have been reported. In contrast, research on OA citation benefits in the social sciences, including library and information science (LIS), has been relatively insufficient. In particular, Khan et al. (2023) suggested that non-OA journals may have a higher citation impact in the field of LIS, raising the need for an in-depth review of the differences in OA effects in this field.

In addition, as Morrison et al. (2022) have observed, OA has evolved into a variety of forms such as Gold, Green, Hybrid, and Bronze models. The analysis of the relative effectiveness of these different types of OA is an important area of research, as shown by the work of Piwowar et al. (2018). Recognizing the current state of the academic publishing ecosystem, characterized by the coexistence of diverse OA models (Legge, 2025), it has become more important to validate the impact of each model.

This study examines the citation advantages of OA in the current academic environment and how their effects differ by type, with a specific emphasis on LIS. It tries to re-evaluate the current validity of OA citation advantages in this field and provide implications for future academic communication strategies.

Research questions and objectives

This study aims to address the following research questions:

- *Do OA articles in library and information science receive a higher number of citations than non-OA articles?*
- *Are there meaningful differences in citation impact depending on the type of OA—namely, gold, green, hybrid or bronze?*
- *What effect do OA status and year of publication have on the citation counts of scholarly articles?*

The study gathers and analyses data on OA and non-OA articles in LIS from the Web of Science (WoS) database to address these questions. This research aims to provide an empirical assessment of the citation influence of OA within a specific academic domain—library and information science—thereby enhancing the understanding of the effectiveness of OA publishing.

Significance of the study

Discussions on the effects of OA have been concentrated in a few scientific fields. The life sciences are the most notable example of this because mandated OA policies have had a big impact on them. The field of LIS, on the other hand, has received limited policy attention. As a result, OA adoption and diffusion may follow different patterns. Empirical studies on the citation impact of OA in this discipline are also relatively scarce. Chakravarty and Diksha (2021), for instance, highlighted both quantitative and qualitative shortcomings of OA journals in this field.

This study seeks to fill that gap. It examines the citation impacts of OA and its various forms within the framework of LIS. The goal is to provide a balanced understanding of OA's influence and to contribute to ongoing discussions within the field.

Theoretical background

Concept and types of open access

The OA movement started in the early 2000s with key initiatives such as the Budapest Open Access Initiative (BOAI, 2002), the Bethesda Statement (2003), and the Berlin Declaration (2003). These initiatives established OA and unrestricted use of scholarly knowledge as the main objectives of OA. According to Legge (2025), by the end of 2024 nearly 50% of all scholarly articles were estimated to be available in some form of OA. This shows that OA is a central model of scholarly communication.

OA has since expanded into several distinct types. Gold OA lets people read articles for free as soon as they are published. Green OA allows self-archiving in repositories, sometimes after an embargo period. Hybrid OA provides optional OA within subscription journals. Bronze OA refers to articles made freely readable on publisher websites but without an explicit license (Piwowar et al., 2018). The history, underlying concepts, and detailed typologies of OA have been extensively discussed in prior studies (Piwowar et al., 2018).

Benefits and challenges of open access

The relationship between OA and citation impact has been one of the central topics in the study of scholarly communication. A study by Eysenbach (2006), which analyzed articles in PNAS, provided empirical evidence that OA articles were cited both more quickly and more frequently than non-OA articles, a finding widely referred to as the '*citation advantage*'.

Subsequent research, however, has produced less consistent results. A systematic review by Langham-Putrow et al. (2021) showed that only about half of the studies reported a positive effect of OA on citations, while many others either found no advantage or drew inconclusive results. This inconsistency has been attributed to a range of factors, including differences in datasets, disciplinary contexts, research methodologies, and OA types. For example, Yi et al. (2024) reported that OA articles in certain medical journals not only achieved higher citation counts but also received more page views and downloads. In contrast, Clark et al. (2024) showed that even within biology the size of the OA citation advantage varied significantly by subfield.

Qualitative concerns within the OA ecosystem have also complicated the discussion. The rise of predatory journals raises questions about the quality control of OA publishing. Maurer et al. (2021) argued that many researchers are insufficiently aware of such journals, which in turn contribute to skeptical perceptions of OA as a whole. These issues add layers of complexity when interpreting and generalizing the effects of OA on citation impact.

Another major challenge involves the cost of publication. Article Processing Charges (APCs) vary widely depending on journal reputation and discipline (Borrego, 2023). They have been criticized as potential economic barriers for researchers lacking funding support, particularly those in under-resourced regions (Frank et al., 2023; Smith et al., 2021). Morrison et al. (2022) further

showed that the average APC has continued to rise, exacerbating ongoing concerns about the economic sustainability of OA publishing.

The citation advantage of OA may also shift over time. As OA becomes more common and the digital scholarly environment continues to evolve (Legge, 2025), the strong citation benefits observed in early studies, such as Eysenbach (2006), seem to have diminished or to occur only under certain conditions.

Research trends in open access within library and information science and the need for this study

LIS, as a discipline that places information access and dissemination at its core, is also an important domain for OA research. However, compared to other fields, empirical evidence on the adoption and impact of OA in LIS remains relatively scarce.

Some indicators of OA development in LIS can be found in the study by Chakravarty and Diksha (2021). They reported that the number of LIS OA journals indexed in DOAJ is smaller than in many other disciplines, and that a large proportion are operated as non-profit models that do not charge APCs. This suggests that the OA ecosystem in LIS may exhibit distinctive characteristics. Disciplinary variation in OA practices has also been confirmed in prior research. For example, Zhu (2017), in a study of UK scholars, showed that Gold OA is widely used in medicine and the life sciences, Green OA is more active in the natural sciences and engineering, while scholars in the humanities and social sciences report relatively limited OA experience. Against this backdrop, detailed analysis of citation patterns in LIS OA articles is still lacking.

There are even fewer studies that have examined the actual citation impact of OA in LIS. A notable example is Khan et al. (2023), which reported the result that non-OA journals in the field showed statistically higher citation impact than OA journals. This finding contrasts with the widely cited early evidence from other disciplines. It may reflect unique disciplinary conditions in LIS, or it could indicate that the evidence base is too limited to support broad generalization.

Overall, the body of research on the citation impact of OA in LIS is very limited, making it difficult to draw generalized conclusions. Further empirical verification is needed to determine whether OA truly provides a citation advantage in this field and, if so, under what conditions. As emphasized by Piwowar et al. (2018), OA exists in multiple types, and each type may produce different effects. It is therefore essential for studies in LIS to consider these type-specific differences.

Research methodology

Research scope and data collection

The purpose of this study is to examine differences in citation impact between OA and non-OA articles in the field of LIS, and to further analyze the effect of different OA types on citation outcomes. To achieve this, the study uses the WoS Core Collection by Clarivate Analytics as the primary data source. WoS is suitable for this purpose because it covers a broad range of academic disciplines and provides detailed bibliographic and citation information for each article. More recently, it also offers the ability to identify OA categories such as Gold, Green, Hybrid, and Bronze, thereby enabling data collection for the objectives of this research (Basson et al., 2021).

The study focuses on the subject category of information science & library science (The WoS library and information science subject category includes some journals in MIS (management information systems) and information systems. Any conclusions drawn from this study need to be interpreted accordingly) and includes only journal articles (Publication Type: 'J') published between 2001 and 2024. The period covers the inception of OA as a publication option and the growing diffusion of OA.

An initial dataset of 426,090 records was retrieved. From these, 244,695 journal articles published between 2001 and 2024 (document type = 'J') were retained as the first screening sample. Next, ISSN and E-ISSN identifiers were mapped to journals indexed in the Journal Citation Reports (JCR) with available quartile rankings, resulting in 219,271 records.

Meanwhile, 108,652 records (49.6%) were identified as '*Library Journal*' articles and subsequently removed due to the fact that the journal is more of a trade journal than a scholarly one. Restricting the dataset to journals with explicit quartile classifications (Q1–Q4) yielded 110,619 records. Finally, citation outliers within each quartile were excluded using a mean + 2.5 SD threshold, producing a final analytical dataset of 109,759 records. For each article, key variables were extracted, including OA status and type, year of publication, and citation counts.

Variable selection

To achieve the objectives of this study, both independent and dependent variables were measured. These variables were defined based on the detailed bibliographic information available in the WoS Core Collection database.

Independent variables

OA Status: A binary variable indicating whether each article is published in OA form. Articles designated as OA were classified as 'OA', while others were categorized as '*non*-OA.' This information was directly extracted from the 'Open Access Designations' field in WoS.

OA Type: A categorical variable specifying the subtype of OA (Bronze, Green, Gold, or Hybrid). This classification was based on the '*Open Access Designations*' field in WoS and further defined in accordance with the OA typology suggested by Piwowar et al. (2018).

Publication Year (Pub-Year): A continuous variable representing the year in which the article was published. This was extracted from the WoS '*publication year*' field. The variable was essential for analyzing temporal changes in citation impact and for assessing how the OA citation advantage changes over time.

WoS Categories: A categorical variable reflecting the disciplinary categories assigned to each article within WoS. Extracted from the '*WoS Categories*' field, this classification provided a standardized subject framework. The information science & library science category encompasses various subfields (business, data science, records management, etc.) in an interdisciplinary manner. To distinguish between the single discipline of LIS and interdisciplinary research, study used this variable to examine differences between articles classified exclusively under Information Science & Library Science and those linked to multiple subject categories.

Q-Level (quartile level): A categorical variable representing the quality rank of journals within their subject areas. Journals were categorized into four quartiles: Q1 (top 25%), Q2 (next 25%), Q3 (third 25%), and Q4 (bottom 25%). This variable was employed to assess both the distribution of OA articles across journal quality levels and the association between journal rank and potential citation advantages of OA.

Dependent variable

Times cited: A continuous variable measuring the total number of citations an article received within the WoS Core Collection since its publication. This variable served as the primary indicator of scholarly impact. Citation counts were obtained from the '*Times Cited, WoS Core*' field. Using this measure, the study quantitatively evaluated differences in citation impact between OA and non-OA articles, as well as among different OA types.

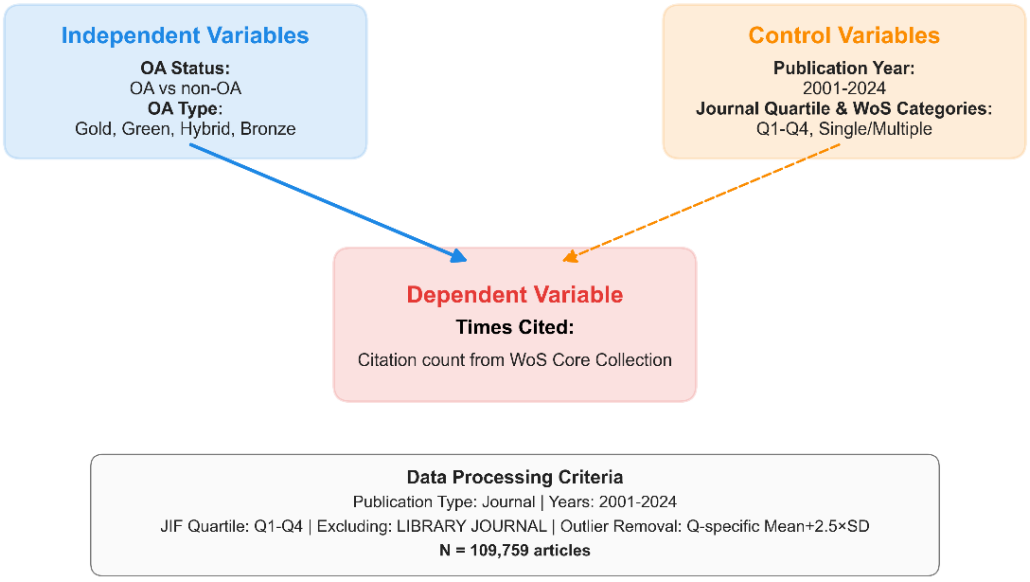

Figure 1. Research framework

Data analysis methods

Descriptive analyses were conducted to provide an overview of the dataset. The composition of OA and non-OA articles was summarized, and the distribution of OA types within the OA subset was examined. In addition, annual publication counts and the proportion of OA articles by year were analysed to identify temporal trends. Finally, the proportion of OA articles across JIF quartiles was calculated to describe variation by journal quality.

Citation impact was then evaluated by using statistical tests. First, the Shapiro–Wilk and Levene's tests indicated non-normal distributions and unequal variances. Consequently, Welch's t-tests were applied for mean comparisons, and Mann–Whitney U tests were used as a nonparametric alternative. Furthermore, differences among OA types were examined with one-way ANOVA, and Kruskal–Wallis tests were used for nonparametric validation. Tukey's HSD was then employed for pairwise comparisons. In addition, subgroup analyses considered disciplinary scope, five-year publication intervals, and journal quality tiers. Throughout, effect sizes were calculated using Cohen's d to complement significance testing.

Results

Descriptive statistics

Overview of the dataset and distribution by OA status

[Figure 2] illustrates the distribution of OA and non-OA articles identified in the study. Out of the 109,759 articles included in the analytical dataset, 34,461 were published as OA, accounting for 31.4% of the total. The remaining 75,298 articles (68.6%) were published as non-OA. This indicates that while non-OA articles still represent the majority of publications in the field, the proportion of OA articles is nonetheless substantial.

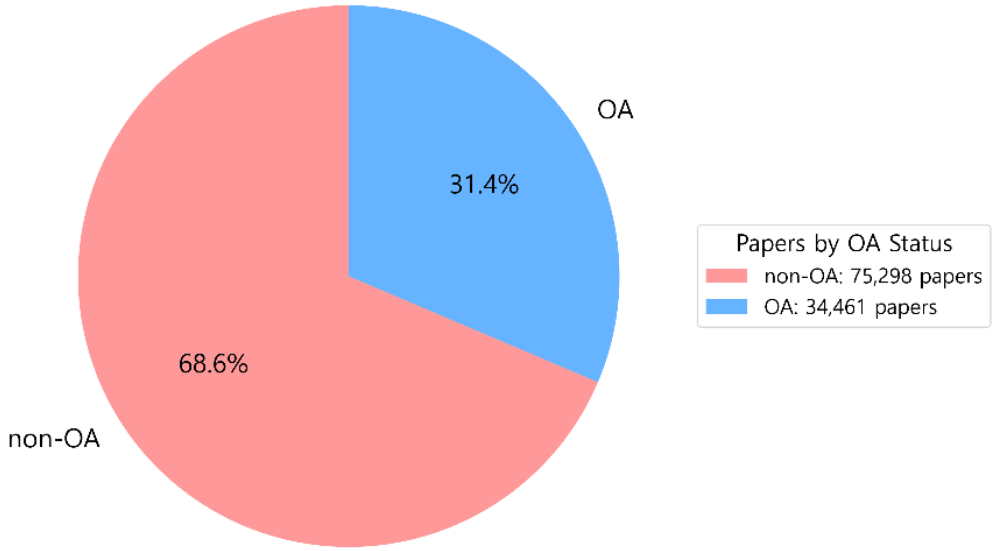

Figure 2. Distribution of OA status in LIS articles (2001–2024)

Distribution and citation impact by OA type

The distribution of OA types among the 34,461 OA articles and their corresponding citation impacts are presented in [Figure 3] Among OA categories, Green OA represented the largest share with 16,060 articles (46.6%). This was followed by Gold OA with 9,569 articles (27.8%), Bronze OA with 4,893 articles (14.2%), and Hybrid OA with 3,939 articles (11.4%).

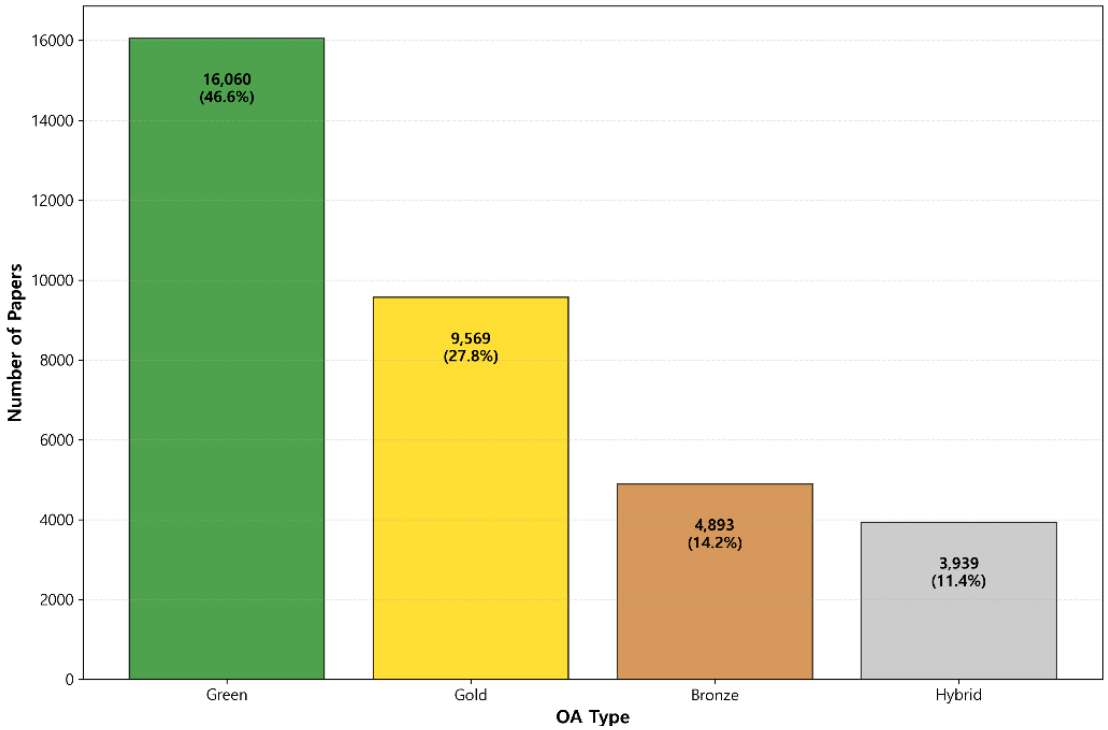

Figure 3. Distribution of OA Papers by OA Type

Trends by publication year

The annual distribution of publications and the proportion of OA articles are presented in [Figure 4]. Between 2001 and 2004, yearly output ranged from approximately 2,200 to 2,600 articles. The volume then showed a steady upward trend, reaching a peak of 8,938 articles in 2024. Since 2020, annual production has remained consistently high at around 8,000 articles per year. This increase corresponds with the expansion of the LIS journal set indexed in WoS. While 95 journals were included between 2001 and 2019, the number of journals rose to 159 in 2020, representing a roughly 60% increase. This is likely due to WoS incorporating additional LIS titles during that period.

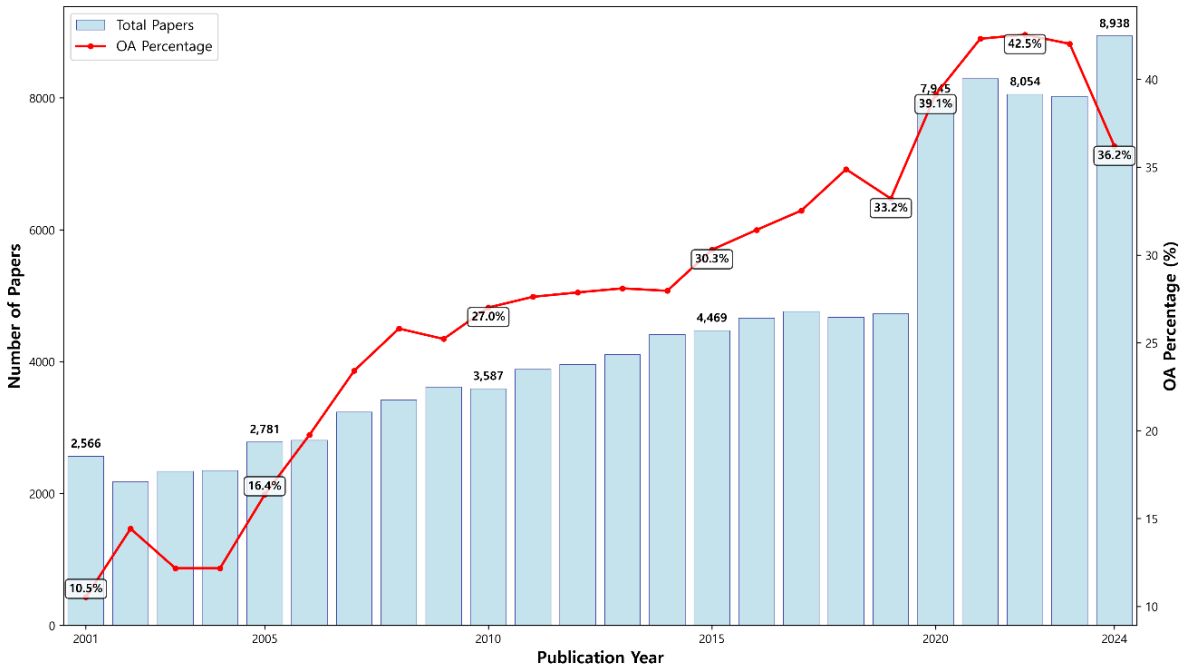

Figure 4. Annual Publication Trends and OA Adoption

The percentage of OA articles also increased over time. OA accounted for only 10.5% of publications in 2001, rising to 16.4% in 2005, 27.0% in 2010, and 30.3% in 2015. A sharp increase followed during the COVID-19 pandemic: in 2020, OA articles rose to 39.1%, representing a gain of nearly 6 percentage points compared to 2019 (33.2%). The proportion peaked at 42.5% in 2022 before declining to 36.2% in 2024.

Distribution of OA articles by JIF quartile

The proportion of OA articles across JIF (Journal Impact Factor) quartiles in the Information Science & Library Science category is shown in [Table 1]. OA accounted for 31.9% of publications in Q1 journals, 32.1% in Q2, 26.6% in Q3, and 34.1% in Q4. The values for Q1 and Q2 are almost identical, at around 32%. By contrast, Q3 shows a comparatively lower proportion, while Q4 exhibits the highest share.

These results indicate that OA publishing is distributed broadly across journals of different impact levels, with a somewhat stronger presence in Q4 journals.

JIF Quartile	OA articles	non-OA articles
Q1	31.92%	68.08%
Q2	32.13%	67.87%
Q3	26.57%	73.42%
Q4	34.11%	65.90%
All	31.40%	68.60%

Table 1. OA distribution by JIF Quartile (%)

Citation impact comparison by OA status

Citation impact by OA status

Descriptive statistics showed that OA articles had a mean of 17.90 citations, while non-OA articles averaged 18.83 citations as shown in [Table 2]. The median citation count was identical in both groups (5.00), but the first quartile was higher for OA (1.00) than for non-OA (0.00), suggesting a larger fraction of uncited papers in the non-OA group. Similar third quartile values and large standard deviations (OA 37.78, non-OA 40.23) indicate a pronounced right-skewed distribution in both groups.

Variable	OA articles	non-OA articles
Sample Size	34,461	75,298
Mean Citations	17.90	18.83
Standard Deviation	37.78	40.23
Median	5	5
Top 25%	18	19
Bottom 25%	1	0
Minimum	0	0
Maximum	441	440

Table 2. Descriptive statistics comparison

As shown in [Table 3], normality and homogeneity of variance were both rejected for the citation distributions (Shapiro–Wilk $p < 0.001$, Levene's test $p < 0.001$), so Welch's adjusted t-test was applied. The t-test indicated a statistically significant difference ($t = -3.74$, $df \approx 70{,}777$, $p < 0.001$), with non-OA articles showing a marginally higher mean citation count (mean difference = -0.94). Nonparametric Mann–Whitney U tests confirmed this result ($U = 1{,}327{,}128{,}009$, $p < 0.001$). Effect size analysis revealed Cohen's $d = -0.024$, indicating a '*very small effect*'. In large samples, modest variations may reach statistical significance but have little real-world impact.

Statistical_Test	Test_Statistic	df	p_value	Interpretation
Shapiro-Wilk (OA papers)	-	-	< 0.001	Non-normal distribution
Shapiro-Wilk (non-OA papers)	-	-	< 0.001	
Levene's test	-	-	< 0.001	Unequal variances
Welch's t-test	t = -3.7445	70,777	< 0.001	Statistically significant difference
Mann-Whitney U test	U = 1,327,128,009	-	< 0.001	
Cohen's d (Effect Size)	d = -0.024	-	-	Very small effect

Table 3. Statistical test results

Overall, OA articles did not exhibit a mean citation advantage over non-OA articles, though OA performed better at the lower quartile of journal categories. These findings align with recent results (Langham-Putrow et al., 2021; Clark et al., 2024; Khan et al., 2023) showing that the citation advantage of OA varies widely across disciplines and methodological choices and may often be minimal in absolute terms.

Citation impact by OA type

Within the cleaned sample (n = 109,759), the 34,461 OA articles were subdivided by OA type. Green OA accounted for 46.6% (n = 16,060), Gold OA for 27.8% (n = 9,569), Bronze OA for 14.2% (n = 4,893), and Hybrid OA for 11.4% (n = 3,939). All citation data were measured using the Times Cited, a WoS Core indicator.

Type	N	Mean	SD	Median	Min	Max	Q25%	Q75%
Green	16,060	28.55	46.69	13	0	441	4	32
Gold	9,569	5.35	15.35	1	0	428	0	5
Bronze	4,893	15.00	36.25	4	0	434	0	13
Hybrid	3,939	8.47	21.19	2	0	380	0	8
Total OA	34,461	17.89	37.77	5	0	441	1	18
Total non-OA	75,298	18.83	40.22	5	0	440	0	19

Table 4. Distribution and citation statistics by OA type

Citation impact, measured by average citation counts, varied across types. Green OA recorded the highest average at 28.55 citations. Bronze OA followed with 15.00 citations, and Hybrid OA with 8.48 citations. Gold OA displayed the lowest average, with only 5.36 citations. Overall, OA articles received on average 17.89 citations, which was slightly below the mean for non-OA articles (18.83). Within the OA subset, however, Green OA stood out with a clear citation advantage.

Median values reflected a similar trend: Green OA (13) exceeded Gold OA (1), and the quartile ranges indicated broader citation distribution for Green OA (Q25/Q75: 4/32) compared to other types (Gold: 0/5, Bronze: 0/13, Hybrid: 0/8).

Source	SS	df	MS	F	p_value
Between Groups	3,719,253	3	1,239,751	939.62	< 0.001
Within Groups	45,463,188	34,457	1,319.418		
Total	49,182,441	34,460			

Table 5. Analysis of variance for citation impact by OA type

Tests of normality (Shapiro–Wilk, all p <0.001) and homogeneity of variances (Levene's test, p < 0.001) were both rejected. However, given the large group sizes (all n ≥ 3,939) and the robustness of ANOVA to assumption violations, one-way ANOVA was performed. The Kruskal–Wallis nonparametric test also confirmed the consistency of results. ANOVA results (see Table 5) revealed significant differences in citation impact across OA types.

Comparison	Mean Diff.	p-adj
Green vs Gold	23.2	< .001
Green vs Bronze	13.55	< .001
Green vs Hybrid	20.08	< .001
Gold vs Bronze	-9.65	< .001
Gold vs Hybrid	-3.12	< .001
Bronze vs Hybrid	6.53	< .001

Table 6. Tukey HSD analysis results

Post hoc analysis using Tukey's honest significant difference test was conducted to examine pairwise comparisons among OA types. Results indicated that all pairwise differences were statistically significant (all adjusted p-values < .001). Specifically, Green OA articles received significantly higher citation counts compared to Gold (mean difference = 23.20), Bronze (13.55), and Hybrid (20.08) OA articles. Bronze OA articles also showed significantly higher citation counts than Gold (mean difference = −9.65) and Hybrid (6.53) OA articles. Gold OA exhibited the lowest citation impact overall.

These findings indicate that citation patterns differ markedly by OA type, with Green OA showing the greatest citation advantage among OA models.

Analysis by disciplinary scope

To investigate whether the citation advantage of OA articles varies by disciplinary scope, the dataset was divided into two groups based on the WoS categories assigned to each article: (1) a single-subject group comprising articles classified exclusively under information science & library science (n = 54,081), and (2) a multi-subject group including articles assigned to information science & library science as well as additional categories (n = 55,678).

Group	OA Status	N	Mean	Median	SD	Q25%	Q75%	Mean Diff.	t-stat	MWU (p)
Single	OA	19,038	9.313	2	25.58	0	8	-0.747	-3.12**	<.001
Single	non-OA	35,043	10.06	1	28.32	0	8			
Multi	OA	15,423	28.49	12	46.67	4	32	2.015	4.55***	<.001
Multi	non-OA	40,255	26.47	11	46.94	2	29			

MWU (p): p-value of Mann-Whitney U test, **p < .01, ***p < .001

Table 7. Citation statistics by WoS categories

As shown in [Table 7], comparison of citation counts between OA and non-OA articles revealed differing patterns by group. In the single-subject group, OA articles had a lower mean citation count (9.313) compared to non-OA articles (10.06). Welch's t-test confirmed this difference as statistically significant ($t = -3.12$, $p < 0.01$), supported by consistent results from the Mann–Whitney U test ($p < 0.001$). Despite this, the median citation count was higher for OA articles (2.0) than non-OA articles (1.0), indicating relatively better citation performance at the lower end. The absolute difference in means remained small.

In the multi-subject group, OA articles showed a higher mean citation count (28.49) than non-OA articles (26.47). The difference was statistically significant (Welch's t-test: $t = 4.55$, $p < 0.001$; Mann–Whitney U test: $p < 0.001$). Median and interquartile ranges were also greater for OA articles (median 12.0, Q1/Q3: 4/32) compared to non-OA (median 11, Q1/Q3: 2/29).

In summary, OA articles did not demonstrate a citation advantage in the pure information science & library science category, with non-OA articles showing slightly higher average citations. However, OA articles associated with multiple subject categories exhibited greater citation counts.

Time-series analysis of OA citation advantage

To analyse the temporal dynamics of the OA citation advantage, the study period from 2001 to 2024 was divided into five-year intervals. For each period, the mean citation counts of OA and non-OA articles were compared, and the statistical significance of the differences was evaluated. [Tables 8] and [Figure 5] summarize the changes in OA citation advantage over time, along with the associated test results.

Period	OA N	non-OA N	OA Mean	non-OA Mean	Mean Diff.	Cohen's d	t-stat	MWU (p)
2001-2004	1,154	8,273	30.54	20.79	9.75	0.196	5.45***	<0.001
2005-2009	3,559	12,290	27.43	25.52	1.91	0.037	1.97	<0.001
2010-2014	5,530	14,409	27.07	25.28	1.79	0.039	2.44*	<0.001
2015-2019	7,568	15,724	24.53	23.34	1.19	0.029	2.06*	<0.001
2020-2024	16,650	24,602	8.92	8.18	0.74	0.036	3.47***	<0.001

MWU (p): p-value of Mann-Whitney U test, *p < .05, ***p < .001

Table 8. OA Citation advantage and statistical test results by 5-year period

[Table 8] indicates that OA articles consistently received higher average citations than non-OA articles throughout all intervals. Independent-sample t-tests revealed statistically significant differences in most time periods (2001–2004, 2010–2014, 2015–2019, and 2020–2024; $p < 0.05$), though the difference in the 2005–2009 period was not significant. Mann–Whitney U tests confirmed significant differences in all intervals ($p < 0.001$). Cohen's d values show that effect sizes varied considerably across periods. The earliest period (2001–2004) had the largest practical effect size ($d = 0.196$). Later periods had much smaller effect sizes ($d = 0.029–0.039$). This suggests that the practical magnitude of the OA citation advantage decreased over time, though it remained statistically significant. Notably, the citation advantage decreased from 9.75 citations in the earliest period to just 0.74 citations in the most recent period, representing a 13-fold reduction in magnitude while maintaining statistical significance.

The descriptive statistics in [Table 2] indicated that, over the aggregated 24-year study period, non-OA articles have a slightly higher mean citation count than OA articles (18.83 vs. 17.90). However, analysis in [Table 8] showed that OA articles outperformed non-OA articles consistently in each five-year interval. This apparent contradiction illustrates the difference between patterns specific to a temporal period and the overall aggregate results.

This contradiction is due to major changes in publication and citation rates over the studied timeframe. As shown in [Figure 5], mean citation counts were notably higher during the early period (2001–2010), while OA adoption rate was relatively low. In contrast, the proportion of OA publications increased substantially in recent years (2015–2024); however, the average citation count declined due to the lag in citation accrual for more recent articles.

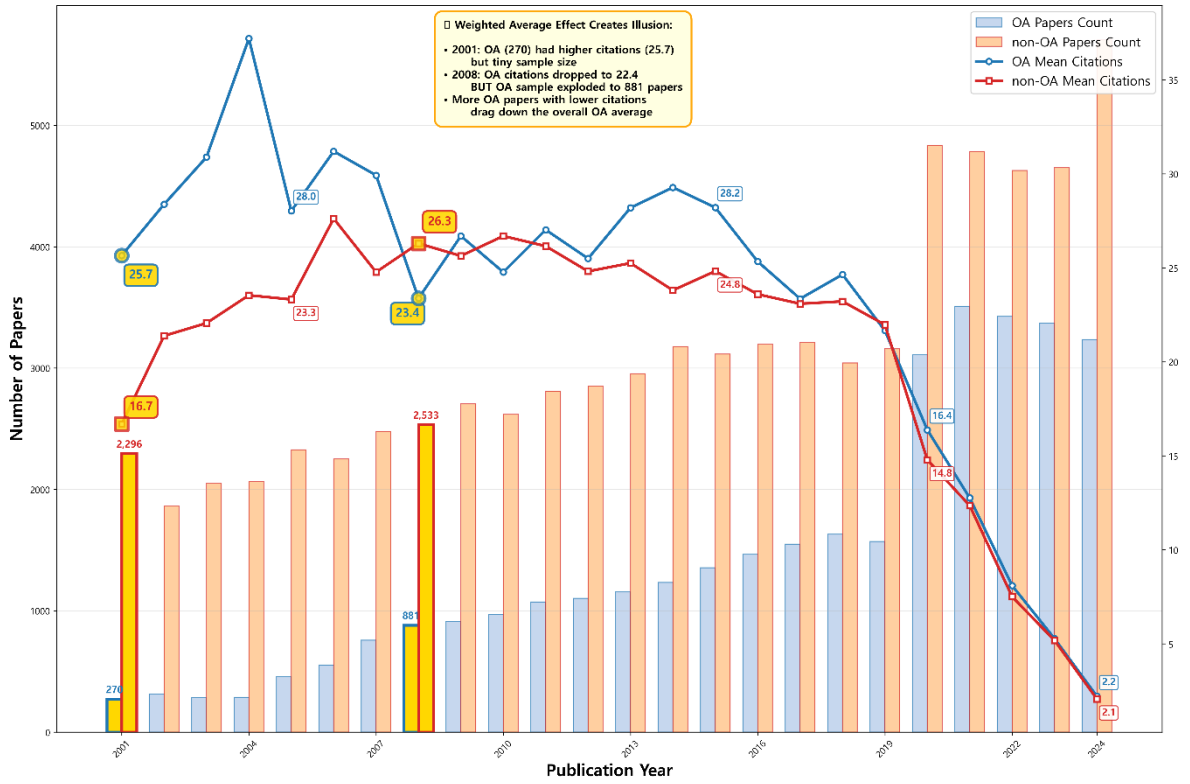

Figure 5. OA vs non-OA Publication & Citation Comparison

For instance, in 2001, OA articles received substantially more citations than non-OA articles but represented only a small percentage of total publications. In contrast, by 2008, OA articles (881 papers) received fewer citations (22.4) than non-OA articles (26.3). Moreover, the OA sample size had increased by more than a factor of three. This pattern, in which periods with the strongest OA advantages contribute minimal weight to the overall calculation while periods in which OA underperform with larger sample sizes dominate the aggregate. As a result, the overall average obscures the nuanced temporal dynamics of OA citation performance.

As illustrated in [Figure 6], the citation advantage for OA exhibited a downward trend over time, with its initial peak occurring between 2001 and 2004 at a maximum of 9.75 more citations. This was followed by a subsequent decline to 1.91 citations in the period between 2005 and 2009, 1.79 citations in the period between 2010 and 2014, 1.20 citations in the period between 2015 and 2019, and finally, 0.74 citations in the period between 2020 and 2024.

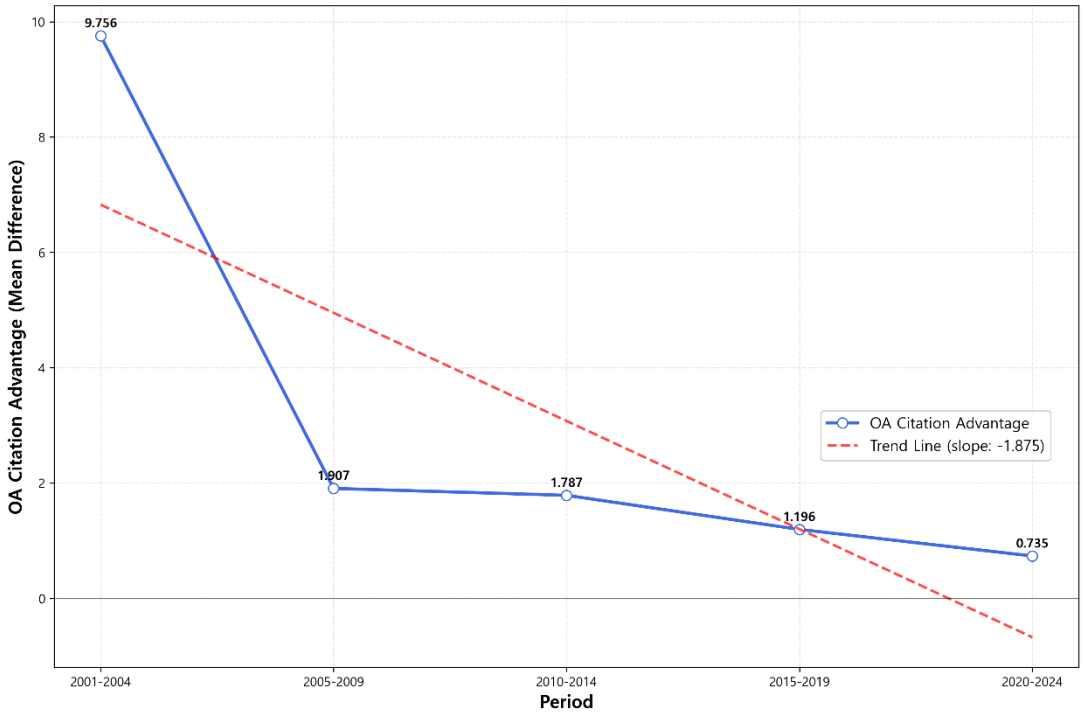

Figure 6. OA Citation Advantage Over Time (5-year Periods)

Citation impact by journal quality (JIF quartile)

This study also analysed differences in citation counts between OA and non-OA articles across Journal Impact Factor (JIF) quartiles (Q1–Q4). For each quartile, the number of OA and non-OA articles, mean citations, OA citation advantage (mean difference), and statistical significance were calculated, with key results summarized in [Table 9].

Quartile	OA N	non-OA N	OA Mean	non-OA Mean	Mean Diff.	Cohen's d	t-stat	MWU (p)
Q1	16,977	36,203	29.32	31.61	-2.29	-0.045	-4.948***	<0.001
Q2	9,270	19,581	10.87	11.78	-0.9	-0.038	-3.178**	<0.001
Q3	4,384	12,114	2.95	2.83	0.13	0.025	1.496	<0.001
Q4	3,830	7,400	1.34	1.22	0.12	0.038	1.902	<0.001

MWU (p): p-value of Mann-Whitney U test, **p < .01, ***p < .001

Table 9. Citation statistics and OA citation advantage by JIF quartile

Normality tests (Shapiro–Wilk) indicated non-normal citation distributions in most groups. To ensure analytical reliability, both parametric (Welch's t-test) and nonparametric (Mann–Whitney U) methods were applied. Results showed that in Q1 and Q2 journals, OA articles had lower average citations than non-OA articles, with mean differences of −2.29 and −0.90, respectively (Q1: $t = -4.95$, $p < 0.0001$; Q2: $t = -3.18$, $p = 0.0015$). In Q3 and Q4 journals, OA articles had slightly higher average citations (0.13 and 0.12, respectively), but these differences were not statistically significant (Q3: $t = 1.50$, $p = 0.1346$; Q4: $t = 1.90$, $p = 0.0572$). Effect size analysis using Cohen's d revealed that all observed differences had very small practical significance ($|d| \leq 0.045$), indicating that while some differences reached statistical significance, their real-world impact was negligible across all quartiles.

These findings suggest that the citation advantage of OA varies by journal quality. In this sample, non-OA articles in top-tier journals (Q1 and Q2) showed a slightly higher citation impact compared to OA articles, whereas in lower-tier journals (Q3 and Q4), OA articles showed minor, statistically non-significant advantages. Overall, a consistent citation advantage of OA across all quartiles was not observed.

Discussion

This study examined the citation impact of OA articles in LIS, considering OA status, type, disciplinary scope, publication years, and journal quality proxy. The results revealed key findings contributing to understanding the variability of OA citation advantages in this field.

Despite the prevailing assumption of an inherent advantage in citations for OA articles (Suber, 2012), non-OA articles had a slightly higher mean citation count, though the effect size was minimal. This suggests that assumptions from the life sciences or medicine may not apply here, emphasizing the importance of considering disciplinary differences. These findings are supported by Eger et al. (2021), who reported discipline-specific effects: OA articles showed an 18.3% citation advantage in biology but a 30.9% decline in economics and management, underscoring that OA's citation impact is not universal.

Significant differences emerged among OA subtypes: Green OA articles outperformed others. According to a study by Archambault et al. (2016), Green OA is consistently more effective than Gold OA in most fields. However, the study also noted that Gold OA is the most effective strategy in specific fields, such as biology and biomedical research. This is likely due to major funding agencies such as NIH and Wellcome Trust. More recently, Huang et al. (2024) found that Green OA has a stronger effect than publisher-based platforms in increasing the diversity of citation sources across institutions, countries, and fields. The findings consistently show the advantage of Green OA over Gold OA, but a unified explanation that accounts for hybrid and bronze models has yet to be established.

Furthermore, a post hoc analysis using Tukey's HSD test revealed that Green OA articles had significantly higher citation counts than Gold, Bronze, and Hybrid OA articles. All of these differences were statistically significant ($p < .001$), highlighting the distinct citation impacts of OA types and supporting the differentiation of OA types. Since this study classified OA types based on WoS, future research could examine the citation dynamics and underlying factors of each OA type, including hybrid and bronze models.

The disciplinary scope analysis underscored that OA citation impact is more pronounced in interdisciplinary works, potentially due to broader audience reach and enhanced knowledge integration. Temporal dynamics showed a clear decline in OA advantage over time, with a significant gap in early years of OA adoption tapering to minimal in recent periods. This trend suggests that as OA publishing becomes more common and alternative access routes proliferate, the relative citation benefit disappears.

Journal quality also moderated the outcomes. In top-tier journals (Q1 and Q2), OA articles received slightly fewer citations than non-OA articles, whereas in lower-tier journals (Q3 and Q4), OA articles exhibited only minor and statistically insignificant advantages. The finding that journal prestige alone does not guarantee a citation advantage for OA articles was consistent with the results of Chua et al. (2017).

The primary finding, indicating the absence of a discernable OA citation advantage in the LIS field, aligns with recent research showing that OA has different effects in different fields. When academic authors decide whether to publish in OA form or in what type, they have diverse reasons for doing so. Even if the main reason for choosing an OA approach is to get more citations, the results of this study don't give clear guidance, indicating that the alleged OA citation advantage is

not clear in LIS. Within the study's parameters, the citation advantages observed in the early periods tapered off and ultimately lost statistical validity over time.

Conclusion

This research offers a comprehensive analysis of OA's citation impact in LIS, showing that OA advantages are conditional rather than universal. Non-OA articles slightly outperformed OA articles overall, but Green OA demonstrated the strongest citation advantage among OA types. Interdisciplinary articles benefitted more from OA, and the citation advantage has decreased over the past two decades, coinciding with OA's path to institutionalization.

Journal prestige further moderates these effects, with a slight disadvantage in high-impact journals and a non-significant advantage in lower-tier journals. These results indicate a nuanced approach to OA publications, applicable to both authors and publishers within the LIS discipline.

This study highlights the necessity of distinguishing OA types, considering disciplinary specificities, temporal trends, and journal quality in future assessments. Expanding investigations beyond citation counts to include altmetrics and qualitative measures can enrich our understanding.

Overall, this work contributes vital insights into OA's complex role in LIS scholarly communication and informs practical approaches for enhancing research visibility and impact in the digital age.

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About the author(s)

Sunwoo Lee is a PhD student in the Library and Information Science Department at Sungkyunkwan University, Seoul, Korea. He received his master's degree from Chonnam National University, and his research interests include open research data. He can be contacted at swadvan2@gmail.com.

Wonsik Shim is a Professor in Library and Information Science Department at Sungkyunkwan University, Seoul, Korea. He received Ph.D. from Rutger's University, and his research interests include scholarly communication and open research data. He can be contacted at wonsikshim@skku.edu.

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