

Open Access Publishing In Science: Why It Is Highly Appreciated But Rarely Used

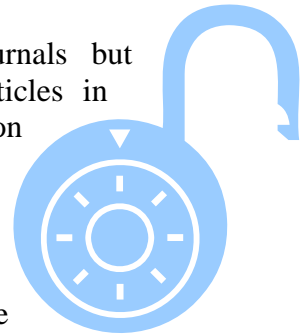
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While the evolving information society is freely opening and sharing its diaries, social networks and source codes, it remains to be seen if the same will come true for scientific knowledge. Despite strong sympathy for the idea, scientists balk at Open Access publishing. Here we shed some light on why this is so.

Scientific journals have two main objectives: the diffusion of research results and the public documentation of copyright. The ultimate goal is to increase society's *stock of knowledge*. Following systematization by FRITZ MACHLUP we hereby mean "the sum total of all stocks of knowledge present in individual minds" [7]. This implies that firstly, knowledge has to be "embodied in books or preserved in other durable records" [7] and secondly – of equal importance – *availability* and *access* has to be provided to society to read and process the written stock of knowledge. Only if both of these requirements are met, the scientific "cycles of accumulation" [6] can be successfully entered, as LATOUR puts it.

Because of declining library budgets and rapidly rising subscription fees, the second requirement for enlarging the stock of knowledge is at risk. For several years libraries have been under considerable strain to provide the desired levels of availability and access to its users. This circumstance is generally referred to as the *serials crisis*. Paired with new possibilities enabled by the Internet as a medium for communication and content distribution, discussions about alternative publishing models have arisen. Subscription fees act as access barriers to scientific literature and are thus counterproductive in regards to expanding the stock of knowledge. In order to meet this development, the idea of *Open Access* to scientific publications has evolved during the last 15 years. The basic concept is access to scientific literature for readers at no charge and without any technical barriers. There are two alternative ways of Open Access publishing. While the "Golden Road" stands for the exclusive publication in dedicated Open Access journals, the "Green Road" describes publishing in

traditional non-Open Access journals but additionally self-archiving the articles in Open Access repositories or on authors' websites [5]. "Golden" Open Access offers are facilitated by new Internet-based business models, which do not indulge in the illusion of an entirely cost-free publication process. They rather focus on minimizing publication costs and taking the burden of costs off the subscribers' shoulders. The study we are reporting about, embraces both options of Open Access publishing.



A VERY GOOD IDEA

From a conceptual and technical view, the Open Access model is at a rather developed stage. In addition the attitude toward Open Access publishing is extremely positive. This was supported by our international study conducted by the Institute for Information Systems and New Media at the Ludwig-Maximilians-Universität München, Germany and the Departments of Information Science and Management at the University of Arkansas at Little Rock (see also "How The Research Was Conducted"). We surveyed 481 researchers from three heterogeneous research disciplines of whom more than 85% liked the idea of Open Access publishing. This result is underscored by the widespread international support for Open Access Initiatives such as the BUDAPEST OPEN ACCESS INITIATIVE or the BERLIN DECLARATION confirmed by long lists of institutional and individual signatories [3].

One of the main arguments for stronger support of the Open Access model is easier access to

scientific knowledge. Almost 90% of the participants of our study believe that Open Access publishing will serve this purpose, which more than 96% consider desirable. Another important argument for free access to research results is easier access for scholars from developing countries. Various attempts *have* and *are* being made to reduce the information gap between rich and poor countries (for example WHO's Health InterNetwork Access to Research Initiative). It is worth looking a bit closer at how this could be achieved successfully, since the widely known *knowledge gap hypothesis* states: "As the infusion of mass media information into a social system increases, segments of the population with higher socioeconomic status tend to acquire this information at a faster rate than the lower status segments, so that the gap in knowledge between these segments tends to increase rather than decrease." [11] In the same article TICHENOR and his colleagues state that "a widening knowledge gap may be occurring in developing nations as a result of the systems for delivering information to people" [11]. Thus new systems and media for the transmission of information should be the starting point in an effort to reduce the knowledge gap. In our study 94% of the respondents agree that Open Access publishing would be helpful in granting better access to developing countries.

A less altruistic but from researchers' point of view not less important aspect is the fact that Open Access publications help reaching a larger potential readership and thus establish the premises for potentially greater impact. Three-quarters of the participants answered in this spirit. 43% believe that their work, when published Open Access, will then be more frequently cited.

Asked for an overall evaluation of the usefulness of Open Access publishing, more than 70% of the respondents answered favorably.

LITTLE USE

Surprisingly, the high level of (seemingly ideological) acceptance and support do not bring about a comparable degree of use of Open Access publishing. Of more than 300,000 periodicals of

all types currently listed in ULRICH'S PERIODICALS DIRECTORY (WWW.URICHWEB.COM), merely 1,120 grant Open Access. In our study, almost two-thirds (66%) of the respondents have used Open Access publication media for *accessing* research results at least once in their academic career. But only about one quarter (28%) of the researchers have used them for actual *publishing* the results of their work. Depending on whether scientists view Open Access publishing from their point of view as readers vs. as authors they apparently evaluate the idea with double standards.

To the best of our knowledge, so far there has not been any theory-based research on this paradoxical gap between the high appreciation but reluctant use of Open Access publishing by scientists in their role as authors. On this account the focus of our research was to identify reasons for the existence of the gap and to provide a quantitative foundation for all relevant actors to react adequately.

JEOPARDIZING PROMOTION AND TENURE?

Despite their positive general attitude, the majority of the survey participants (61%) fear that Open Access publishing might jeopardize their chances of promotion and tenure. At the same time, 63% worry about Open Access publishing damaging their chances for research funds. A possible explanation for these results is that the current impact factors of Open Access outlets are seen as insufficient by more than 60%. For almost three-quarters (72%) this is reason not to publish their work Open Access. This pattern of results cannot surprise in a "publish or perish" environment (see, e. g., [2]) where impact factors function as indicators for the absolute quality of publication outlets and are often consulted in promotion and tenure decisions. However, these metrics are only able to measure the relative weight of journals/media that are actually listed in the underlying databases [10]. Impact factors are not able to provide us with valid numbers on citation rates for all possible types of publications. Coming back to the idea of the scientific "cycles

of accumulation” [6], citation rates should really be the numbers of interest [5].

Lastly, an overall increase in productivity through Open Access publishing is only seen by 36%, whereas 44% even think that productivity will decrease.

WAIT AND SEE

When asked about the publishing behavior of their peer researchers of the *same* discipline, only 14% agreed that Open Access publishing is a common practice. The picture shifts when asked about researchers of *other* disciplines. Here, 40% believe that Open Access publishing would be practiced. The initial low level of agreement could be witnessed once again when asking about the behavior of direct colleagues. Only 8% state that their direct colleagues use Open Access media for publishing their work. The pattern to be observed here is characteristic for the wait-and-see attitude that many researchers currently show when it comes to Open Access publishing. Many believe that others would already do it and that they are the only ones waiting.

In our study we also explored the *behavioral intention* of researchers to publish in Open Access outlets. The results of the corresponding items are in line with the wait-and-see attitude pointed out above. Only 26% held it for likely to publish in the form of Open Access in the coming six months, while 52% did not see this happen. When looking back at the percentage of respondents who state that they have already published in Open Access media (28%), the measured level of intention (26%) does not lead to the conclusion that Open Access publishing will become extraordinarily popular overnight. If broad

diffusion of this new publishing model ever occurs, it will be a rather long-term development.

WHY NOT

The interesting question now is which of the results presented above are prevalent when it comes to explaining *why* a researcher decides to publish or not to publish in the form of Open Access. To this end we separated all items included in our survey into different groups. Our analyses showed that items connected to the *performance* – that is the degree to which researchers believe that Open Access publishing will help them get gains in their jobs [12] – are of

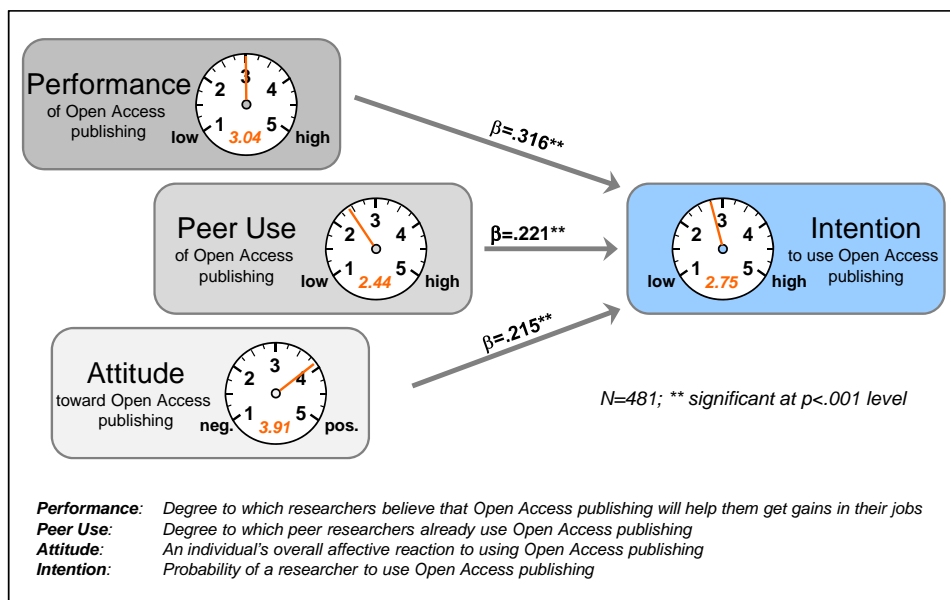


Figure 1: Predictors of the intention to use Open Access publishing

greatest importance. Ranking second are items connected to the *peer use* of Open Access publishing, which we define as the degree to which peer researchers already use Open Access publishing. Of comparably least – but still significant – importance are all items related to *attitude* being an individual’s overall affective reaction to using a technology or innovation [12].

Now let us look at the values of each of these three constructs: The attitude toward Open Access is extremely positive; peer use is rather low and the performance indicator shows moderate values when including all relevant items.

From the combination of the two dimensions – importance and parameter values (Figure 1) - it becomes possible to see where promoters of Open Access publishing would have to start in an attempt to push the diffusion of this new publishing model forward: *Performance* turns out to be of relatively highest importance while showing only moderate values. Therefore performance related issues should be addressed first. *Peer use* has the second greatest weight in determining researchers’ intention to use Open Access publishing or not. Since levels here are comparably low, there is the largest room for improvement here. Last and with least weight, *attitude* already shows very positive values. As a consequence, Open Access advocates do not need to worry about researchers’ attitudes in the medium term, but should rather focus on advancing performance and peer use.

FOCUS ON PERFORMANCE

With performance being evaluated the most important facet in researchers’ decision whether to join Open Access publishing, we dug deeper into this dimension. While exploring the importance of seven relevant items connected to performance, we also asked respondents to estimate whether traditional publication media or Open Access better fulfill the corresponding item today (Figure 2).

The results show a clear split between attributes that are better fulfilled by Open Access media and ones that traditional media better satisfy. On the

one hand Open Access publications seem to have advantages when it comes to the wide and rapid dissemination of knowledge to a broad readership. Reaching a broad readership often is communicated as the outstanding advantage of Open Access publications. The results of this study indeed confirm that Open Access publications are superior concerning this particular attribute. Nevertheless it is considered to be of comparably lower importance and thus will probably not be able to boost the popularity of Open Access publishing.

On the other hand traditional media are superior in reaching an expert readership, which is seen as the most important of the seven attributes. According to the participants, the important attribute of guaranteeing long-term availability is also better fulfilled by traditional media. These are also superior with regard to the impact factor. Lastly, the reputation of editorial boards of traditional publications is superior to the one of Open Access publication media.

Generally all items in the upper right quadrant should be seen as critical when it comes to enhancing the performance of Open Access publishing.

A PROBLEM OF REACHING CRITICAL MASS

Besides shortfalls in performance, the low level of use among colleagues (peer use) retards the further diffusion of Open Access publishing. As a result, ways to increase usage within the community of researchers have to be found if the

goal is to further promote Open Access. Once the critical mass is reached, network effects could ignite a virtuous circle and allow for further diffusion [8]. In order to reach critical mass there are two fields of action.

Firstly, the performance related issues shown in the upper right quadrant of Figure 2 should be addressed, since these are regarded as being of high importance and – at the time being – better fulfilled

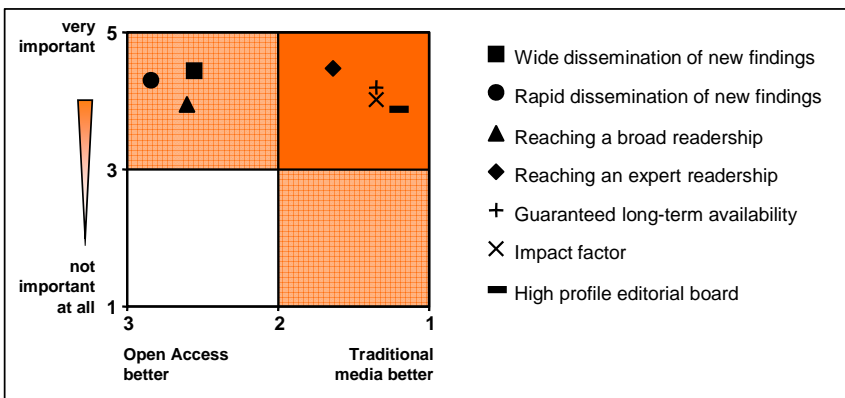


Figure 2: Performance of Open Access and traditional publication media

by traditional publication media.

Secondly, ways have to be found to boost usage of Open Access publishing directly. On this note a possible measure could be an obligation to make all publicly funded research freely available on the Internet as also encouraged by a study recently published by the European Commission [4].

OPEN FUTURE

Our study shows that the overall attitude toward Open Access among scientists is very positive. Among the main reasons for this is the expected broader and easier access to literature for everyone, possibly resulting in higher citation rates, higher impact and eventually a higher stock of knowledge. However, in the short-term performance related concerns and the wait-and-see attitude of the majority of researchers prohibit the broad adoption of this publishing model. Critical mass has not been reached and the virtuous circle of diffusion has not taken off yet. Established scientific publishing companies have two strategic options for the future. They can either continue capitalizing on their distinct advantages vis-à-vis Open Access publishing or they can proactively and gradually change their existing business models to incorporate the Open Access idea. One option to achieve the transition could be giving authors the choice whether they would like to publish their articles traditionally with access restricted only to subscribers of the respective journal or whether they prefer paying a publication fee and make their work freely available to everyone (*Open Choice*). Another option is to provide Open Access only after a certain period of time, e. g., six months (*Delayed Open Access*).

In other information industries a trend towards open content is highly visible. Open Source Software has been around since Netscape decided

to reveal the source code of its Netscape Navigator in 1998. With the help of the Open Source Initiative (OSI) and its marketing activities Open Source Software now successfully performs in corporate as well as consumer environments. On a similar notion, commercial DRM-free music downloads have increasingly become available during recent months. Also, millions of people share open information in blogs, social networking platforms and audio/visual platforms over the Internet. Even though a similar cultural change is to be expected in the scientific community, the ultimate question remains if the current publishing system will pry open the collective inertia of its own accord or if a top-down impulse for change, such as a legislative alteration, is desirable and needed.

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HOW THE RESEARCH WAS CONDUCTED

Between July and August 2006 we distributed a web-based quantitative survey. Through our website WWW.OPENACCESS-STUDY.COM we were able to attract a total of 1433 participants from 49 countries. In order to stay in line with our initial research design and to minimize a potential pro-Open-Access-bias, we only included *publishing scientists* from the disciplines *Information Systems*, *German Literature* and *Medical Science* in our analyses and results. This subset constitutes our sample of 481 respondents, which we do not claim to be representative per se, but it allows for a broad interdisciplinary picture. The goal was to systematically uncover reasons for the current relatively low-level use of Open Access publishing. To this end we built a survey based on a newer theory from the field of technology acceptance research. We regard Open Access publication media as a technology that provides publishing scientists with a tool to reach their goals of distributing research results and documenting copyright. The Unified Theory of Acceptance and Use of Technology (UTAUT) [12] hypothesizes the constructs *performance expectancy*, *effort expectancy* and *social influence* to be predictors of *behavioral intention* to use a new technology or system. In addition to these constructs *attitude* was added to our research model following the Theory of Planned Behavior [1]. *Attitude* was also initially included in UTAUT but then found non-significant by the authors due to interaction effects with the constructs *performance* and *effort expectancy*. We rounded the research model off with one construct rooted in network economics, *peer use*. Since Open Access publishing is a medium of scholarly communication, which requires at least one sender (author) and one recipient (reader), this new publishing model is subject to network effects [9]. After ensuring reliability with Cronbach's α and construct validity with confirmatory factor analyses the relative predictive power (β) of the constructs was estimated with the help of multiple linear regressions. We were interested in finding the determinants of the *intention to use* Open Access publishing (dependent variable) and their relative *beta* weights. Only one of the original UTAUT constructs could be verified as a significant predictor of behavioral intention: *Performance expectancy*. This construct also had the largest predictive power ($\beta=.316$), followed by *peer use* ($\beta=.221$) and *attitude* ($\beta=.215$; all significant at the $p<.001$ level; $R^2=.386$).

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