



Deliverable 3.3 - Application framework and transformation scenarios for open peer review

OPENingUP new methods, indicators and tools for peer review, impact measurement and dissemination of research results

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Summary

Open peer review (OPR) is attracting increasing attention, but it is often poorly understood and surveys of researcher attitudes show important barriers to implementation. As more journals move to implement and experiment with the myriad of innovations covered by this term, there is a clear need to produce guidelines to best implementation and to develop a framework within which the success of these initiatives can be assessed. This document aims to address these knowledge gaps, reporting work based on literature research, expert interviews and an interactive stakeholder workshop to: (1) create best-practice guidelines for editors and journals who wish to transition to OPR; (2) create a framework for data-sharing amongst publishers regarding OPR and construct a shared agenda for assessment of the efficacy of OPR approaches.

The OpenUP project

Open Access and Open Scholarship have revolutionized the way academic research is evaluated and published, while the introduction of new technologies and media in scientific workflows has changed the “how” and to “whom” research is communicated, and how stakeholders interact with the research community. The OpenUP project studied key aspects and challenges of the currently transforming research landscape to provide a cohesive framework for the review-disseminate-assess phases of the research life cycle that is fit to support and promote Open Research and Open Science.

The OpenUP partners engaged in an overarching research exercise (see Fig 1). It included landscape scans of literature and a Europe-wide survey of researchers on the key topics of the project, open peer review, innovative dissemination and altmetrics. The consortium reached out to the main experts and stakeholders in the review-assess-disseminate areas to gather their inputs on the current practices, challenges and the latest developments. OpenUP engaged with all the stakeholders via a series of outreach and training events, and a newly created OpenUP Information Hub. The OpenUP Hub is a collaborative web-based platform that hosts a catalogue of open tools, services, methodologies, best practices from various disciplines and success stories that can be used by researchers, policy makers, funders and other interested parties. All the project’s results were tested through a series of pilots involving researchers from four scientific communities (Life Sciences, Social Sciences, Arts & Humanities, Energy Sciences). The final recommendations of the OpenUP project will be evidence-based and validated practical guidelines directed to the EU, national and institutional policy makers researching ways to address the emerging challenges and adapt to the rapidly changing scientific research landscape.

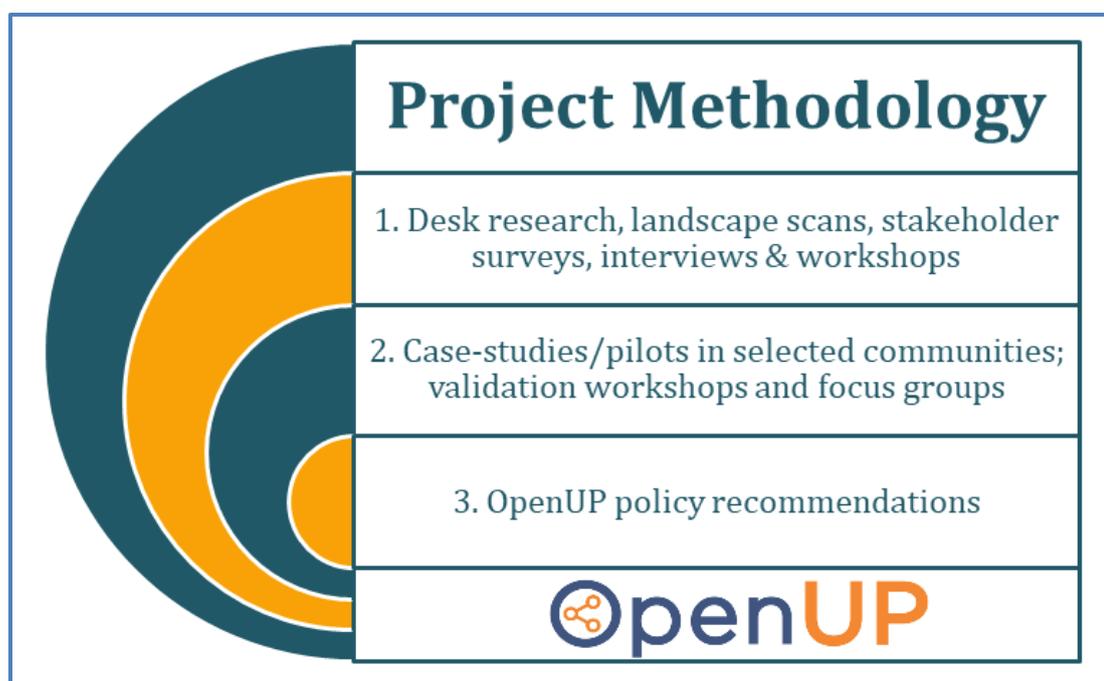


Figure 1 OpenUP project methodology

1 Introduction

1.1 What is open peer review?

Informally, peer review is the development of nascent ideas and theories through critical discussion with others. As such it is as old as knowledge creation itself. Its stricter sense – the formal scholarly publishing process where an editor sends copies of a manuscript to people judged knowledgeable enough to be able to comment on its suitability for publication – is more recent. In this mode it has been the default of academic publishing only since the mid-20th century.

Peer review serves to validate the soundness, substance and originality of a work, to help improve it until it meets required standards for these criteria, as well as sometimes to select for "appropriateness" or "fit" for certain journal titles. Peer review, in its current form, is typically:

- **Anonymous:** either the author doesn't know who the reviewer is (single-blind) or author and reviewer are unknown to each other (double-blind). In some cases, authors identities are also hidden from editors (triple-blind).
- **Hidden:** the process takes place behind closed doors (or, rather, password privileges) and reviews are not published.
- **Selective:** reviewers are chosen by the editor.

Studies have shown that although academics are, on the whole, fairly content with peer review, they think it could work better (Nicholas et al., 2015; Ross-Hellauer et al., 2017). Problems include:

- **Accountability:** The anonymity of reviewing, although in principle meritocratic (as junior researchers can criticise the work of luminaries without fear of reprisals), also makes it unaccountable. Should professionals cast judgements in secret? Shouldn't they be prepared to stand openly by what they believe? Relatedly, would reviews conducted in public be more constructive and less confrontational? Finally, that the peer process takes place behind closed doors also likely aids misconduct or undisclosed conflicts of interest avoid detection.
- **Bias:** Given the specialised nature of academia, a researcher's nearest "peers" will often be known to them as either friends or competitors. This fact naturally leads to concern that rejection or acceptance might sometimes have social, rather than scientific, grounds. Even where authors' names are withheld, it is often clear from the research itself (or a cursory Google search) who the author is. If reviews were public, such biases might be further suppressed.
- **Inconsistency:** The subjective nature of peer review means it often results in reports which diverge in their judgements. Furthermore, peer review can often fail to detect errors. Could models of open peer review help counteract such effects?
- **Time:** Peer review often takes a long time. Could open review help speed up the process?
- **Incentive:** Reviewing, done well, is hard work. If reviews were open, busy academics and researchers could take credit for them, demonstrating experience, community involvement, and impact.
- **Wasted effort:** Reviewer comments often add context or point to areas for future work. Reviewer disagreements can expose areas of tension in a theory or argument. Readers may find such information helpful and yet, at present, this potentially valuable additional information is wasted.

As the open science agenda has taken hold, "open peer review" (OPR) has been proposed as a solution to some of these problems. By bringing peer review into line with the aims of open science, proponents aim to bring greater transparency, flexibility, inclusivity and/or accountability to the process. Various innovative publishers already implement systems that identify themselves as OPR. However, such

these claims, finding that in general “there is often little evidence to support or refute many of these claims”:

- **Accountability:** The increased transparency offered by open identities and reports could increase accountability and make reviewer conflicts of interest more apparent. Open participation could reduce possible problems with biases or elitism associated with editorial selection of reviewers; on the other hand, it could engagement by those with conflicts of interest (particularly where anonymity is allowed). Open identities is sometimes theorised to discourage reviewers from making strong criticisms, especially against higher-status colleagues – if true (and there is little evidence against which to judge this), this could subvert review by weakening criticism.
- **Bias:** Open reports allow the scientific community to examine how publication decisions were made. However, open identities removes the anonymity for reviewers (single-blind) or authors and reviewers (double-blind) which has traditionally been used to counteract such biases.
- **Inconsistency:** Open identities and open reports could improve the quality of reviews, encouraging reviewers to be more thorough in their assessments (although there is too little evidence to say if this is the case). Open participation, by increasing the number of potential reviewers, could lead to more thorough review processes (although note that open participation processes often fail to attract large numbers of comments). Some evidence suggests open interaction could increase accuracy of reviews.
- **Time:** Publishing manuscripts online in advance of peer review, either as pre-prints or as part of the publisher workflow, speeds up dissemination and (in disciplines like Physics) enables researchers to claim priority in a finding. Open platforms could help avoid cycles of review, where articles are submitted to various journals before finally being published and are reviewed anew each time. However, open identities and open reports could increase delays by increasing the number of reviewer invitations needed to secure the required number, and open interaction could delay processes by leading to cycles of comments back and forth between reviewers and authors.
- **Incentive:** If review reports were published alongside reviewer names, it would be easier for researchers to claim credit for these activities, thus incentivising review. Open participation could incentivise researchers by allowing them to seek out works they want to review.
- **Wasted effort:** Rather than hiding the useful contextual information contained in peer review, open reports would make this available.

The study concluded by noting that although OPR covers a multitude of combinations of discrete innovations, this need not be seen as a problem, but rather an advantage: “The large number of possible configurations of options presents a tool-kit for differing communities to construct open peer review systems that reflect their own needs, preferences and goals”. This, however, raises the question of which systems *are* best for these different communities.

1.2 Attitudes amongst researchers

Evidence to answer these questions comes in the form of two stakeholder surveys conducted by the OpenUP and OpenAIRE projects:

OpenUP survey 2017 (Görögh et al., 2017): The OpenUP survey was conducted between 20 January and 23 February 2017 with an aim to capture current perceptions and practices in peer review, dissemination of research results and impact measurement among European researchers. It was implemented via online survey and directly targeted to mined contact details of the main authors of publications stored in arXiv, Pubmed and RePEc. The survey received 1347 responses, of which 976 were completed. On peer review, the OpenUP survey found that when asked their preferences for review

of their own research outputs between more open peer review or the established peer review process, in some categories there was no unanimous preference among the researchers. For instance, 42% of the researchers preferred open participation (when a wider community of the researchers contribute to peer review) and 41% supported closed participation (only appointed peer reviewers contribute to peer review). Also, small differences were noted among the researchers who ‘strongly supported’ or ‘supported’ open report (review report is published alongside the relevant article), and closed report (no review report is published alongside the relevant article), and who assigned open pre-review (manuscripts are made available to researchers/public before formal peer review), and ‘no open pre-review’ (manuscripts are not made available to researchers/public before formal peer review) to the same categories. Nevertheless, the majority of researchers expressed similar opinions on some aspects of peer review. There were nearly 30% more respondents, who preferred closed identity (when neither the author’s nor the reviewer’s identity are disclosed) than open identity (59% versus 29%). Female researchers supported open identity over closed identity more than male researchers (i.e. 35% versus 26%). On the other hand, female scientists were much less in favour of open pre-review (33% versus 51%). More than half of the survey respondents showed strong support for open final version commenting (54% in favour of open final-version commenting versus 27% in favour of established practices) and more than two thirds supported open data review compared to no data review along with the paper (71% versus 14%).

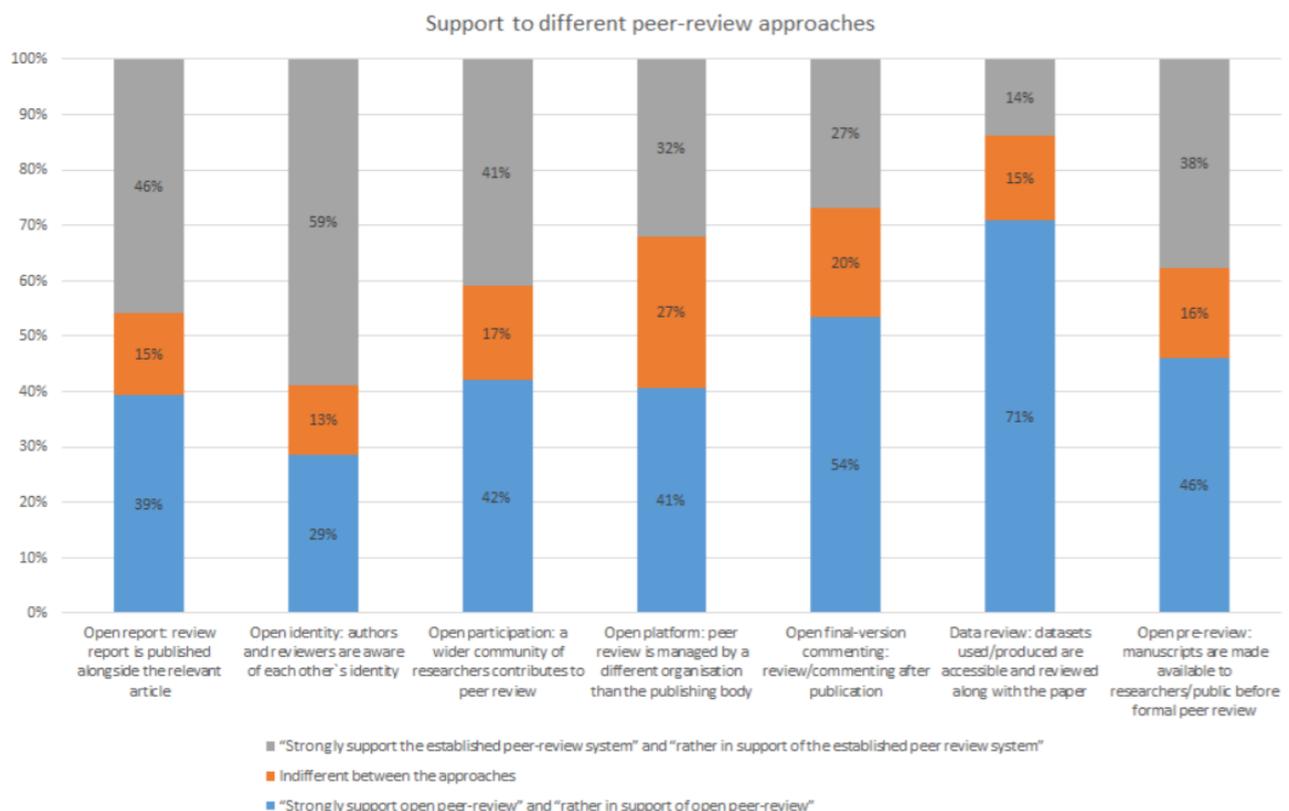


Figure 3 Proportions of respondents attributing their support to different peer-review approaches (Görögh et al., 2017)

OpenAIRE survey 2016(Ross-Hellauer et al., 2017): OpenAIRE conducted an online survey of 3062 editors, authors, and reviewers during September and October 2016. The full survey results, recently published in PLOS One, show the majority of respondents to be in favour of OPR becoming mainstream scholarly practice, as is the case for other open science practices, like open access and open data. We also observed surprisingly high levels of experience with OPR, with three out of four (76.2%) respondents reporting having taken part in an OPR process as author, reviewer, or editor. There were

also high levels of support for most traits of OPR, particularly open interaction, open reports, and final-version commenting. Respondents were against opening reviewer identities to authors, however, with more than half believing it would make peer review worse. Overall satisfaction with the peer review system used by scholarly journals seems to significantly vary across disciplines.

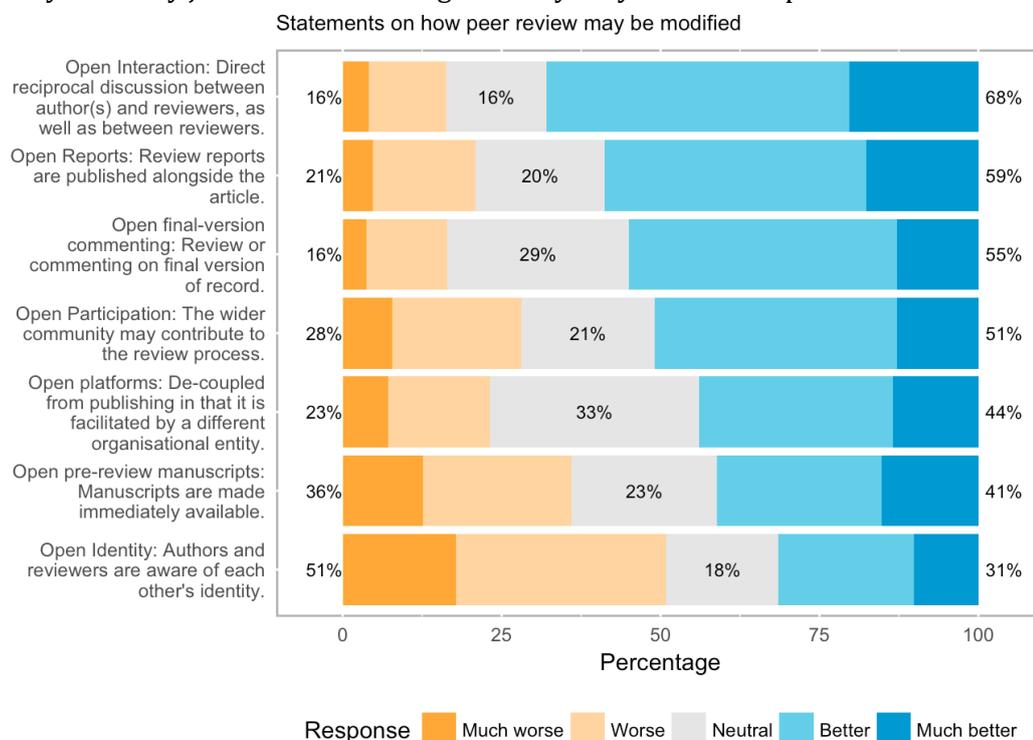


Figure 3 Will XXXX make peer review better, worse, or have no effect? (Ross-Hellauer et al., 2017)

1.3 The way ahead

Taken together, these findings are very encouraging for OPR’s prospects of moving mainstream but further indicate that due care must be taken to avoid a “one-size-fits-all” solution and to tailor such systems to differing (especially disciplinary) contexts. They also show clearly that more research is needed. OPR is an evolving phenomenon and hence future studies are to be encouraged, especially to further explore differences between disciplines and monitor the evolution of attitudes.

There is hence an urgent need to offer further clarity on OPR, guidelines for effective implementation to foster innovation, and a need for publishers and researchers interested in OPR to come together to share data and scientifically explore the efficacy of OPR systems as part of an Open Peer Review Assessment Framework.

This report aims to address these needs. In what follows we report work based on literature research, expert interviews and an interactive stakeholder workshop to: (1) create best-practice guidelines for editors and journals who wish to transition to OPR; (2) create a framework for data-sharing amongst publishers regarding OPR and construct a shared agenda for assessment of the efficacy of OPR approaches. The findings and recommendations have been gathered iteratively, via literature review and background research to map the landscape, broad-ranging expert interviews (n = 4) to map out the broad problem space, an expert workshop attended by 14 experts on peer review and OPR, which was preceded by a questionnaire to collect, synthesise and validate best-practices on OPR implementation and to discuss the possibilities for future collaboration to deepen research into OPR.

2 Implementation guidelines for editors and publishers

2.1 Aims

This section seeks to be of use to those who oversee the peer review of manuscripts for publication who are considering introducing more transparency or inclusivity to their peer review processes by implementing any of the innovations grouped under the term “open peer review”. As shown above, OPR is attracting increasing attention, but there are a diverse cluster of interrelated but distinct innovations, which can be combined in a myriad of combinations, that fall under this term. Hence any publisher wishing to move in this direction faces crucial choices about which elements of openness to embrace, and these decisions will in their turn expose them to potential advantages and disadvantages for the quality of their peer review systems. Which OPR system is optimal, for which communities and in which circumstances? How should these systems be implemented, and what opportunities and pitfalls should be recognised? This section offers concrete advice to answer these questions gained from background research, expert interviews and an expert synthesis/validation workshop. It first gives general advice which cuts across all OPR elements, before going on to detail specific advice for each of the OPR elements.

Although the advice is directly mainly at editors and publishers of scientific journals, since this is the area in which OPR is at its most mature, many of the principles may also be applicable for the implementation of OPR in other areas (e.g., books, conference submissions).

2.2 General advice

2.2.1 *Learn from existing models and implementations*

Any journal editor or publisher wishing to implement some form of OPR would be well-advised to first do their homework. Study existing models and OPR implementations through publisher websites, published literature, presentations and online resources. Use industry contacts and discussion platforms to discuss and learn lessons from publishers and journals who have already implemented OPR procedures. Examine which particular aspects of your peer review process you would like to improve – for example transparency, participation, speed – and choose the elements of the process to open up based on this.

2.2.2 *Listen to your research communities*

Next, engage journal communities – firstly by consulting your editorial board and reviewers to get them on board with the idea. A committed and engaged Editor who can drive such discussions will really help. Find keen researchers to work with and gauge interest in the model among communities the journal serves. Let their reviewers, authors and readers know in advance, and if you are unsure of how such developments might be received, consider announcing plans in a journal editorial and seek community feedback. Be conscious that there will be differences in perceptions and willingness among different research communities. Consider starting with particular disciplines that are more open to trial OPR, especially those where other journals in the field already use OPR (although note that this may be challenging for broad scope interdisciplinary journals). For journals with close-knit communities, for example society journals, which regularly seek feedback from authors or society members regarding journal policies, consider including questions regarding open peer review models to gauge attitudes directly.

2.2.3 *Be pragmatic in your approach*

Next, be flexible and choose your battles carefully. Change is difficult and you may run into problems if you try too many things at once. Your communities may be more receptive to some elements than

others, and so prioritising the areas you would like to change and being prepared to compromise from the ideal situation or at least take a phased approach may help you maintain traction and community buy-in. It will also make it easier to systematically assess the success or otherwise of any particular innovation. Another option would be to make elements you would like to introduce optional. In that case, it would still be possible to signal your support for this innovation by making it the default option and inviting reviewers or authors to opt-out via a question positioned within the review report screen. From the user surveys discussed above, for instance, it seems that researchers are far more favourable to the idea of open content of reports than open identities, and so if you do wish to support both these options you may make open reports compulsory but make open identities the default, but optional, choice.

2.2.4 Plan technologies and costs

A deciding factor in your prioritising the elements of openness to include will be the technical possibilities of your system. Whether you are a small publisher using open source software or a large publisher which uses one of the major manuscript handling services, if your electronic editorial office and production/publication systems and workflows cannot currently be easily configured for OPR elements, they may be difficult and/or expensive to implement. Ask yourself: Which options does your system already support, and do you have the technical staff or resources to fund system development? Consider also that costs will likely not only be in initial implementation (e.g. custom system development), but also ongoing support costs (e.g. staffing). It is important to recognise potential costs in advance. If you are just experimenting with OPR, it may be that rather than immediately extending your whole publication architecture, it might be better to start small with work-arounds, although be aware that ad-hoc work-arounds may produce a less smooth user-experience which could affect uptake and user attitudes to the experiments. Consider, however, that the sub-optimal nature of work-around solutions may then become an inhibiting factor in the success of the experiment. One solution here would be for a third-party OPR platform to offer their service as a plug-in to existing workflows for conducting such experiments.

2.2.5 Sell the concept

Once you have decided on the model you'd like to move to, you have your communities on board, and have prioritised which OPR elements to implement, you'll still need to sell your communities on the concept. As a general strategy, you should engage with the research community to find academics who are enthusiastic about OPR to be "open champions" in advocating to their peers. The arguments in section 1.1 above in favour of the various aspects of OPR will help sell the concept, especially with regard to increasing transparency, enhancing credit for review activities and demonstrating, and (although this is an understudied area) potentially enhancing the quality of reviews. Finally, be aware that communication is key and terminology is important. Use editorials, webinars, infographics and/or blog posts to articulate decisions and justify why these decisions have been made.

2.2.6 Watch out for pitfalls

As the stewards of the peer review process, publishers and editors have a duty of care to ensure reviewers and authors fully understand the systems of peer review in which they participate, and its potential advantages and disadvantages. Misunderstandings could derail processes.

Researchers often have strong feelings about OPR, and not all of them are positive. Ensuring dialogue with your journal communities in advance will help garner support for the process, but especially with open identities, many will remain reticent. In particular, there is a persistent concern that reviewers (and especially early career researchers) might either put themselves at risk of retribution from more senior colleagues whose work they openly critique, or that they will temper their criticisms to avoid such negative consequences (thus leading to less stringent review). It is important to note that there is no real evidence yet beyond anecdotal comments to demonstrate that either of these concerns hold. For

many, though, such concerns are very present and underlie much of the negative response to open identities. This concern may be especially prevalent in more niche scholarly communities or smaller linguistic communities. In this case, publishers operating open identities may find it more difficult to engage reviewers to review manuscripts. Making OPR optional might assuage such concerns. At the same time, encourage any reviewers experiencing negative consequences to contact the journal as a matter of academic ethics. Publishers should also use their experiences to contribute to the evidence-base on this issue by monitoring whether open identities leads to more positive reviews overall, for example. There is a need to track review quality and acceptance rates to monitor how OPR affects processes. If reactions amongst research communities may be uncertain, consider introducing OPR through a pilot study with an accompanying survey for participants which would show that any final decisions would be based upon real experiences, whilst allowing the journal to experiment with the confidence of the community.

2.2.7 Set goals and evaluate performance

As said above, it is good to decide a vision for the kind of peer review you want in the context of your end-to-end publication workflow and then prioritise goals in order to reach this vision. A key part of this planning should be deciding how you will define and evaluate success. Have a clear framework for assessing success ("of what on whom", so on specific measures and specific population clusters). Systematically collect data and study the impact of the practice on journal performance. Key questions could be: is review quality improved? Is it more difficult to find reviewers? Are review times impacted? Are open reports being consulted and re-used? It is also advisable to consult with your journal community once the new process has been in place for some time, perhaps via survey, to gauge the development of their attitudes towards processes. However, bear in mind that cultural change takes time, and so even where uptake is not as quick as wished, the broader ethical aims of transparency and accountability in scholarly publishing might make persistence in spite of low uptake desirable.

2.3 Trait-specific advice

2.3.1 Open identities

Whether or not to open reviewer identities is a huge question. Reviews with open identities can seem to be more constructive in tone but there is some evidence (van Rooyen et al., 2010, 1999) that finding reviewers to review openly might be more difficult (although this is not necessarily detrimental to the performance of the journal (Kowalczyk and Samarasinghe, 2017)). If you opt for open identities, therefore, it would be advisable to create a standard reviewer invitation email which includes a clear description of the open identities review process and its potential advantages as well as disadvantages, as well as a standard follow-up text which goes deeper into these issues to convince those who are reticent. If you are keen to invite a specific person who is reticent, be ready to negotiate to persuade them (e.g., by offering more time to review).

If you are interested but not ready to fully commit to open identities, you could start small with a pilot and scale up. Alternatively, you could allow reviewers to opt in or out (as happens, for example, at eLife and MDPI). As said above, to signal the journal's support for the concept but allow reviewers choice, you could make open identities the default but enable reviewers to opt out of the process. Another possibility would be to maintain a standard single- or double-blind review process but to publish reviewer names alongside the final article (the practice at the publisher Frontiers). Bear in mind, though, that changes in these conditions could introduce biases whereby reviewers who are inclined to be more lenient towards a manuscript may be more likely to accept the review. A further issue to consider is whether the identity of the handling editor(s) should also be open. After all, at journals with very high desk rejection rates, editorial selection is also a form of peer review.

A common concern regarding open identities is that junior researchers who give negative reviews to more senior colleagues may face retaliation in some form. While it is important to note that there is at present only anecdotal evidence of this, it is also beholden upon publication venues to limit the risk to which they expose the researchers who take part in their review processes. Have in place clear processes for dealing with any reviewer concerns regarding this.

Finally, wherever reviewer names are disclosed along with publication, be sure to use identifiers (e.g., ORCID) to link that activity to reviewer profiles and further enable credit and career evaluation.

2.3.2 *Open reports*

Open reports peer review is where review reports (either full reports or summaries) are published alongside the relevant article. Often, although not in all cases (e.g., EMBO reports, <http://embor.embopress.org>), reviewer names are published alongside the reports. The main benefits of this measure lie in making currently invisible but potentially useful scholarly information available for re-use. There is increased transparency and accountability that comes with being able to examine normally behind-the-scenes discussions and processes of improvement and assessment, and a potential to further incentivize peer reviewers by making their peer review work a more visible part of their scholarly activities (thus enabling reputational credit via linking reviews to researchers' ORCID or Publons profiles, for example).

The technical requirements for publishing review reports should be considered. Best practice is to assign individual DOIs to reports. In this way, review reports become a citeable, discoverable and creditable part of the scholarly record in their own right. To facilitate this process, Crossref has been developing a schema for review report metadata (Hendricks and Lin, 2017).

2.3.3 *Open participation, pre-review manuscripts & open final version commenting*

Open participation peer review allows the wider community to contribute to the review process. This can be either during publication (by making a pre-review manuscript openly available online as a pre-print or discussion paper) or after publication (by enabling comments on the publisher website or via a third-party platform like PubPeer). Whereas in traditional review, editors identify and invite specific parties (peers) to review, open participation processes allow any interested members of the scholarly community to participate in the review process, either by contributing full, structured reviews or shorter comments. Often open participation processes will be used as a complement to traditional, invited reviews. Crowdsourcing reviewers in this way in theory ensures that fields do not become too insular or self-referential, enabling cross-disciplinary perspectives and potentially increase the number of researchers who can contribute to the quality assurance of manuscripts.

A key decision here is whether to make comments open to anybody (anonymous or registered), or whether to require some credentials before allowing comments. Various options are available depending on your own communities. At Copernicus Publications, for example, reviewers can be anonymous but open commentators on discussion papers must add their identities. However, although MDPI's Preprints service originally allowed only registered users to comment, this condition was recently relaxed. Despite concerns that this would lead to a lower-quality of comments, MDPI in fact reports having had few problems so far. One issue here is that for indexing services to accept comments (as, for example PubMed Central accepts comments from F1000research), they may require a named individual and their affiliation.

A further crucial issue is that open participation processes often experience low-uptake. Thus, as already said, they are hence often used as a complement to a parallel process of solicited peer review. At the open access journal Atmospheric Chemistry and Physics (ACP), which publishes pre-review discussion papers for community comments, only about one in five papers is commented upon (Pöschl,

2012). Hence, open participation review is arguably better seen as a complement to, rather than a replacement for, invited peer review. In any case, some mediation of the community will help to stimulate engagement.

2.3.4 Open interaction

Open interaction peer review allows and encourages direct reciprocal discussion between reviewers, and/or between author(s) and reviewers. In traditional peer review, reviewers and authors correspond only with editors. Reviewers have no contact with other reviewers, and authors usually have no opportunity to directly question or respond to reviewers. Allowing interaction amongst reviewers or between authors and reviewers, or between reviewers themselves, is another way to “open up” the review process, enabling editors and reviewers to work with authors to improve their manuscript. Examples of journals which enable pre-publication interaction between reviewers are the *EMBO Journal* and *eLife*. *Frontiers* has gone a step further, including an interactive collaboration stage with dialogue between authors, reviewers and editor(s).

While this extended dialogue might be expected to increase the editorial workload in some parts of the process, publishers practicing such methods actually report that they can also reduce workload in other parts. For example, the *eLife* consultation approach involves more work upfront (i.e. the consultation process and the drafting of the consensus decision letter), but time is saved later on if the editor decides on the revised version rather than sending back to the referees.

3 Fostering greater data-sharing and systematic evaluation of the efficacy of OPR

3.1 Introduction

We have seen that the variety of innovations that come under the umbrella term “open peer review” can be combined in a multitude of ways. The differing kinds of OPR have a lot of potential to improve peer review, but it is clear that no one model will fit all disciplines or overcome all obstacles. Which of these are best, in which circumstances, and for which communities? What is their effect upon factors like review quality, the time the process takes, incentivising researchers to review (or not), the participation of traditionally under-represented groups, or (in open identities) the risks of negative consequences for especially early-career researchers from more senior colleagues whose work they negatively review? The fact is, as a recent systematic review of the available evidence makes clear (Ross-Hellauer, 2017), none of these questions can be currently answered authoritatively with hard evidence. Much information on best practice is available within publishing communities, and an overview is presented in the last section. However, peer review, as the basis for scientific quality assurance should itself rest firmly on a scientific footing. Scholarship should take peer review seriously as an object of study. It is too central to the shaping and validation of scientific knowledge to rely too heavily on mere anecdote and intuition. As an important recent study by Grimaldo, Marušić and Squazzoni (Grimaldo et al., 2018) of the scientific literature on peer review shows, although research on that subject has been growing in recent years, to date “despite its central role in research, peer review has been examined only through small-scale research projects”. In the assessment of the authors, “there is need to encourage collaboration and knowledge sharing across different research communities”.

The authors are key members of PEERE, an EC-funded network of researchers interested in peer review (<http://www.peere.org/>). In 2017, PEERE established a data sharing protocol (PEERE, 2017) whose aim was “to provide data on internal peer review processes in a sample of journals [to] allow PEERE to study peer review across different fields and identify important factors that could help to improve quality, transparency and accountability of the process.” Signatories include Elsevier, Springer, Wiley and the Royal Society. While PEERE’s achievements are an important step towards opening data on peer review, at the time of writing access to the shared data is restricted to consortium members only (although the consortium is working on opening access to their corpus of data). It can be argued that more research would be able to be fostered if we were able to open all suitably anonymised information about peer review, via open datasets according to shared standards, to the wider community of scholars to maximise research. Here, journals with OPR processes have a key advantage, since so much more of the peer review process is already, by its nature, public.

As pertains to OPR, the need for data-sharing to foster research and hence evidence-based innovation in peer review is especially acute. OPR is an umbrella term for a cluster of innovative methods with far-reaching impact upon the peer review process, but whose full consequences are often obscure. A recent blog post¹ by an early-career researcher, Libby Pier, makes this point wonderfully well:

“Given the novelty of OPR and its slow but increasing adoption in science, it remains to be seen whether the risks to reviewers’ professional identities and time invested are borne out. It also isn’t clear to what extent having proof of one’s reviewing will serve as

¹ Pier, L (2017). ‘What is open peer review—and should I be doing it?’ libbypier.com, 14th July 2017 <https://web.archive.org/web/20180501215217/https://libbypier.com/thoughts-musings/2017/7/14/what-is-open-peer-review>

an effective professional cachet. Until there's more data on how OPR affects not just authors but also reviewers, I think scientists ought to be wary of donating their time and resources to an uncertain process. On the other hand, we can't obtain more data on the effects of open peer review if we don't have willing participants. And therein lies the paradox of OPR: We won't know if it works until more of us try. So for the good of the future of science, perhaps we need to be willing to participate in an experiment of our own collective making." (Pier, 2017)

But we should only agree to a point. Experimentation is certainly to be encouraged. However, the burden of risk should not rest too heavily on participants who are “early adopters”. With a sociotechnical system of such consequence to the validation of scholarship and the careers of researchers, experimentation with new systems must be accompanied by systematic studies of the consequences of these changes and hence enable an evidence-based approach to changes in processes. To date it cannot be said that this is the case. This is, I believe, due to the fact that thus far peer review has been treated as a publisher-internal process, with the data regarding those processes treated as confidential and proprietary. This “black-box” approach perhaps made sense in the paper-paradigm, where the boundaries of communication via hard-copy manuscripts and mailed reviews enforced material limits on openness. But in the age of the web, information can be more easily shared (although other barriers remain in the form of intellectual property and data privacy legislation, of course). What is more, it can be argued that it *should* be shared, to the extent possible. In this argument, publishers, as custodians of the scientific record, have a duty of care to ensure their quality assurance processes are as robust and accountable as possible, and a duty of care to the authors and reviewers taking part in peer review workflows to ensure that those workflows are as efficient and free of risk as possible.

This section reports on efforts to create a framework for data-sharing amongst publishers regarding OPR and construct a shared agenda for assessment of the efficacy of OPR approaches. The findings and recommendations have been gathered iteratively, via literature review and background research to map the landscape, broad-ranging expert interviews (n = 4) to map out the broad problem space (notes were taken during interviews and kept according to the OpenUP Data Management Plan²), an expert workshop attended by 14 experts on peer review and OPR (including the four interviewees), which was preceded by a questionnaire to collect, synthesise and validate best-practices on OPR implementation and to discuss the possibilities for future collaboration to deepen research into OPR.

Note: the question of the need for data-sharing to foster research into OPR was not originally foreseen within the OpenUP Description of Work, but was rather identified as an emergent priority during the EC project review in Autumn 2017.

3.2 The need for more evidence regarding the efficacy of OPR

Our cohort of experts universally saw the need for more research into the efficacy of OPR. It was felt that in general, further research is needed into peer review as a whole, with a lack of evidence of the contribution peer review makes to the scientific process. Among the key reasons given for the need for more research into OPR specifically, it was stated that decision-making should be data-driven, and respondents reported concerns that there is a lack of systematic analysis on the impact of various forms of OPR on the quality of peer review processes, with arguments for or against OPR often based on political or philosophical preconceptions rather than on data about its efficacy. This was attributed to the limited availability of datasets, restricted to only a few publishers. One respondent advised they felt that even some of the studies that have been done should not be relied upon too heavily, owing to poor generalisability, weak study design or the age of the studies in a shifting landscape. Even those

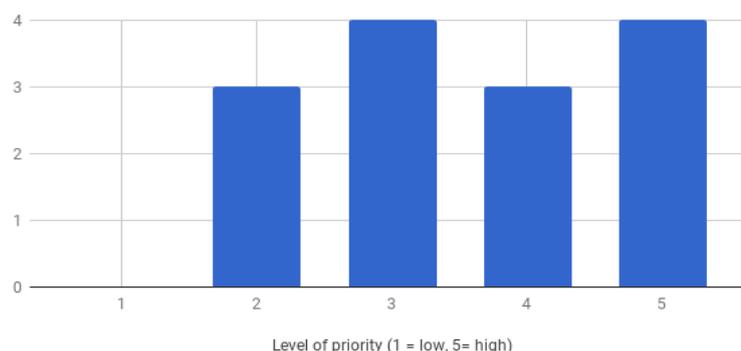
² http://openup-h2020.eu/wp-content/uploads/2017/01/OpenUP_D1.2_M6.pdf

convinced by the studies already available acknowledged that more data/studies would be key in persuading others (especially in fields where OPR is less established) of the efficacy and advantages of OPR. In general, although attitudes to OPR have been more widely studied than actual practice, here too, more evidence is needed on how different disciplines react to OPR. These questions extend beyond mere efficacy to peer review's place in the broader culture of research – it was felt that there is a lack of understanding of the influence of contexts and academic hierarchy and power on attitudes towards OPR and open review methods.

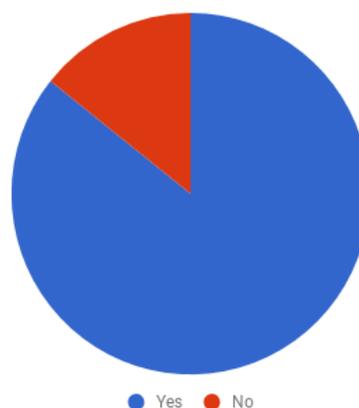
Asked how big a priority fostering research into the efficacy of OPR was for their organisation, the majority reported it was either a quite high or high priority.

- High priority (n=5): Respondents choosing this option advised this was based on a commitment to and interest in all aspects of open science and transparency. Two reported already having OPR in place at a few journals and being interested in taking an evidence-based approach to assessment of how it is working. There was also a recognition that more research into the benefits and limitations of OPR would be informative for other publishers interested in adopting OPR.
- Quite high priority (n=4): Amongst the respondents who indicated this option, it seemed that fostering researching into peer review generally was a priority, although not necessarily focussed on OPR. There was a recognition, however, that any evidence into the efficacy of open peer review would certainly be helpful to inform future decisions on peer review models.
- Medium priority (n=3): Those who indicated that OPR research was only a medium priority indicated this was because they had previously done work in this area or had OPR processes up and running.
- Low priority (n=2): Those who reported it was a low priority advised that OPR was still seen a niche subject, “a nice-to-have rather than a priority”, with only a minority of journals employing it.

How big a priority is fostering research into the efficacy of OPR for your organisation?



Would your organisation be interested in collaborating in the development of a programme of data-sharing and research into the efficacy of OPR? (n=14)



All except two respondents indicated that their organisations would be interested in collaborating in the development of a programme of data-sharing and research into the efficacy of OPR. Those who indicated otherwise advised this was, in one case, because the respondent was from a research institution more focused on education and teaching, and in the other case because they had already shared data, including data about OPR, via the PEERE data sharing protocol, but that this initiative could and should be able to access such data through

PEERE. In the event, it seems this is not the case, as access to the PEERE data is still limited only to members of that COST action at present (although PEERE are working on enabling greater access).

3.3 Barriers to data-sharing

Having established that there was a need to foster greater data-sharing, and the will amongst organisations to do so, we moved on to address the barriers our respondents could see to such an initiative. Our respondents highlighted the following issues:

- **Data confidentiality:** There will need to be an adequate framework data release agreement and mechanisms for data confidentiality. Open data should be suitably anonymised where necessary, according to criteria established by contributing parties. Data which cannot be made open should be made available only to permitted third parties.
- **Data ownership:** Publishers do not own all the data that might be shared. Review reports usually remain the intellectual property of reviewers, for example (conditions are usually set by publishers). Where open reports have been published under open licenses, sharing should not be an issue. But for closed reviews, data-sharing will be problematic and may require reviewer agreement (although mechanisms such as that which the medical community use to manage data could be used). Finally, not all journal data is owned by the publisher – where the publisher only runs the journal (e.g., for a scholarly society) there would be a need to secure approval from societies and editors for journals the publisher does not own.
- **Stakeholder approval:** Even where the data is owned by the publisher or society consenting to share, the initiative would be advised to secure agreement of editorial boards, communities and reviewers. Although achievable, this would likely be complex in the context of sharing retrospective datasets. It would, however, be much easier to achieve in a setting where a prospective agreement is outlined and data collected from that point onwards.
- **Time, effort, costs:** Publishers are also naturally wary of the amount of work and commitment that might be involved. For example, the costs of identifying, collating, cleaning, anonymizing, harmonizing and curating data. Note that some publishers may not be equipped to efficiently anonymise data, and that a degree of consensus would be needed on how to achieve this to ensure datasets are comparable and same degree of anonymisation is achieved. In addition, some reports, particularly manuscript-level cross-journal reports for titles using off-the-shelf manuscript submission systems, can have hefty costs.
- **Reputational risk:** Reticence might also come from concerns amongst publishers and scholarly societies about the risk to reputation that could stem from opening up such data to wider scrutiny – they may be wary of standing out as performing poorly in some respect, for example. As one participant bluntly noted, if sharing data stands to hurt publishers, participation will be affected. For this reason, it was suggested that information such as review times, number of invitations, number declined, etc., could be aggregated or anonymised so as not to identify individual journals. In practice such steps might hurt the transparency and reproducibility of any subsequent studies which use that data. Here critical mass might be needed - if most publishers were to engage then others would likely follow.
- **Enabling meaningful comparisons:** There would be a need to ensure that data from different journals can be meaningfully compared. The variety of different peer review models would make it difficult to compare like with like. This would be better enabled by defining specific data-fields and documenting any idiosyncrasies which might make comparison difficult. From the publishers' point of view here, there would be a need to ensure that the different models of OPR are sufficiently explained by publishers and well-understood by researchers to enable meaningful analysis. All journals will have slightly different processes that would need explanations from the journals on exactly what the data means. Hence, for a fair and accurate representation of data, it may be advisable to implement a schema and for the journal in question to be on hand to work with researchers to help them understand the data in question.

3.4 Varieties of data that could be shared

We next moved on to consider the varieties of data that it would be possible to usefully make either:

- 1 **Data openly available online for use and re-use:** This would encompass open data (i.e., data, suitably anonymised where necessary, that is freely available online to everyone to use and re-use as they wish)
- 2 **Closed but FAIR (restricted access) data:** Data which cannot be made only available online could be made closed but otherwise FAIR (data that is not immediately available online, but that is *findable, accessible, interoperable* and *re-usable* (Wilkinson et al., 2016) with restrictions on access and suitable processes to ensure confidentiality)

3.4.1 Data openly available online for use and re-use

Respondents agreed that the following types of data could be usefully opened **for OPR journals**, where the OPR process was such that this information was already public, or where releasing such information would not breach existing agreements or norms of confidentiality:

Journal information

- Type of peer review process at the relevant journal

Reviewer information

- Names of reviewers
- Demographics of reviewers (institution, country, and possibly gender, although publishers will often not hold gender information) – although note that publishers suggested this information is often incomplete or out-of-date and for these reasons may not be suitable for sharing.

Review information

- Review word-count
- Full texts of reviews (if peer review model includes open reports)

Editorial processes

- Article type
- Name of the handling editor, if this is usually published
- Number of invitations, assigned reviewers and completed reviews per submission
- Time taken to agree to review and time taken to submit review (linked to temporal information on the exact system of peer review in place at the time). Note, however, that review times, number of invitations, etc., are affected by a number of factors, including the topic of a paper and so will not necessarily make a statement about the effect of the OPR process per se.
- Number of reports delivered per manuscript
- Number of rounds of review
- Uptake for signing reviews (if optional)
- Number of [open final Version of Record] comments during peer review or post-publication

3.4.2 Closed FAIR (restricted access) data

For restricted data (whether for OPR or traditional peer review journals), it was agreed that given sufficient confidentiality guarantees, all the above information could also be in principle subject to

sharing. Sharing contents of reviews and reviewer names would be the most difficult, however. The additional data could also be made available under these conditions:

- Reviewer recommendations
- Cover letter to the editor
- Triage documentation
- Original submission manuscripts and subsequent revision rounds
- Journal/publisher business model
- Data on linking review reports to manuscript and to other datasets

3.5 Prioritising research questions

We next asked our experts what they thought are the most important areas in which more evidence is needed with regard to the different elements of open peer review, and which specific research questions they would like to see addressed. A long-list of questions was sourced via the pre-workshop questionnaire:

- Is review quality improved with open peer review?
- Does OPR lead to higher quality of published research?
- What is the impact of status, gender, institutional affiliation and country on OPR attitudes?
- How are underrepresented groups impacted by open identities?
- Does OPR affect manuscript acceptance rates?
- Does OPR take more 'effort' and 'time'?
- Do open reports deter reviewers from reviewing?
- Are open reports less stringent/too lenient?
- Does open identities put early career/'low status' researchers at risk?
- Are researchers citing OPR activities in grant or tenure applications?
- To what extent are published referee reports valued, cited or otherwise reused?
- Does OPR affect reviewer agreement rates?
- Does OPR change submission patterns?
- What is author/ reviewer uptake by subject area?
- How do open reports affect the quality, substance, and length of review reports?

Workshop participants were then split into two groups and asked to prioritise these questions.

Priorities from the perspective of publishers: One group chose to prioritise the questions according to the concerns of publishers, which led to a list of priorities which focussed on questions of process and costs

1. Does OPR affect manuscript acceptance rates?
2. Does OPR take more 'effort' and 'time'?
3. Does OPR change submission patterns?
4. Do open reports deter reviewers from reviewing?
5. Does OPR affect reviewer agreement rates?

Priorities from the perspective of research: The second group spontaneously chose to rather prioritise the questions according to what would be most valuable to learn from the perspective of inclusion, participation and transparency in research:

1. What is the impact of status, gender, institutional affiliation and country on OPR attitudes?
2. How are underrepresented groups impacted by open identities?
3. Does open identities put early career/'low status' researchers at risk? (Although note that our experts acknowledged that this would be very difficult to measure using research driven by the existing data. Reviewers are not usually labelled by career status, for example, and often the

potential risks – of retribution from more senior researchers aggrieved by a negative review, for example – would be difficult to measure or discover. It may hence be that this is a question better approached by alternative means, e.g., simulation of reviewer interactions, survey of researcher experiences.)

4. Do open reports deter reviewers from reviewing?
5. Does OPR affect reviewer agreement rates?
6. Does OPR take more 'effort' and 'time'?

3.6 Next steps

From this analysis it is clear that publishers and others see the need for more research into OPR. They are open to the idea of data-sharing to foster this, but they see some concrete barriers to implementation, for example, ownership and confidentiality of some data, the need to gain stakeholder approval, the degree of effort and costs that might be involved in participating, risks to reputation, and the need to collect, structure and document data in such a way as to enable meaningful comparisons. With this landscape made clearer, we can map a way ahead.

- **Define agenda and research priorities:** From the foregoing, it is clear that publishers often remain the gatekeepers of information regarding peer review processes. Concerns about reputational risk and potential costs in terms of time and effort are powerful barriers against participation in such an initiative. Hence, it seems publishers – even though interested in participating – may not immediately be ready to open all varieties of data possible. As a first step, it was suggested by respondents that one or two key priority questions could be selected and publishers invited to contribute data. A central repository of data could be collected (perhaps as a Zenodo community), linked to a registry of key research questions. This would have the advantage of acting as a proof-of-concept to demonstrate value while targeting key research questions.
- **Incentivizing research:** Once data has been collected and made available (either as open data or with restricted access), there remains the question of how to incentivize research that utilises that data. It was suggested that research could be incentivized via a hackathon linked to a journal special issue (the Open Access journal Publications, of which the primary author of this study is Editor-in-Chief, would be a potential venue).
- **Coordination:** The value of OpenUP coordinating this activity, as a third-party organisation distanced from publishers, was noted by a few participants. To further formalise the initiative, it was suggested that it could formally be convened as an interest or working group via the Research Data Alliance. Alternatively, the new TRANSPOSE initiative (<https://transpose-publishing.github.io>, which the main author of this report is helping to lead) could provide such a forum.
- **Foster cultural change:** It is widely accepted that peer review processes are largely a black-box of proprietary information, and that publishers can act as gate-keepers of this information, allowing access to researchers as they wish. As such, publishers have the duty to participate in improving their processes, as well as improving scholarly processes. The means to achieve this is however not clear-cut. The Open Science agenda presses the need for ever greater transparency and accountability on researchers and research institutions – should the same principles not extend to those overseeing quality assurance processes? Funders and institutions could support such initiatives by explicit statements of support for such transparency, or even by making transparency on journal processes a key condition for eligibility for reimbursement of APCs or journal subscriptions.

4 Conclusions

Open peer review (OPR) is moving into the mainstream, but it is often poorly understood and surveys of researcher attitudes show important barriers to implementation. As more journals move to implement and experiment with the myriad of innovations covered by this term, there is a clear need to produce guidelines to best implementation and to develop a framework within which the success or otherwise of these initiatives can be assessed. This document aims to address these knowledge gaps, reporting work based on literature research, expert interviews and an interactive stakeholder workshop to: (1) create best-practice guidelines for editors and journals who wish to transition to OPR; (2) create a framework for data-sharing amongst publishers regarding OPR and construct a shared agenda for assessment of the efficacy of OPR approaches.

This deliverable report has produced two important steps in realising an application framework and transformation scenarios for OPR:

1. A list of practical guidelines and recommendations for publishers interested in implementing OPR processes co-created with the involvement of peer review experts. These guidelines will be of use to help foster the uptake of OPR and assist publishers in adopting best practices in their transition to these new processes.
2. A landscaping study of the potential for greater data-sharing regarding OPR processes, which if realised would fuel much-needed further research on their efficacy. This landscaping study has resulted in a list of next steps which the working group will pursue in the future.

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6 Appendix A: Workshop 27-3-18 Scope, Agenda, & Attendees

When: March 27th 2018, 9.30-14.00

Where: The Stables, Springer-Nature offices, 2 Trematon Walk, Kings Cross, London N1 9RZ, UK. <https://goo.gl/maps/25rf6Qf7ag62>

Led by: Tony Ross-Hellauer (tross@know-center.at), Edit Görögh (goeroegh@sub.uni-goettingen.de) & Elizabeth Moylan (Elizabeth.Moylan@biomedcentral.com)

6.1 Workshop scope

The EU-funded OpenUP project (openup-h2020.eu) addresses key aspects and challenges of the currently transforming science landscape to come up with a cohesive framework for the review-disseminate-assess phases of the research life cycle that is fit to support and promote Open Science. Within this context, OpenUP has been studying novel tools for peer review. As a next step we are hoping to foster increased data-sharing and knowledge-transfer (including best practices) about varieties of open peer review amongst all stakeholders. This workshop is an important step in this initiative. It will be an active event with circa 15 expert attendees, where we harness your knowledge and expertise to pursue two concrete aims:

- Encourage the open sharing of data about open peer review processes in order to foster further studies on the subject, as well as to investigate the kinds of data that might potentially be opened up, any potential barriers to this initiative, key research questions, and ways that new studies from external groups based on this data could be encouraged (e.g., hackathons, journal special issues, research prizes).
- Produce guidelines for publishers operating traditional peer review processes to move towards more open systems, including best practices, barriers and incentives.

6.2 Reading

Ahead of the meeting, it may be useful for you to read the following outputs upon which this meeting will build:

- Ross-Hellauer, T. (2017). What is open peer review? A systematic review. F1000Research, 6:588. doi:[10.12688/f1000research.11369.2](https://doi.org/10.12688/f1000research.11369.2)
 - Taxonomy paper, also describes research to date on the efficacy/value of each OPR element
- Ross-Hellauer, T., Deppe, A., & Schmidt, B. (2017). Survey on open peer review: Attitudes and experience amongst editors, authors and reviewers. PLOS ONE, 12(12). doi:[10.1371/journal.pone.0189311](https://doi.org/10.1371/journal.pone.0189311)
 - Survey of attitudes to OPR amongst various stakeholders
- Görögh, E. et al. (2017). OpenUP Deliverable D3.1– Practices, evaluation and mapping: Methods, tools and user needs http://openup-h2020.eu/wp-content/uploads/2017/01/OpenUP_D3.1_Peer-review-landscape-report-1.pdf
 - Extensive overview of innovations in peer review, including survey evidence

6.3 Definition of Open Peer Review

During the meeting we'll use the taxonomy described in (Ross-Hellauer, 2017) to discuss the various elements of OPR:

OPR definition: Open peer review is an umbrella term for a number of overlapping ways that peer review models can be adapted in line with the aims of Open Science, including making reviewer and author identities open, publishing review reports and enabling greater participation in the peer review process. The full list of traits is:

- **Open identities:** Authors and reviewers are aware of each other's identity
- **Open reports:** Review reports are published alongside the relevant article.
- **Open participation:** The wider community are able to contribute to the review process.
- **Open interaction:** Direct reciprocal discussion between author(s) and reviewers, and/or between reviewers, is allowed and encouraged.
- **Open pre-review manuscripts:** Manuscripts are made immediately available (e.g., via pre-print servers like arXiv) in advance of any formal peer review procedures.
- **Open final-version commenting:** Review or commenting on final "version of record" publications.
- **Open platforms ("decoupled review"):** Review is facilitated by a different organizational entity than the venue of publication.

6.4 Agenda

09.30	Registration and coffee
09.50	Tony Ross-Hellauer Welcome & description of workshop aims
10.00	Flaminio Squazzoni Keynote – Data-sharing and building a research agenda in PEERE (*Provisional title)
10.30	Session 1: Data-sharing, barriers, data-points, key research questions to address
12.30	Lunch
13.00	Session 2: Innovating peer review – defining best practices, and drivers/barriers to implementation for publishers
14.00	Close

6.5 Attendees

Last name	First name	Organisation
Markie	Michael	F1000
Barros	Tiago	Publons

de Ranieri	Elisa	Nature
Haire	Lynsey	Taylor & Francis
McCallum	Catriona	Hindawi
Mehmani	Bahar	Elsevier
Moylan	Elizabeth	BMC (part of Springer Nature)
Puebla	Iratxe	PLOS
Rittman	Martyn	MDPI
Rodgers	Peter	eLife
Sanders	Jeremy	Royal Society Open Science
Sands	Richard	BMJ
Squazzoni	Flaminio	PEERE
van Edig	Xenia	Copernicus Publications
Willis	Michael	Wiley
Ross-Hellauer	Tony	Know-Center
Gorogh	Edit	University of Goettingen

7 Appendix B: Semi-structured interview protocol

Do you believe we need more evidence into the efficacy of OPR?

How big a priority is fostering research into the efficacy of OPR for [name of publisher]

Explain core concept: “We propose the development of an OPR Assessment Framework, which would seek to systematically evaluate the efficacy of differing OPR systems across publishers and OPR models. This would be greatly helped by making available open datasets of open peer reviews and associated metadata. Ideally we would open all suitably anonymised information about OPR. We are proposing to convene a group of publishers interested in OPR to expose as much data as they can (suitably anonymised where needed), via open datasets according to shared standards, to enable the wider community of scholars to maximise research into this area”

Do you think [name of publisher] would be interested in collaborating in this regard?

What kinds of data do you think could be collected/opened? (e.g., review times, invitations, full-text of reviews)

What difficulties/barriers are you aware of that would make such data-sharing difficult for your organisation? (e.g., legal, business, technical (formats, platforms))?

Assuming we succeed in creating an open corpus of data on OPR - how could we then incentivise researchers to pursue research in this area?

What would be the difficulties in creating studies across publishers (e.g., standard vocabulary)?

On another topic, we are interested in gathering experience from publishers who have already adopted OPR procedures and will next ask two questions on this subject.

If a publisher or journal is interested in implementing OPR in some form, what advice would you give them on how to get started?

What pitfalls should they look out for?

Finally, OpenUP will be hosting a workshop on these issues in March 2018 in London - would you be interested in attending?