

# CHAPTER 14

## Rethinking scholarly publishing: How new models can facilitate transparency, equity, efficiency and the impact of science

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### **Introduction: Legacy publishing systems and requirements for new approaches**

For centuries, the scientific journal has been the medium through which original research findings are reported and disseminated. Up to the late twentieth century, space and cost restrictions, dictated by printed copy formats, were main drivers for scientific publishers to develop processes to help them decide and prioritise what to include in a specific journal volume. However, over time, the development of selection criteria and processes used to identify content that publishers would wish to include in their journals has morphed considerably and is now thought to have had a detrimental effect on the careers of scientists and on the progress of science more broadly. And for researchers working in the Global South and in resource-poor environments, the detrimental effects are thought to have been particularly acute, presenting significant barriers to entry to publish in a highly selective journal market.

Today, scientists from across the world experience significant frustration with both the requirements and processes involved in sharing and disseminating the results of their research. Studies show

that many of the processes and practices used by legacy publishers, which may have been somewhat justifiable in the era of printed journals, are outdated and outmoded, dependent upon complex, cost-inefficient, opaque, time-consuming processes that are largely non-transparent and, taken together, are a significant cause of research funding waste (Chalmers and Glasziou 2009; Chan et al. 2014; Munafò et al. 2017). Delays of months or more between submitting an article and it being published, access and licence constraints, bias resulting from opaque peer review, the tendency to favour the publication of positive results and incomplete availability of data are among the myriad issues that face a researcher wanting to publish research (Warren 2003; Harris et al. 2006; Carrol et al. 2017). Moreover, the determination to publish is often driven by subjective criteria about whether an article contains novel, exciting or radically new perspectives – what has implicitly come in selective journals to define ‘excellence’. Such selection criteria result in the fact that much important, useful work, performed at public expense, is being left unpublished (including for example, negative and null findings). In addition to the resultant waste of resources and the hindering of careers, the advancement of science itself is in large part dependent on the building of such ‘incremental’ results.

Furthermore, the promise and potential for cost reductions in scholarly publishing associated with a shift to largely digital formats (i.e. not print) do not seem to have been passed on to the researcher and consumers of scholarly output, evidenced by escalating costs for publication and journal subscription fees.<sup>1</sup> Added to this, information about what (and predominantly *where*) someone has published remains the dominant currency used across the world to support research and researcher evaluation, informing grant allocation, and career appointments and promotions for researchers and research teams. The need for researchers ‘*to publish and to publish well*’ therefore creates a reliance on an established publishing system and an inertia among publishers to change the service or the status quo.<sup>2</sup>

In today’s world of the web, the costs of space – for paper, printing, shipping and storage – once incurred by scholarly publishers have largely disappeared. Moreover, the ‘costs’ to the reader of combing

through detailed information within an article and the magnitude of articles published in one's field have also largely disappeared, thanks to powerful search tools that enable consumers to zero in efficiently on content of interest. These forces demand that it is no longer acceptable to limit the sharing of science output through selection which is too often subjective and arbitrary. It is time to reinvent outmoded and potentially damaging publishing practices and policies. This particularly applies to the selection process of original research for publication, encapsulated in the recent statement from the leadership of the Howard Hughes Medical Institute (HHMI) that scholarly publishing should move to a system of '*publish first, curate second*' (Stern and O'Shea 2019). The frontier of science communication must be an approach that *combines* the ability of researchers to publish rapidly, without pre-selection according to interest and novelty, with a mechanism to assure quality and trust in the work being published through peer review that is open and transparent throughout. The overall goal is to accelerate access to original research findings of all types, in order to optimise the use, re-use and potential impact of research – indeed to incentivise its creation in the first place. Enshrined in such an approach is the belief that researchers (as authors, users and consumers of research) are in control, thus removing the barriers to publish that disproportionately affect researchers from less-established research institutions or resource-poor environments.

### **The changing landscape of scientific publishing**

Prior to the introduction of the internet, dissemination of knowledge was relatively slow, dictated by largely manual processes for selecting, validating, editing, setting, printing, mailing, archiving and storing research journals. As the system for cataloguing and recording the use and citation of published material developed, so the practice of developing and using bibliometric indicators around how published research was 'used' (i.e. cited) by others became a key component of how a researcher's productivity and 'excellence' was judged. Today, the Journal Impact Factor (JIF) of the journal in which a piece of work is

published remains a remarkably sticky (despite being generally agreed as being misapplied and unhelpful [Zhang et al. 2017]) proxy for the quality of published work.

Since the late twentieth century, enabled by the web, the volume and diversity of research output being published began to increase rapidly, and continues to grow. Access to research has been further facilitated by the introduction of open access (OA) business models across scholarly publishing, first introduced by BioMedCentral (BMC) in 1998,<sup>3</sup> supported by requirements and mandates from research funding agencies and research institutions for scientists to make their work available in OA formats. There have been a variety of responses over time from states and regions across the world to support OA for publicly funded research findings; see, for example, the SciELO<sup>4</sup> and Redalyc<sup>5</sup> initiatives in Latin and South America and the recent cOAlition S ‘Plan S’<sup>6</sup> in Europe. Market share of OA in STM publishing has grown since its introduction to about 12% of articles and 26–29% of journals as of 2017.<sup>7</sup> However, despite many funding agency and institutional requirements and policies to encourage and mandate researchers to share their research through open access, achieving OA as a global standard remains elusive for many practical, economic, cultural and political reasons, compounded by a system of scholarly publishing which has been slow to adapt to the requirements of a digital, OA world.

Despite the growth in the capacity to publish, most publishers continue to hold on tight to their role of custodian and gatekeeper of what science is eventually published in their journal, in large part because, whether they are commercial or non-profit publishers, they must be at least financially sustainable, and in many cases profitable. In the case of non-profit publishers, such as scientific societies, journal revenue often sustains the other activities of the organisation. Over time, many publishers have grown into large corporate enterprises that are accountable to stakeholders and driven by a profit motive that means that the interests of the entity and its stakeholders are often at odds with the interests of scientists and the advancement of science more broadly. The dominant role of scholarly publishers on science communication practices has been hard to loosen, in great part because

hiring, grant-making, promotions and awards have been determined by *where* a researcher has published instead of *what* is being described and the intrinsic value of the insights being published. The fact that many large scholarly publishers are governed by the vested interests of their company shareholders and by profit margins makes for a system that is unlikely to have the interests of science and scientists as its first priority. While individual scientists usually recognise the dysfunction of this system, they generally feel that they are hostage to it, especially early-stage researchers who are dependent on the system to gain a foothold in their career.

For all these reasons, publishing practices are replete with outdated and unfair features. First of all, over time, the judgement of a small number of editors as to the ground-breaking nature, novelty and 'excellence' of research – as indicated by its selection for publication – has proved weak at best. This is not because of any lack of intelligence of editors, but rather because the nature of research is such that it is difficult, if not impossible, in most cases to determine *a priori* what the value of a particular research output will be after it is (or is not) built upon by others. When making a 'value' calculation, it is moreover important to bear in mind that the *ultimate* value of research is its return to the taxpayer (who is the major funder of research), other funding agencies that invest in research, and of course individuals whose well-being depends on it – as measured in human health, agricultural and veterinary advances and environmental benefits. Second, the traditional curatorial function of editors – to comb through many submissions to select the nuggets that they think will be of greatest interest to the greatest number of scientists who may read it – is much less essential now that search tools can in seconds enable scientists to home in on findings of specific interest better than any editor or group of editors possibly could. And third, a huge amount of scholarly output is wasted: because it ages beyond a useful point while awaiting journal acceptance, because most of it is still hidden by subscription barriers from most other researchers who are thus prevented from building upon it, because of limitations in the form and nature of publishable outputs, because of peer review that is only accessible to authors and because of the failure to require that the data upon which claims are

staked be shared with others who may wish to analyse, collaborate and/or reproduce findings.

Nevertheless, driven by a number of influential research funders, institutions and research leaders, change is coming; change that is likely to significantly reduce the barriers to entry to share and publish scholarly work. And change that is significantly likely to benefit those who to date have found it difficult to compete and have equitable access to a scholarly publishing system founded upon criteria of being highly selective and driven by subjective notions of ‘excellence’ and novelty.

### **Science communication at an evolutionary inflection point**

It is evident to those in the field of science publishing and to many scientists worldwide that for these myriad reasons, traditional scientific journals themselves are an outdated mode of building research to the benefit of humankind. Yet, as is predictable with a product that has been the standard – indeed to many people, the only imaginable mechanism for stimulating, rewarding and building science – for over three centuries, it is hard to abandon, notwithstanding widely recognised shortcomings. First, loyalty to the concept of traditional publishing, as well as to particular journals, is extremely strong. Declaring that an author has had a ‘paper’ published in a highly selective journal is in itself often used as shorthand for success and prestige. The prestige of any particular journal has come to be measured by the handy yet misleading JIF. It is very hard to compete with the brand value that the highest JIF journals offer, especially in the crowded marketplace of scientific output. Second, editorial boards, as well as staff editors, identify strongly with the title(s) with which they are associated, often especially so when the titles are published by the disciplinary scientific society to which they have a parallel loyalty. And third, anyone who has ever published in a particular journal during the course of its existence has a vested interest, as well as often an emotional bond, to the journal that conferred prestige on the author by accepting his or her paper for publication.

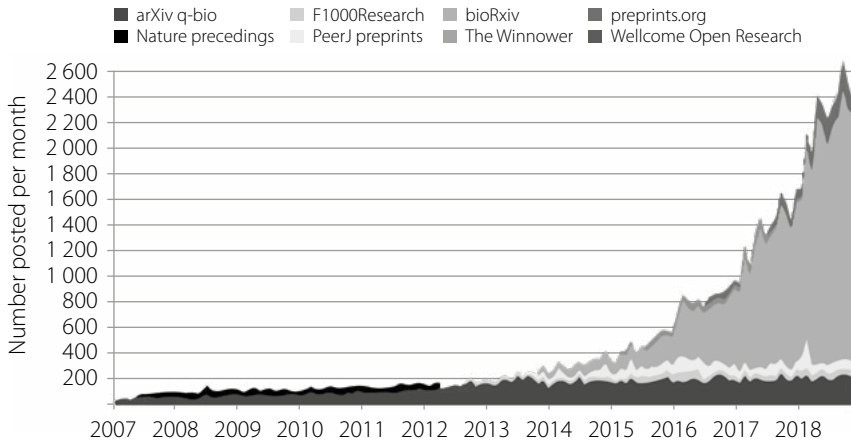
Yet journals, while they have enjoyed an impressive run, are no longer necessary – at least not in their current format as the dissemination point

for original research. Indeed, other mechanisms are potentially much more effective vehicles for the sharing, discovery and dissemination of research results. We have seen the introduction and massive growth of the ‘mega-journals’ (spring-boarded with the introduction of *PLoS One* in 2006),<sup>8</sup> which are designed to select and publish content based only upon ‘soundness’, reducing the editorial function of the journal to a focus on credibility of the work. More efficient tools and services now exist to support discoverability of content and articles; journal editions often contain such a mix of articles that readers are unlikely to be interested in the full range of articles in one edition, and are much more likely to search for specific articles or material to use through bibliographic and citation databases such as PubMed (for biomedical research) and/or Google Scholar, Scopus or Web of Science.

It is incumbent upon policy-makers, governments, foundations, universities, science disseminators and public-interest entities to fully displace any use of the JIF with a more rounded and tailored suite of research-related indicators that can be used to support decision-making, in all its guises, across the industry of sciences, as advocated through DORA.<sup>9</sup> This will clear the way for researchers to publish, share and collaborate around scientific findings in a manner that will speed up the progress of science and increase the fairness of the system used to judge researchers for grants, awards, tenure and promotion. This in turn will enable funders to maximise the value of their research investment.

### **A solution? The growth of rapid and open publishing platforms**

A number of new approaches to scholarly publishing have emerged in the last years, particularly those focusing on the demand among research stakeholders to make findings more accessible at speed. Perhaps the most notable growth has been in the use by researchers of rapid publication platforms such as those provided by pre-print servers such as arXiv, bioRxiv and the open research platforms provided predominantly by F1000 (see Figure 1 which presents the lens of bioscience-related content).

**Figure 1:** Growth in content being published via rapid publication models

Source: [http://www.prepubmed.org/monthly\\_stats/](http://www.prepubmed.org/monthly_stats/)

In 2013, F1000 introduced the first open publishing platform for science, F1000Research, which effectively *combined* the key benefits of pre-printing (*rapid publication*) with peer review (*quality assurance* provided by experts). The approach removes any undue delay with the publication of submitted research, publishing after a series of basic technical, ethical and credential checks (which remains an important component of the validation of research), but before invited peer review is undertaken, termed *post-publication peer review*. F1000 has since worked with a range of funding agencies and research-performing institutions, as its publishing approach chimes with their increasing demands for more rapid and open access scholarly publishing services that present minimal barriers for those wishing to publish, while being cost effective.

And outside the Global North and high-income countries (HICs), and perhaps where research assessment systems are less entwined with a focus on scholarly publications, the introduction of new outlets for sharing research presents an opportunity for scientists. In Latin America, facilitated by the SciELO network, open access to research produced in the region is simply not an issue, as all content is guaranteed OA. Publication of research on preprint servers across the world provides an easy route for researchers to present early sight of their



work. Initiatives to secure full OA, such as Plan S, led by the cOAlition S funders across Europe, are driving the reinvention of legacy publishing systems; this reinvention has resulted in newer models of publishing becoming viewed as part of the mainstream. Researchers in the Global South are effectively in a position to ‘leapfrog’ over much of the legacy system and take advantage of and help shape a new world of scholarly publishing.

There are examples in other sectors that demonstrate how later adopters of technology can leap ahead, bypassing legacy systems and processes, notably in banking, fintech and utilities. In Kenya, more than 90% of the population were without a bank account at a time when 88% of individuals enjoyed access to a mobile phone. Thus Mpesa was introduced, with little notice or resistance from the banking industry, enabling people to move money through mobile platforms. Today, 60% of Kenyans actively move money – from buying bananas from a street vendor to paying for a vehicle – through Mpesa.<sup>10</sup> However, there is only isolated uptake of such technology in the US and Europe.

In recent years, while the quantity and quality of research output has rapidly grown across Africa, the role of legacy of science publishers within this has not been dominant. African scientists have traditionally found it difficult to publish work in journals based in the Global North because of the lack of familiarity among editors with regard to African laboratories and institutions, and the perception of the lesser value of more locally based research findings to a global audience. In 2018, recognising the opportunity to bypass legacy publishing systems for scientists in Africa and to help build reach to findings and research capacity, the African Academy of Sciences took the bold step to launch AAS Open Research. AAS Open Research joined a group of other funder-sponsored open research platforms to demonstrate that new models of publishing (outside of traditional journals) can help to deliver good science that is fully accessible and useable by all.

### **How open research platforms work: Case study of African Academy of Sciences Open Research**

The guiding principle of open research publishing platforms such as

AAS Open Research, provided as a service by F1000, is that they are ‘author-centric’: shifting the balance of power about what is published to the authors and away from publishers. Figure 2 presents an overview of the publishing process adopted by AAS Open Research.

Importantly, the approach, like a mega-journal, is content agnostic and takes a holistic view of the types of research output it can publish – there are no space limitations and there are no editors screening out content for interest. Published outputs include not just traditional research articles, but any research output that requires peer review, including methods, study protocols, software tools, case reports and research notes. While fully open, peer review is not ‘crowd-sourced’ but is invited, and a published piece is considered iterative, not static: versioning is clearly delineated and each revision is entirely open and visible throughout, moving to a concept of continuous publishing.

**Figure 2:** Overview of publishing process used by AAS Open Research



Source: <https://aasopenresearch.org/about>

This transparency applies to the content as well as the reviews, offers credit and exposure not just to authors, but also to reviewers; it also invites the active or passive participation of readers who can benefit from the content of scientific exchange between authors and reviewers. Published work is subject to quality control through the invited peer-review process and is fully indexed after it passes peer review. However, even before indexing, the work is available for others to see and scrutinise (as it is on a pre-print server).

As part of a move to a world of ‘open publishing’, F1000 has been working alongside its platform partner to help shape a paradigm for how original research should be published in the future to maximise its potential for use and to minimise the risk of waste, duplication and redundancy. We consider there to be a number of key requirements for work being published via such an ‘open research’ mode of publishing in order to help to assure its provenance, credibility and trust, and thereby its rigour and potential for use and re-use (see Table 1), though these remain a work in progress. Some of these features (e.g. open access, FAIR data) are finding their way into legacy publishing systems. All of these – and more? – could be essential to underpin a more transparent, equitable, efficient and impactful science publishing system for the future, and one that removes the barriers to publication of research for researchers in the Global South. And we are keen to build the evidence base around how new models work best to support researchers across disciplines, career levels and geographies.

### **Indicators of quality and importance**

In all the opportunities presented by new modes of rapid and open publishing, it is important to remember that researchers still require indications of their productivity and quality of research output and impact. Research outputs, in all their forms, remain a valuable contribution to knowledge, and are the route through which researchers share and communicate their progress and discovery. Such indicators are also vital for users of research findings, such as health professionals, journalists and policy-makers, to help get relevant research findings into policy and practice more effectively and without unnecessary delay. It

**Table 1:** Principles for the publication of original research in an ‘open’ future

Principle	What?	Core aim
<b>Pre-review publication</b>	<ul style="list-style-type: none"> <li>all submissions published prior to peer assessment for research quality</li> </ul>	<b>speed of access to new knowledge</b>
<b>No selection</b>	<ul style="list-style-type: none"> <li>all submissions assessed against only objective technical checks, e.g. plagiarism, ethics, readability, scope</li> <li>no subjective checks for novelty, perceived importance or impact</li> </ul>	<b>reducing reporting bias and publication bias</b>
<b>FAIR source data and resources</b>	<ul style="list-style-type: none"> <li>underlying source data/software made FAIR (findable, accessible, interoperable and re-usable)</li> <li>adhering to the principle of ‘as open as possible, as closed as necessary’</li> </ul>	<b>maximising re-use and enabling verification</b>
<b>Open access</b>	<ul style="list-style-type: none"> <li>immediately OA: open, machine-readable licensing that enables re-use for any purpose, subject to attribution</li> </ul>	<b>maximising access and potential for use and re-use</b>
<b>Open, signed, invited peer review</b>	<ul style="list-style-type: none"> <li>peer review by invited experts; conflicts of interests declared</li> <li>peer review reports openly published, and reviewers named, with the ability to publish new versions</li> <li>peer reviewers able to get visibility and credit for their efforts in supporting the work of others</li> </ul>	<b>transparency, fairness and accountability</b>

remains important that there be credible measures of the value, importance, use and re-use of research findings and data.

Research outputs published outside the traditional journal system, but which secure a digital footprint (e.g. digital object identifiers [DOIs]) and bibliographic record – such as are made available through pre-print servers and open publishing platforms (e.g. *AAS Open Research*) – are as discoverable, trackable, citable and useable as those published within the traditional journal system, except they can be reached and discovered more quickly and openly.

Furthermore, open-peer review is increasingly helping to support visibility and recognition of the work that scientists do as ‘peer reviewers’ in supporting the development of work being published through initiatives such as ORCID and Publons. And, in actual fact, transparent refereeing provides researchers and potential users of research with another marker of quality as a peer reviewer’s credentials; what they say about a piece of research can become part of the assessment, as

well as part of the reviewer's own scientific output, instead of hidden and lost from the public record.

## Conclusion

There is massive change afoot in the scholarly publishing and communication system. The balance of power is shifting as researchers, funders and institutions are demanding more rapid access and usability of research findings. We know that many of the processes and systems intrinsic to traditional science publishing are increasingly outdated and anachronistic. And we know that the ecosystem for research and researcher evaluation and assessment has been built upon an unhealthy and misleading dependence on indicators of research quality and value, based largely upon a judgement about *where* someone has published their work instead of *what* has been discovered and how research might have value in all its forms. But we believe that this is changing. New modes and outlets for sharing research outputs are reducing the practical barriers for researchers from across the globe wishing to share their findings and participate in a more connected and open science system.

In the absence of complex research assessment systems focused upon scholarly publications and many of the constraints and legacy systems and processes that researchers in HICs face, researchers in the Global South are in a good position to 'leapfrog' over established systems of publishing and to take advantage and help shape this new world of scholarly publishing. Adoption of models with features such as those integral to AAS Open Research can put researchers in control of what they wish to share, and enable the publication of insights and findings that are important in a global, regional and local context, no matter how ground-breaking or 'excellent'. And, most practically, changing the paradigms and basis upon which research is *selected* for publication effectively frees up researchers to be honest and holistic in what they share.

Many of the challenges in making this shift are more philosophical, financial and political than technological. They involve rethinking how stakeholders can work together to provide solutions and services

that can be best tailored to support rapid, shareable publication and access to research findings. We believe that this challenge signals an inflection point that presents researchers in low- and middle-income countries – where dependence on legacy publishing systems, cultures and assumptions is less of a barrier than elsewhere – with unique and important opportunities to lead the way.

Research has value in many different ways and in many different contexts; that why it is done in the first place. Communicating what is found (or not) during research, and most especially when this involves the use of scarce resources, is a core requirement of the research process. It is, and always has been, an essential part of the research process; remodelling how that research is shared and published to improve access, to enable use and re-use and to reduce waste makes for an effective and efficient science system – with benefits for all concerned.

## Notes

- 1 See for example: <https://wellcome.ac.uk/funding/wellcome-and-coaf-open-access-spend-201617>
- 2 See analysis: <https://www.forbes.com/sites/stevensalzburg/2019/04/01/nejm-says-open-access-publishing-has-failed-right/#31b8b0d76a44>
- 3 <https://blogs.biomedcentral.com/bmcblog/2015/10/22/history-open-access/>
- 4 <http://www.scielo.org/>
- 5 <https://www.redalyc.org/home.oa>
- 6 <https://www.coalition-s.org/>
- 7 <https://www.zbw-mediatalk.eu/wp-content/uploads/2017/07/STM-Report.pdf>
- 8 <https://www.plos.org/history>
- 9 <https://sfdora.org/>
- 10 See: <https://lup.lub.lu.se/student-papers/search/publication/8952015>

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