Plan S: response to a revolution in publishing

Academic publishing has evolved over a long period of time. As such it functions as a complex ecosystem. It is the place where academics share the findings of their research with colleagues and with the wider public. It is also the environment in which the lives of academics are played out. Academic publishing serves different academic communities in different ways and, like any complex system, suffers from a range of local and systems-wide problems. This is where Plan S comes in.

Plan S has been drawn up the European Commission and is being promoted by a host of important research funders from across Europe. It is designed to change the way academic publishing is funded and disseminated and, more ambitiously, aims to alter the culture of publishing. While many of its aims are laudable, concerns have been raised about the potential impact of Plan S, its attempt to impose new rules on the system, and the speed with which its authors aim to implement it. Cultural revolutions have unintended consequences and their effects are hard to foresee.

As anyone will learn if they step into the coffee room in any academic institution, the current publishing system has a host of problems – both real and perceived. There are problems with peer review (e.g. academics using their power as editors and/or reviewers with top journals to dominate or to police a field), the time taken from submission to publication (and rejection), journal impact factors being used as proxies for paper impact (something that the community tried to address using the DORA declaration), the dominance of some commercial journals (the highest the impact the more pain they inflict on individual members of the community), and problems with the quality of publications themselves (plagiarism, fraud and a worrying lack of reproducibility in some fields).

Moreover, with the rise of online publication and of publications from academics in Asia, the system is evolving fast. There are now an estimated 3 million papers per year and a burgeoning number of new journals. The publishing landscape has also been affected by the advent of pre-print servers, where papers can be posted immediately without peer review, and journals like PLoS ONE that have minimal requirements for novelty. All this is changing the nature of science and its communication in dramatic, exciting, but unpredictable ways.

Because science (meant in its broadest sense) and the communication of science are intimately connected, the impact of these changes is profound. Since publication is the main output of many academics, publications function as one of our main bodies of collective human thinking and understanding. It is the main outcome of much research funded by governments and charities. It is a source of “public knowledge” that is used to advance technology and to make policy everywhere. (Although publications are held back for the purposes of patenting and researchers in the private sector tend not to publish their research). And, of course, publication plays a major role in the lives of academics. If someone else publishes first, it hurts. Such events can determine whether an academic is hired or fired. It is the river in which academics swim.

While most of the problems of academic publishing seem hard to grapple with, there is a widespread feeling that there is a problem with the costs of publishing and accessing published work that could be addressed with concerted effort. This is because there is a clear perceived injustice. The complaint is that journals charge authors to publish, without

granting them copyright, while relying on academics to review the work of their peers for free, and charge the same academics and their Institutions to read papers. This costs the research community money. Moreover, because of the demand for access to papers, many of the most highly-prized and successful journals make large profits – something that causes widespread anger – even if some of these profits are used to the benefit of the community. A biproduct of this financial arrangement is that the latest raw data and thinking, together with reviews written by academics to explain their latest discoveries in their fields to broader communities, are not free for everyone to access at the time of publication.

This has led to calls for “Open Access” - a system that enables everyone to access papers and data freely as soon as work is published. This makes sense to funders who want the work they fund to reach the widest possible audience and who don't want to pay library charges. In the case of government and charity funded work, it makes the fruits of funding available to the people who paid for it - the public. It also makes sense to Industries across the world who benefit from having access to immediate academic findings for free.

Over the past 10 years, in response to this push, many journals currently have started giving authors the option of publishing via Open Access for a charge. However, even then, most continue to enforce an embargo period (6-24 months), during which time publications are not free to view, so that the same journals can leverage money from individuals and libraries as subscription fees. As a result, academics and students from many countries cannot access much of the latest research. This is unfair. This is another way in which the modern world continues to disadvantage the poorest communities.

While the behaviour of journals puts up barriers to access, many academics still choose to publish in journals like Cell, Nature and Science that are not fully Open Access. Why is this? Counterintuitively, academics choose to do so precisely because these are the journals that best guarantee a wide readership. Papers in these journals get picked up by news outlets. It is papers in these journals (often behind paywalls) that will reach workers in other fields and in other countries, that get prizes, and that cause trouble when they are found to be fraudulent. The famous MMR-autism paper was published in one of these journals. The paper was found to be wrong and was retracted, but this has not stemmed the impact of this type of bad science, since this paper is still used by concerned parents around the world who are worried about vaccinating their children as another reason to distrust the establishment.

It should therefore be clear that increasing the number of Open Access publications will not, by itself, lead to the fruits of research being more widely read or understood. This isn’t just a problem for the wider public. Few scientists have the skills required to assess the quality and likely impact of work outside their core discipline. A biologist who works on cell growth may have little understanding of cell death. Scientists rely on reviews to get up to speed in areas they are unfamiliar with, just as students do everywhere.

Moreover, even if publications could be accessed freely, it is near impossible for most people to gain access to the knowledge, expertise, tools and materials required to understand and critique papers, let alone to build on or debunk published work. This is why the best students apply to research active Universities. Scientists travel to meetings and

workshops to seek out and share this expert knowledge. Open Access is not the same as Open Science. And making all publications accessible won't by itself increase scientific literacy.

The realisation that there are problems with the way the system works, however, has led to Plan S, and a push towards universal Open Access. The question is, how will Plan S change things? Plan S's stated goal is to force journals to comply with new Open Access rules so that everyone has immediate free access to publications. At the same time, it is hoped that this will also reduce publication costs and journal profits. Although some of its goals are laudable, there are several potential problems with Plan S as currently framed:

1. It is a very heavy-handed solution to a perceived problem that is unlikely to lead to a significant improvement in the way the latest fruits of academic research are communicated to the public in a way that makes the research accessible. Despite being of arguable benefit, Plan S hopes to up-end a complex ecosystem that has evolved over hundreds of years.
2. It is being implemented incredibly quickly (early 2020), seemingly without a proper assessment of the risks and the potential for negative unintended consequences for specific communities (e.g. society journals, early researchers, retired researchers, self-funded researchers, researchers in fields that don't own their own data and so who cannot own the copyright).
3. It forbids journals from using a hybrid model in which some papers are published via Open Access while others are not. Thus, Plan S seems to be designed to force journals to make ALL publications are Open Access. This will kill many journals that rely on the hybrid model to keep the costs of Open Access fees down and to remain financially viable model.
4. Plans S aims to introduce a cap on the cost of Open Access publication. The value of this has yet to be set. However, if the cap is set low at a flat, low rate, e.g. €2000 per publication, many journals will fail (although many of these would be viable under a hybrid model in which a mix of Open and non-Open Access is allowed). Moreover, introducing a flat rate will establish a new market that could well drive a race to the bottom, since publishing a small number of excellent papers that make it through stringent peer review is expensive. Perhaps some journals will move to an advertising model – publishing industry-funded "papers" alongside peer-reviewed academic papers?
5. It aims to reduce the embargo time of publication from 6-24 months to zero. While this may be useful in some instances, it is important to realise that nothing should be deemed to be true by the public until the expert community has had a chance to replicate and test published findings. Failing to appreciate this could have serious consequences. In addition, real inequality will remain in the system, since certain academics will have been aware of the work months or years before it is published through meetings and by acting as peer reviewers or editors.
6. Open access will not, by itself, have much impact on the ability of more people across the world to understand and engage with the latest research.

When considered in the round, it therefore seems that Plan S's is not designed solely to promote Open Access. It is also aimed at preventing journals from making large profits. In

addition, it seeks to force through a rapid wholesale change in the culture and market of academic publishing, from the top down. If executed as currently formulated, Plans S is likely to have many negative unforeseen consequences for publishing, science and academia, some of which could be profound.

Strikingly, despite these obvious concerns, there appears to have been little effort to carry out a comprehensive assessment of the potential negative consequences of Plan S. Why is it, for example, that despite funding from organisations like Wellcome, there has not been more take up by journals and academics of Open Access publication? Finding out will help identify real problems on the ground.

Below we look at some of the specific aspects of Plan S and suggest a few things that should be addressed before it is implemented.

1. The stated goal of Plan S.

Open access publication is widely agreed to be a good goal. However, it's shouldn't be our only goal as a community.

Goals to improve the current system should include moves towards:

a. Rapid barrier free communication of new scientific findings to everyone across the world.
b. Expansion of the ability of everyone across the world to do and use cutting edge science.
c. Efforts to enhance scientific literacy worldwide.
d. Better science publishing: wider high-quality peer review and better reproducibility, less science fraud.
e. Removal of double charging by journals for both publishing and access to publications.
f. Efforts to ensure that academic institutions everywhere follow the paper not the journal (DORA) in hiring promotions etc.

Plan S could help **1a** and **1e.**
Plan S is unlikely to deliver **1b**. We don't try to raise the quality of learning in schools by putting all materials online.

i) Plan S is unlikely to deliver **1c.** If there is a deluge of data in new journals whose record of peer review is not established and a loss of well-established society journals – it will be hard for anyone to know what is *good science.* Just look at the effects of the internet on science literacy! The problem with the MMR vaccine paper is that people still believe it after it has been retracted – including the President of the United States. This is a problem with **1c** above not with **1a.**
ii) If the goal is to address **1a** and everything is published openly online in a machine-readable form (as has been suggested), the ability to do and use science will not necessarily become more equal (**1b**). More of the data will be used by companies (like Google/Pharma) for profit. How can the private sector be made to pay for access the results of publicly funded research?

iii) It is easy to set up large cheap Open Access journals. Good peer review costs money and requires communities of experts happy to peer review for free. Thus, Plan S may severely compromise the quality of science itself.

iv) As currently formulated, Plan S fails to take into account the real revolution in publishing (e.g. pre-print servers, self-publishing and journals like PLoS ONE)

2. Questions about Plan S

a. If the goal is open embargo-free access, why not push academics to publish everything before and (in an accepted form) at the time of publication on pre-print servers? This costs very little, means extremely rapid access to the latest science as it is generated (which is currently seen prior to publication by a clique of reviewers who sometimes act as gatekeepers that protect their own interests), enables the value of peer review in different journals to be assessed, and could easily be mandated by funders and academic institutions.

b. If publishers open access is the goal, why does Plan S focus on the journal model? Why shouldn't journals work under a hybrid model? The reason given by the promoters of Plan S is that the system hasn't switched to all open access. By why then is the goal to force 100% take up of open access for ALL academic publishing? Why don't funders simply ensure that all their funded research is published in Open Access form without an embargo?

c. Because of Plan S's focus on journal model it appears that the true goal is **1e**. This means that, for all the high-minding talk about Open Access and a change in science culture, the real issue is money. The goal is to break the rich journals who are deemed to make too much profit and who are resented by so much of the community (largely because they employ non-academic editors to reject so many of our papers – note this they do for free).

d. The level of the cap on open access charges is critical. If the cap is low (say €2000), many journals will likely fold. This may lead to a race to the bottom. If the cap were linked to the quality of services offered by a journal – how could this be fairly and effectively implemented and policed?

e. Why shouldn't academics be free to choose where best to publish their work? This freedom is enshrined in the German constitution for a reason (past experience).

3. Potential unintended consequences of Plan S.

a. Different fields will be affected in profoundly different ways. Some fields may be very adversely affected.

b. Some researchers may be more affected than others, e.g. retired and early stage researchers.

c. Journals that can't deliver publication with peer review for the cost of the cap will fail. This is likely to include academic/society journals) If these fail it will have a profound impact on entire communities of experts. For example, the UK Company of

Biologists funnels profits into conferences across the UK and travel for young scientists. This would all end. Who would pick up the tab?

d. If Plan S is implemented it seems likely to induce widespread changes in the way publication works.

i) Attempts to get rid of very profitable high-profile journals will likely fail. Not all journals are equal. Not all journals can be equal. Rich, powerful high-profile journals will exist after Plan S in part because we need some way to keep track of the "most important" findings in amongst the enormous mass of papers published. While the current system is not perfect, there is no reason to think it will be better post Plan S. Scientists try to publish in Science and Nature to avoid their work being lost in the noise, and to better communicate their results to a wider audience. In this, these journals provide a good service. This is why so many academics and non-academics read Nature and Science. At the same time, these magazines play an important function as news outlets that help to explain science to the wider public and to influence current and future scientific debates. Thus, it seems likely that a change in the model would simply shake up the system and lead to new "top" journals taking the place of many of the current (especially society) journals. Would UK and European science really be well-served if Nature folded?

ii) The function of journals to publicise science is changing with Twitter and other Apps. As we have experience with politics, Twitter-based communication doesn't ensure the wider dissemination of fact over fiction. It simply means that popularity (e.g. number of followers) is everything. Scientists are learning to promote their own work – leading to a diminished role for editors/reviewers. If things move towards self-promotion with Plans S-style open access, might we all be poorer for it?

iii) Peer review takes time and is expensive. If there is a cap then it could trigger the formation of a host of new journals that deliver open access on the cheap and a race to the bottom. To make a profit, journals can compromise on editorial oversight and peer review. If everything shifts to new open access journals will this get worse or better? How could one ensure that Plan S doesn't inadvertently compromise Science itself (**1d**)?

iv) Many academic and professional editors at current journals possess valuable knowledge and experience that contribute to high quality science publishing. How is this expertise going to be taken into account when assigning cap charges to journals?

v) If cost is the main problem, a *"good"* outcome of Plan S might be the establishment of a raft of new academic publishers, e.g. in Asia where publication could be done on a larger scale and more cheaply (as for DNA synthesis). If such a shift occurred, how would the supporters of Plan S ensure that current standards of peer review were met/improved?

e. If Germany, the USA and China do not sign up to the plan – then Plan S could split the world science community. How would this impact on science and science mobility? What might this do to European science in the long term?

4. What to do about Plan S?

A careful risk assessment needs to be done to check with all fields to determine the likely impact of Plan S, and to assess and ameliorate likely unintended consequences. Is the goal to reduce costs or to increase open access? These are different.

Academic institutions should decide where to comply and where not to comply with Plan S if implemented – and should communicate their reasoning with researchers and funders.

If China and the USA don't sign up, what happens to Plan S?
Can the timeline of Plan S be slowed?
How can it be made more flexible?

Academic institutions should work together with other organisations who haven't signed up to Plan S to make sure there is a coherent and intelligent and thoughtful response to the challenge posed by the agencies who have framed and are promoting Plan S? It is important to realise that publishers, the targets of Plan S, are likely to fund it hard to get their voices heard otherwise.

5. What could be done to help improve the system?

Academic institutions should do more to look at how best to achieve the other goals (listed in 1 above) and ask funders and learned societies to help with this, e.g. to widen scientific literacy and access to science.

Open access is a good thing. It can be promoted without destroying the whole publishing ecosystem. Academic institutions could help push this by encouraging people to put papers on pre-print servers, to post accepted manuscripts on servers, and by helping authors explain their science (e.g. as we do at the LMCB (https://www.ucl.ac.uk/lmcb/news/), and making raw data available (e.g. via EMBO J. - http://www.embopress.org/sourcedata).

Perhaps academic institutions should take control and publish their own papers in an open access form?