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Open Access and Its Implications for the Dissemination of Scientific Knowledge

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Abstract

The development of information technology has transformed the dissemination of knowledge globally. The Open Access (OA) movement emerged as a fundamental response to democratize scientific access and break down the financial barriers (paywalls) adopted by conventional publishing models. Trends over the past decade have shown a clear paradigm shift, with an increase in Gold Open Access articles from 11% to 38%, and a 47% increase in citations for OA articles compared to paid articles. Nevertheless, the implications of OA for the overall dissemination of knowledge, including aspects of affordability, visibility, citation impact, equality of access, and its relationship to digital literacy, still require in-depth synthesis. This study aims to map, analyze, and synthesize findings from previous research on the development of Open Access and its comprehensive implications for the knowledge dissemination ecosystem. This study uses a systematic literature review method. Data were collected through a review of various literature, regulations, and data related to the trends and impacts of Open Access implementation over a relevant timeframe. Open Access has significant positive implications for accelerating the dissemination of knowledge and improving global digital literacy. This literature synthesis emphasizes the importance of policy support and strengthening open access journal governance to create equitable, inclusive, and sustainable access to science.

Keywords: Open Access, Dissemination of Knowledge, Literature Review, Digital Literacy.

1. Introduction

Science develops through an effective and sustainable dissemination process. In today's digital era, the speed of scientific information transfer plays a crucial role in encouraging global innovation, solving humanitarian crises, and bridging education gaps between countries. Ideally, every researcher, academic, and the general public have an equal right to access the latest research results to underpin decision-making or advanced science development.

The development of information and communication technology has brought about a fundamental transformation in the way science is produced, disseminated, and accessed by the global community. In this digital era, a movement has emerged that fundamentally challenges the conventional scientific publishing model, namely Open Access (OA). The Budapest Open Access Initiative (BOAI) marked the beginning of the formal Open Access movement [1]. In 2002, its members first coined and defined the term "Open Access" and laid the principles of accessibility and free use as its foundation. BOAI defines Open Access as the free availability of scientific literature on the public internet, which allows any user to read, download, copy, distribute, print, search, or link to the full text of an article without financial, legal, or technical barriers, apart from the inseparable barriers of internet access itself.

The urgency of Open Access is increasingly felt in line with the increasing volume of global scientific production which is not balanced with ease of access, especially for researchers in developing countries. Open access to scientific literature is a powerful mechanism for creating and validating knowledge, as well as supporting the development of science as a public good, rather than as an activity carried out behind closed doors. This principle is in line with the Universal Declaration of Human Rights which states the fundamental right to participate in the advancement of science and its benefits [2]. Libraries in Indonesia, implement open access in online journals which are directly supported through the Regulation of the Minister of Research, Technology, and Higher Education of the Republic of Indonesia Number 9 of 2018 concerning Accreditation of Scientific Journals [3]. The regulation requires that journals to be accredited must be published online. This of course encourages journal publishers to quickly migrate from print journals to online journals.

Empirically, the growth of Open Access in the past decade shows a significant trend. Between 2013 and 2023, the percentage of global scientific articles available through the Gold Open Access pathway increased from 11% to 38%. In contrast, the percentage of articles only available through subscriptions dropped from 70% in 2013 to 52% in 2023. This growth reflects a marked paradigm shift in the global scientific publishing ecosystem [4]. One of the most crucial dimensions of Open Access is its implications for the dissemination of knowledge. There are broad citation advantages for researchers who publish their work openly, as well as additional benefits in disseminating their work outside the academic environment. In addition, Open Access has the potential to provide economic benefits for subscription-based journals and can save considerable financial resources for publishers and research funders.

The impact of Open Access on dissemination is also evident in the context of the use of public knowledge platforms. Open Access articles are increasingly cited over time, with their proportions on Wikipedia significantly exceeding their proportions in the broader scientific literature. Previous research has found that OA articles are 47% more likely to be cited than paid articles when controlled by journal and research area [5]. The availability of Open Access-based journals is projected to have a positive impact on strengthening competencies in other sectors. Through the provision of scientific data in digital format that can be accessed online, this platform is closely related to the concept of digital literacy. In line with this, Deakin University's Graduate Learning Outcome 3 (DU GLO3) conceptualizes digital literacy as a series of activities that include the discovery, utilization, and dissemination of information in cyberspace by relying on technological support [6].

Although the benefits of Open Access have been widely documented, a comprehensive study that specifically analyzes its implications for science dissemination including aspects of affordability, visibility, impact of citation, and equality of access across countries still requires a comprehensive synthesis of the literature. Therefore, this research is present as a systematic literature review that aims to map, analyze, and synthesize the findings of previous research related to Open Access and its implications for the dissemination of knowledge.

2. Research Methods

This research is designed using a descriptive qualitative approach with data collection techniques based on literature studies. The qualitative approach was chosen because it is able to produce descriptive data sourced from written documents and oral speech as well as behaviors that are the object of observation. Through this approach, the researcher seeks to describe and analyze how Open Access journals contribute to supporting the improvement of digital literacy. The data sources in this study were obtained from various scientific documents, including books, journal articles, research reports, and periodical publications relevant to the topic being studied. The data is then processed and analyzed systematically to produce findings that are then presented in the form of conclusions.

The data used includes two main groups, namely data on Open Access which includes its concept, function, and role in the scientific publishing ecosystem and data on digital literacy and its constituent elements. The two data groups were analyzed integratively to identify the contribution of each element, so as to be able to answer the research questions that have been formulated.

3. Results and Discussion

3.1. Open Access

Peter Suber, Director of the Harvard Open Access Project, is one of the most influential thinkers in the OA movement. According to Suber, Open Access literature is digital, online, free of cost, and free from most copyright and license restrictions. This definition emphasizes two main dimensions of OA, namely free of charge (free OA) and free from permit barriers (libre OA).

Harnad defines Open Access as immediate, permanent, and free online access to the full text of all research journal articles that have gone through a peer review process. This definition emphasizes the speed and sustainability aspects of access as crucial elements.

According to Osborne, ease of access is the most important element in accessing a scientific work. The implementation of Open Access in journals can make it easier for anyone who needs access to scientific papers. Open Access journals can also be interpreted as journals that provide literature that can be accessed easily, from reading to downloading, via the internet.

From the various definitions above, Open Access can be comprehensively understood Open Access is a publishing system in which scientific papers are available for free via the internet without membership barriers or

access fees. This concept emerged in response to the increasingly expensive cost of journal subscriptions, as well as the need to disseminate knowledge more widely and equitably. Prior to Open Access, access to research results was often limited to institutions that could afford to pay for journal subscriptions, thus creating a knowledge gap between institutions and between developed and developing countries.

Open Access journal is a scientific journal that provides free access to the general public to read, download, and disseminate scientific articles. The emergence of such journals is a support for the Open Access movement that aims to build a sustainable means of scientific communication, while allowing authors to maintain their copyrights while allowing others to distribute, modify, and reuse the work on certain terms. Open Access can accelerate the recognition and dissemination of research results that have the potential to support the scientific literature. The advantages of open access literature can be seen from its two basic characteristics, namely solving price and licensing problems.

3.2. Digital literacy

Paul Gilster is the figure who first introduced and popularized the term digital literacy. In his book *Digital Literacy* published in 1997, Gilster defined digital literacy as the ability to understand and use information through various digital sources. Gilster emphasized the importance of the ability to read, write, and interact with digital technology, and that digital literacy is not only the technical ability to use devices, but also the ability to think critically about information.

According to Devri Suherdi in her book *The Role of Digital Literacy in the Pandemic Period* (2021), digital literacy includes knowledge and skills in utilizing digital media, such as communication tools and internet networks, effectively and intelligently. He emphasized the aspect of the ability to find, evaluate, use, and create digital content wisely.

Rila Setyaningsih defines digital literacy as a person's ability when operating digital technology that is used as a communication tool to establish relationships with others, as well as used as a tool to access, manage, analyze information, and gain new knowledge [22].

3.3. The Relationship between Open Access and Digital Literacy

The relationship between Open Access and digital literacy is complementary and mutually reinforcing. Both are based on the same basic principle, namely openness of access to information as the foundation for the development of individual knowledge and abilities:

a. Open Access as Digital Literacy Infrastructure

Open Access Journal has a significant role in people's digital literacy skills, because Open Access Journal supports the ease and freedom of information and science sources. Digital literacy requires the support of easy access to literacy resources which is the goal of the Open Access Journal itself.

Knowledge that was once limited to libraries and paid publications is now accessible to anyone around the world. Open access journals have become a key vehicle in this transformation, allowing scientific research to be published freely and quickly. Media literacy includes not only the technical ability to use digital devices, but also critical skills in assessing the quality and validity of the information received.

b. Open Access Supports the Development of Information Evaluation Capabilities

In the post-digital context, literacy is understood as the ability to think critically and make balanced judgments of the information found and used. Empowerment and critical thinking are the basis of the transformative perspective of critical information literacy, which is increasingly relevant as the Open Access movement in scientific communication develops.

Information literacy skills enable learners to effectively find, evaluate, and use information, supporting independent learning, critical thinking, and ethical use of information. Open access to digital resources is an important prerequisite for the development of these capabilities.

c. Open Access Expands the Reach and Equitable Distribution of Digital Literacy

Open Access not only accelerates the dissemination of knowledge globally, but also opens up opportunities for researchers from developing countries to contribute more to the international scientific community. In the context of digital literacy, this means that more and more individuals can hone their ability to access, evaluate, and use scientific information without being hampered by subscription fees [14].

Open access is the only way to digitize existing archives so that anyone or a group of people can use them without restrictions because they provide a means of access to archives. By utilizing developing technology, libraries will not be outdated in supporting the growth of people's digital literacy [24].

d. Reciprocal Linkages

The relationship between Open Access and digital literacy is reciprocal: Open Access provides the resources needed to develop digital literacy, while high digital literacy encourages people to make more optimal use of Open Access resources. Open Access increases community participation because it involves stakeholders in research processes that support the co-creation and dissemination of academic knowledge, which in turn strengthens the capacity of digital literacy collectively.

3.4. Concepts and Open Access Models in Scientific Publishing

Open Access comes in several main models that have different characteristics. In general, there are two main paths to Open Access, namely Green OA and Gold OA, as well as one additional path that is often called Diamond OA. Green OA or self-archiving refers to the practice of publishing works that have been published freely through the repository of certain institutions or disciplines. Gold OA refers to the publication of scientific papers in OA journals that undergo the same quality assurance process as closed-access publications. Diamond OA is a subtype of Gold OA that is financed without the author's article processing fee (APC).

The Diamond model is a favorable option for researchers because it removes financial barriers for writers, ensuring that everyone can publish their work regardless of the institution's budget or personal financial ability. This is especially important for researchers from regions or institutions that are less able to afford the high APC that is generally applicable in Gold OA.

3.5. Obstacles and Challenges of Open Access Implementation

The popularity of Open Access has posed new challenges. Many scientific journals began charging researchers to maintain Open Access and cover the cost of the editorial process. The practice is difficult to regulate, and opportunistic groups have seen a financial opportunity that gives birth to the phenomenon of predatory journals — journals that prioritize profit over the dissemination of scientific knowledge and publish papers without adequate peer review.

For researchers in low- and middle-income countries, the cost of article processing (APC) is so burdensome that it hinders the publication of research conducted in and relevant to those countries. Ironically, three-quarters of journals offer no fee waivers for scientists from low-income countries, thus perpetuating inequalities in scientific knowledge.

Additional barriers also include language barriers, where only 13% of SCOPUS-indexed Latin American journals use English as the language of publication. In addition, APC costs for full OA publications increased by about 10% in 2023–2024, as well as about 30.38% of predatory journals published in Asia.

3.6. Implications of Open Access on Science Dissemination

a. Accelerating the Dissemination of Scientific Findings

The most fundamental implication of Open Access is the acceleration of the dissemination of research results to a wider audience. Communication and dissemination of scientific knowledge are fundamental aspects of the overall scientific effort. The European Commission affirms that making research results more accessible contributes to better and more efficient science, as well as encouraging innovation in both the public and private sectors [23].

By removing the paywall, research findings can reach a much wider audience ranging from scientists, students, policymakers, to the general public. This increased visibility can drive higher citation rates and greater engagement from the research community. Open Access also facilitates cross-disciplinary collaboration, as researchers from different fields can more easily access and develop each other's work, thus encouraging innovation and advancing knowledge at a faster pace.

b. Increased Citation Impact and Academic Visibility

Open Access has been empirically proven to increase the number of citations and visibility of a scientific work. Open Access articles show a 15% higher chance of being cited on Wikipedia than closed access articles, after controlling for confounding factors. The OA citation effect is particularly strong for articles with a low

number of citations, including newly published articles, so Open Access plays a key role in the dissemination of scientific knowledge including by providing timely access to the latest research results.

Evidence suggests that OA increases academic visibility, although heterogeneously depending on the discipline and OA model used. Green OA and preprints consistently improve citations and speed up readability, while Gold OA makes a positive impact especially in the fields of medicine and biology.

c. Democratizing Access and Equitable Global Science

Open Access has major implications for equality of access between countries, especially for researchers in developing countries. Journals that provide direct open access apply the principle that making research freely available to the public supports a broader global exchange of knowledge and is a valuable way to maximize the visibility and impact of research. Everyone has free and unrestricted access to the full text of all published articles.

Open Access not only accelerates the dissemination of knowledge globally, but also opens up opportunities for researchers from developing countries to contribute more to the international scientific community. This directly breaks the cycle of inequality in which researchers from low-income countries cannot afford to access the literature necessary to produce competitive research.

d. Strengthening Research Transparency, Accountability, and Reproducibility

Open Access regulations support transparency and accountability in research practices. By making research results publicly available, researchers and the general public can verify, replicate, and review published research results. In addition, Open Access is expected to increase collaboration, exchange of ideas, and innovation among the scientific community, thereby accelerating the progress of research and development in various fields of science.

The open research agenda has three main features: open access to publications, methods, and tools; data that meets FAIR (Findable, Accessible, Interoperable, Reusable) principles; and increased transparency, accountability, equity, and collaboration. These core principles mobilize vital knowledge, improve research validation, and improve the robustness and accuracy of science.

e. Community Participation and Strengthening Public Policy

Open Access not only impacts the academic community, but also expands the reach of science into public policy and community participation. Open Access increases community participation because it involves stakeholders and citizen science in the research process that supports the co-creation and dissemination of academic knowledge. Evidence-informed policy-making and modern society require high-quality knowledge that can be accessed openly as input for transparent and accountable decision-making [9].

UNESCO's 2023 report estimates that more than 50% of scientific articles are now published in open access journals, which means that more than half of new scientific knowledge is already openly accessible to anyone around the world [25].

e. Transformation of the Academic Repository and Library Ecosystem

The integration of Open Access resources into library collections has facilitated wider access to academic work, allowing libraries to shift budgets from expensive subscription fees to support OA initiatives and digital infrastructure upgrades. Open repositories have a positive impact on collaboration, innovation, and equitable dissemination of information.

Institutional repositories are seen as an alternative to scientific communication that plays a role in increasing visibility, bridging access, and building a culture of knowledge sharing in the university environment. The provision of full text repository services not only meets the needs of library users, but also has an impact on improving content citations and institutional reputation.

4. Conclusion

This research is a literature review that aims to analyze the concept of Open Access and its implications for the dissemination of knowledge, with particular attention to its relationship with the development of digital literacy. Based on the results of the study and discussion, it can be concluded that Open Access represents a new paradigm in scientific publishing that emerged as a response to the limitations of conventional subscription models that have hindered access to scientific knowledge. Open Access is implemented through several major models, including Gold OA, Green OA, and Diamond OA, each of which offers different mechanisms for managing costs and access openness while sharing the common objective of expanding the dissemination of scientific knowledge without

financial barriers for readers. The implications of Open Access for knowledge dissemination have proven to be significant in various dimensions. Empirical evidence indicates that Open Access articles exhibit higher citation rates, broader academic visibility, and a greater likelihood of being cited on public knowledge platforms such as Wikipedia than closed access articles. Open Access has also been shown to accelerate the dissemination of scientific findings, expand cross-disciplinary and cross-border collaboration, strengthen research transparency and reproducibility, and encourage community engagement and evidence-based public policy. Furthermore, the rapid growth of Open Access from 11% in 2013 to 38% in 2023 in the Gold OA category further highlights its central position in the contemporary scholarly publishing ecosystem. Despite these broad benefits, the implementation of Open Access is inseparable from several challenges that require serious attention. High Article Processing Charges (APC) remain a burden for researchers in developing countries, while the emergence of predatory journals exploiting OA models threatens the integrity of scientific communication. In addition, the uneven distribution of Open Access benefits among countries and institutions indicates that formal openness does not necessarily guarantee substantive equality within the global research ecosystem. This study also reveals a close and reciprocal relationship between Open Access and digital literacy. Open Access provides scientific information resources that serve as an important foundation for the development of digital literacy, particularly in terms of the ability to access, evaluate, and use information critically. Conversely, adequate digital literacy enables individuals to utilize Open Access resources more effectively, ethically, and productively. Overall, this study concludes that Open Access is a strategic instrument that not only accelerates and broadens the dissemination of knowledge but also contributes significantly to building a more information-literate and digitally literate society. To maximize these benefits, comprehensive support from governments, academic institutions, and research funding agencies is needed to ensure that the advantages of Open Access can be enjoyed fairly and equitably by the global scientific community, including researchers and communities in developing countries.

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