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Evaluating the Obsolescence Patterns in Early and Non-Early Publications: The Role of Open Access and Document Type

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Abstract

This study evaluates the obsolescence patterns in early and non-early publications within the field of library and information science, focusing on the role of open access (OA) and document type. The findings reveal distinct patterns in the dissemination and longevity of research. Early publications exhibit a higher preference for OA, reflecting a trend towards rapid and accessible dissemination of research findings. The citation half-life analysis indicates that non-OA early publications tend to have a longer citation lifespan compared to OA early publications, while OA non-early publications demonstrate a more extended impact than their non-OA counterparts. Document type analysis shows that 'Article' and 'Review' papers are predominantly early publications, suggesting these formats are prioritized for early release due to their comprehensive and impactful nature. The study underscores the evolving landscape of scholarly communication, highlighting the increasing adoption of OA and its implications for research visibility and longevity. Future research should expand to other disciplines, extend the temporal scope, and incorporate a broader range of impact metrics, such as social media mentions and altmetrics. Additionally, differentiating between types of OA (e.g., gold, green, hybrid) could provide more nuanced insights into their respective impacts on citation and dissemination patterns. This research emphasizes the importance of OA in enhancing the accessibility and impact of scholarly work, while also identifying areas for further exploration to better understand the dynamics of early and non-early publications.

Introduction

The lifecycle of information involves its creation, documentation, dissemination, usage, and eventual decline in use. From an information science perspective, the value of documented information diminishes over time, a process known as literature obsolescence (Gosnell, 1943). Literature obsolescence is primarily defined as the decrease in the usage of papers, typically assessed through citation or being cited. However, obsolescence is a dynamic process and challenging to capture. Therefore, the measurement of literature obsolescence often borrows the concept of half-life from physics, defining the half-life of a paper as the time required for its usage to reach half of its total usage.

Generally, the measurement of literature obsolescence can be conducted using two methods: synchronous and diachronous. The synchronous method explains the phenomenon of obsolescence at a specific point in time, focusing on the age distribution of cited information. This can be obtained by calculating the median age of cited references. The diachronous method observes a specific group of papers and

measures the time required for their citations to reach half of their total citations after publication. This can be obtained through citation data of the papers.

With the digital age transforming the academic publishing process, many journal articles are often disclosed as "early access" before their official publication. This necessitates considering whether the "early publication date" significantly impacts the assessment of literature obsolescence. Since December 2017, the WoS database has provided early publication date information and bibliographic fields, including Early Access Date (EA) and Early Access Year (EY). Once a paper is officially published, the EA and EY information is retained, and the official publication year and date are added (Clarivate, 2020b). However, the EY bibliographic field is no longer provided.

Many studies have explored the differences in various publication dates, such as early access date, official publication date, and database indexing date (Alves-Silva et al., 2016; Das & Das, 2006; Maflahi & Thelwall, 2018). There have also been comparisons of publication delays and early access (Al & Soydal, 2017; Gonzalez-Betancor & Dorta-Gonzalez, 2019; Heneberg, 2013; Hu et al., 2018; Kousha et al., 2018; Liu et al., 2020).

Dong et al. (2024) investigated the differences in literature obsolescence assessment caused by time lag, using the field of library and information science as an example. They analysed trends, citation impact, timeliness, and time lag of early publications and non-early publications. The results showed that the number of early publications has steadily increased each year, while non-early publications have shown a declining trend, although their numbers are still higher than early publications. Despite being fewer in number, early publications have a higher citation impact, with significantly higher average citation counts than non-early publications. Additionally, the citation half-life of early publications is about seven years or longer, indicating a longer citation lifespan, whereas the citation half-life of non-early publications is one to three years. Finally, the study found that more than half of early publications are officially published within three months, and about a quarter are exposed nine months in advance. This study highlights the importance of early publication in enhancing the impact and visibility of academic research.

Open Access refers to the authorized provision of free access to the full text of academic papers, which has become a significant trend in academic publishing in the internet age. It helps facilitate academic dissemination and promotes academic freedom. Because Open Access (OA) journal articles have lower access barriers, they tend to have higher visibility and citation opportunities compared to subscription-based journal articles. Consequently, many studies have explored and compared the citation impact advantage of OA versus non-OA journal articles. Most research suggests that OA journal articles indeed have a citation impact advantage (Eysenbach, 2006; Gargouri et al., 2010; Harnad & Brody, 2004; Norris et al., 2008), and they are cited more quickly (Atchison & Bull, 2015). However, some researchers argue that OA journals do not have a citation impact advantage (Davis et al., 2008; Davis & Walters, 2011; Dorta-González et al., 2017; Moed, 2007; Sotudeh, 2020). Additionally, some scholars believe that this discrepancy is due to differences across disciplines (Hubbard, 2017).

Document type refers to the format in which a paper is published. According to the SSCI database, there are 13 types of documents, roughly ranked by quantity as follows: Article, Meeting Abstract, Review, Editorial Material, Proceedings Paper, Book Review, Letter, Correction, Book Chapter, Biographical-Item, Retracted Publication, News Item, and Retraction (Clarivate, 2020a).

Different types of papers can lead to variations in citation counts. For example, theoretical or empirical research papers tend to be cited less frequently than methodological papers. The differences in document types also significantly impact citation counts, making it necessary to consider document types when conducting citation analysis (Peritz, 1983). Hamilton (1991) also pointed out that papers that are not cited may be obituaries, short notes, reviews, communications, or other types of documents. These types of papers often do not contain rigorous experimental or survey results, which explains why they are cited less frequently.

Based on the study by Dong et al. (2024) that investigates the obsolescence and time lag of early publications and non-early publications, this research aims to further explore the obsolescence patterns of EA and non-EA papers from the perspectives of Open Access and document types. The research objectives are as follows:

1. Investigate the Impact of Open Access on the Citation Half-Life of Early and Non-Early Publications: Examine how open access status affects the citation half-life of early publications and non-early publications.

2. Analyze the Effect of Various Document Types on the Citation Half-Life of Early and Non-Early Publications: Explore how different document types influence the citation half-life of early publications and non-early publications.

Methodology

This study investigates the obsolescence patterns in Early Publications and Non-Early Publications. It examines whether there are differences in the aging of literature between Early Publications and Non-Early Publications based on two attributes: whether the publication is Open Access and the document type of the publication. The following sections will detail the research methods, data acquisition, and data processing of this study.

Data collection

This study retrieved and downloaded bibliographic data from the SSCI database nn June 20, 2023. The search query was "WC=Information Science & Library Science," with the publication date limited to between January 1, 2013, and December 31, 2022. SSCI only started providing early publication dates for papers in 2019, and the early publication date data in the downloaded bibliographies is not comprehensive.

Therefore, this study used Python programming language to extract the online publication date of each article in journals within the field of Library and Information Science from the journal's website. The online publication dates obtained from the websites were combined with the early publication dates in the bibliographies to

form the early publication date data for this study. The research samples were divided into two categories: early publication papers and non-early publication papers.

(1) **Early publication**: Refers to bibliographies in the field of Library and Information Science with early publication dates. The early publication dates mainly come from journal websites, with some from WoS bibliographic data. There is a total of 33,748 early publications.
(2) **Non-early publication**: Refers to bibliographies in the field of Library and Information Science without early publication dates. This study includes a total of 63,450 non-early publication papers.

Literature Obsolescence

This study uses the citation half-life to measure literature obsolescence. The citation half-life is defined as the median age difference between the publication year of a set of papers and the publication year of their cited references. A smaller value indicates a faster rate of literature obsolescence, meaning the knowledge in that set of papers is updated more quickly. Conversely, a larger value indicates a slower rate of literature obsolescence, meaning the knowledge in that set of papers is updated more slowly.

The calculation method involves first sorting the cited references of each paper by publication year. Then, the publication year of the median cited reference is obtained. The time difference between the official publication year and the early publication year of each paper is calculated. The average value of the citation half-life is then computed for groups of papers based on whether they are Open Access (OA) or by document type.

Open Access and Non-Open Access

Whether a journal is OA is determined by the OA field in the SSCI bibliographic data. If the OA field has a value, the paper is considered Open Access; if the OA field is empty, the paper is considered Non-Open Access.

Document Type

The document type is based on the DT field in the SSCI bibliographic data. There are 1,752 bibliographic records that include more than one document type. Among them, there are 1,303 early publications and 449 non-early publications.

Results

Distribution and Ratio of Early Publications and Non-Early Publications Between Open Access and Non-Open Access

Table 1 compares the number of early publications and non-early publications between open access and non-open access in the field of library and information science from 2013 to 2022. In early publications, there are 12,119 open access papers, accounting for 35.91% of early publications. However, in non-early publications, there are only 7,434 open access papers, accounting for just 11.72% of non-early publications. Early publications not only have more open access papers, but the

proportion of open access papers is also higher. Regardless of whether they are early publications or non-early publications, the number and proportion of non-open access papers are higher. Particularly in non-early publications, the proportion of non-open access papers is as high as 88.28%.

Looking at the annual trend, in early publications, the number of open access papers shows a gradual increase, with a slight increase in proportion. The number of non-open access papers also shows a gradual increase, but the proportion slightly decreases. As for non-early publications, the number and proportion of open access papers remain relatively stable, while the number and proportion of non-open access papers show a slight decrease. Overall, whether open access or non-open access, the number and proportion of early publications are gradually increasing.

Table 1. The Number and Ratio of Early Publications and Non-Early Publications Across Open Access (OA) and Non-Open Access (non-OA) Papers.

Publication	*Early publications*		*Non-early publications*	
Year	*OA (%)*	*non-OA (%)*	*OA (%)*	*non-OA (%)*
2013	794 (30.54%)	1,806 (69.46%)	713 (10.01%)	6,411 (89.99%)
2014	915 (31.31%)	2,007 (68.69%)	651 (9.01%)	6,571 (90.99%)
2015	932 (31.49%)	2,028 (68.51%)	756 (10.00%)	6,802 (90.00%)
2016	1,183 (38.38%)	1,899 (61.62%)	813 (11.00%)	6,576 (89.00%)
2017	1,194 (38.04%)	1,945 (61.96%)	745 (10.71%)	6,214 (89.29%)
2018	1,204 (38.37%)	1,934 (61.63%)	845 (13.50%)	5,416 (86.50%)
2019	1,128 (36.39%)	1,972 (63.61%)	744 (14.57%)	4,362 (85.43%)
2020	1,462 (39.40%)	2,249 (60.60%)	762 (15.64%)	4,111 (84.36%)
2021	1,769 (40.20%)	2,632 (59.80%)	710 (14.43%)	4,211 (85.57%)
2022	1,538 (32.76%)	3,157 (67.24%)	698 (11.56%)	5,340 (88.44%)
Total	12,119 (35.91%)	21,629 (64.09%)	7,437 (11.72%)	56,014 (88.28%)

Citation Half-Life Comparison Across Open Access and Non-Open Access

Table 2 compares the citation half-life of early publications and non-early publications between open access and non-open access in the field of library and information science from 2013 to 2022. Over the 10-year citation half-life, the citation half-life of non-open access early publications (7.73) is higher than that of open access early publications (6.40). However, for non-early publications, the citation half-life of open access papers (7.07) is higher than that of non-open access papers (1.38).

Looking at the annual trend, the 10-year citation half-life for early publications, whether open access or non-open access, remains relatively stable. For non-early publications, the citation half-life of open access papers shows a slight upward trend each year, while the citation half-life of non-open access papers shows a slight downward trend each year. In summary, early publications have a higher citation half-life, with non-open access early publications having a slightly higher citation half-life than open access early publications.

Table 2. The citation half-life of Early Publications and Non-Early Publications for open access and non-open access.

Publication Year	*Early publications*		*Non-early publications*	
	OA	*non-OA*	*OA*	*non-OA*
2013	5.85	7.43	6.14	1.47
2014	6.19	7.70	6.26	1.22
2015	6.38	7.88	7.46	1.11
2016	6.41	8.14	6.52	1.35
2017	6.76	7.97	6.64	1.29
2018	6.39	7.80	7.35	1.27
2019	6.79	7.79	7.59	2.04
2020	6.52	7.71	7.82	1.57
2021	6.16	7.61	7.50	1.80
2022	6.46	7.56	7.91	1.15
Average	6.40	7.73	7.07	1.38

Distribution and Ratio of Early Publications and Non-Early Publications Across Various Document Types

Table 3 presents the number and ratio of early publications and non-early publications of various document types in the field of library and information science. The table only includes document types with a total paper count exceeding 500 over ten years. It reveals that the document type 'Article' has the highest number of papers in the field, totaling 43,416. The second most abundant document type is 'Book Review' with a total of 43,012 papers, followed by 'Editorial Material' with 6,424 papers. The remaining document types have fewer than 2,000 papers each.

In terms of early publications, the number of 'Article' papers remains the highest, with the ratio of early publications reaching 66.74%, indicating that 'Article' papers tend to be published early. Although the number of early publications for 'Review' is not the highest, the ratio is the highest at 75.18%, with as many as three-quarters of 'Review' papers being published early. For 'Letter' and 'Proceedings Paper', although the numbers are not large, more than 30% of the papers are early publications. On the other hand, the ratio of early publications for 'Book Review' and 'News Item' document types is quite low, especially for 'News Item', where all papers are non-early publications with no early publications at all.

Table 3. The Number and Ratio of Early Publications and Non-Early Publications Across Various Document Types.

Document Types	*Total*	*Early publications (%)*	*Non-early publications %)*
Article	43,416	28,974 66.74%)	14,442 33.26%)
Book Review	43,012	1,448 3.37%)	41,564 96.63%)
Editorial Material	6,424	1,505 23.43%)	4,919 76.57%)
Review	1,640	1,233 75.18%)	407 24.82%)
News Item	1,088	0 0.00%)	1,088 100.00%)
Letter	832	302 36.30%)	530 63.70%)
Proceedings Paper	733	284 38.74%)	449 61.26%)

Citation Half-Life Comparison Across Various Document Types

Table 4 compares the citation half-life of total papers, early publications, and non-early publications of various document types in the field of library and information science from 2013 to 2022. For total papers, 'Proceedings Paper,' 'Article,' and 'Review' have relatively high citation half-lives, all above 7. The citation half-life of 'Book Review' is only 0.37, significantly lower than other document types. This is because 'Book Review' mainly cites newly published books.

Comparing early publications and non-early publications, except for 'Letter' and 'Book Review,' early publications generally have a lower citation half-life. Most document types have a higher citation half-life for non-early publications. Particularly for 'Proceedings Paper,' 'Article,' and 'Review,' the citation half-life of non-early publications is above 8. In conclusion, non-early publications generally exhibit a higher citation half-life compared to early publications across most document types.

Table 4. The citation half-life of Early Publications and Non-Early Publications for various document types.

Document Types	*Total publications*	*Early publications*	*Non-early publications*
Proceedings Paper	7.97	7.03	**8.54**
Article	7.81	7.63	**8.39**
Review	7.19	7.02	**8.21**
News Item	6.81	0.00	**6.81**
Editorial Material	5.17	4.45	**6.12**
Letter	4.68	**5.72**	1.41
Book Review	0.37	**2.68**	0.31

Conclusion and discussion

This study investigates the obsolescence patterns in Early Publications and Non-Early Publications based on Open Access and the document type of the publication. The findings reveal several key trends and patterns. Early publications have a significantly higher proportion of OA papers compared to non-early publications, indicating a preference for OA in the early dissemination of research findings. Both early and non-early publications show an increasing trend in the number of OA papers over the years, although the proportion of OA papers in non-early publications remains relatively stable. The citation half-life of non-OA early publications is higher than that of OA early publications. Conversely, for non-early publications, OA papers have a higher citation half-life compared to non-OA papers. The 'Article' document type has the highest number of papers, with a significant proportion being early publications. 'Review' papers have the highest ratio of early publications, while 'Book Review' and 'News Item' have the lowest ratios of early publications.

The findings of this study highlight the evolving landscape of scholarly communication in the field of library and information science. The higher proportion

of OA in early publications suggests that researchers are increasingly opting for OA to ensure rapid dissemination and wider accessibility of their work. This trend aligns with the broader movement towards open science and the push for greater transparency and accessibility in research. The increasing trend in OA papers, particularly in early publications, reflects the growing acceptance and adoption of OA publishing models. This shift is likely driven by several factors, including the increasing availability of OA journals, mandates from funding agencies, and the perceived benefits of OA in terms of visibility and impact.

The citation half-life analysis provides insights into the longevity and impact of OA and non-OA publications. The higher citation half-life of non-OA early publications suggests that these papers continue to be cited over a longer period, possibly due to their perceived quality or the prestige of the journals in which they are published. However, the higher citation half-life of OA non-early publications indicates that OA papers in this category also have a lasting impact, likely due to their accessibility and visibility. The analysis of document types reveals that 'Article' and 'Review' papers are the most common and have the highest ratios of early publications. This suggests that these document types are prioritized for early dissemination, possibly due to their comprehensive nature and the critical role they play in advancing knowledge in the field. On the other hand, 'Book Review' and 'News Item' document types have lower ratios of early publications, indicating that these types of documents are less likely to be published early.

Despite the comprehensive nature of this study, several limitations should be acknowledged. The study is limited to the field of library and information science and may not be generalizable to other disciplines. Future research could expand the scope to include other fields to provide a more holistic view of OA and non-OA publishing trends. The analysis covers a ten-year period from 2013 to 2022. While this provides a substantial dataset, extending the temporal coverage could capture longer-term trends and changes in publishing practices. The study relies on citation half-life as a measure of impact. While this is a useful metric, it does not capture other dimensions of impact, such as social media mentions, downloads, or altmetrics. Future studies could incorporate a broader range of impact metrics to provide a more comprehensive assessment. The study categorizes papers as OA or non-OA based on their availability. However, there are different types of OA (e.g., gold, green, hybrid) that may have varying impacts on citation and dissemination. Future research could differentiate between these types to provide more nuanced insights.

In conclusion, this study sheds light on the dynamics of OA and non-OA publishing in the field of library and information science, highlighting key trends, patterns, and areas for future research. The findings underscore the importance of OA in the early dissemination of research and its potential impact on the visibility and longevity of scholarly work.

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