The Association of Learned & Professional Society Publishers

Open access megajournals: The publisher perspective (Part 2: Operational realities)

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Abstract

This paper is the second of two *Learned Publishing* articles in which we report the results of a series of interviews, with senior publishers and editors exploring open access megajournals (OAMJs). Megajournals (of which *PLoS One* is the best known example) represent a relatively new approach to scholarly communication and can be characterized as large, broad-scope, open access journals, which take an innovative approach to peer review, basing acceptance decisions solely on the technical or scientific soundness of the article. Based on interviews with 31 publishers and editors, this paper reports the perceived cultural, operational, and technical challenges associated with launching, growing, and maintaining a megajournal. We find that overcoming these challenges while delivering the societal benefits associated with OAMJs is seen to require significant investment in people and systems, as well as an ongoing commitment to the model.

INTRODUCTION

This paper represents the second article reporting the results of a major investigation of publisher perspectives on open access megajournals (OAMJs). Part of a wider study of the megajournal phenomenon (see www.oamj.org), and based on interviews with publishers and editors, paper one (Wakeling *et al.*, 2017) presented results relating to the definition and defining characteristics of a 'megajournal', finding that the four criteria identified by Björk (2015) – large size, broad scope, an open access (OA) publishing model, and a peer review process assessing only the technical soundness of the work – were all commonly mentioned. There were, however, competing views about the relative importance of these criteria, particularly a split between those viewing OAMJs' peer review process as their defining characteristic and those believing megajournals were defined primarily by their size. Paper one also reported the varying motivations and rationales given by publishers for launching or not launching an OAMJ title. Publishers described a range of motivations: some

based on the potential for the megajournal model to positively impact the scholarly communications system by improving efficiency, democratizing knowledge, and facilitating open science, and others on the model's possible benefits to the publisher, particularly increased revenue generation and retention, portfolio diversification, and capture of emerging markets.

This second paper explores the cultural (e.g. reputation, quality indicators, and role of OAMJ in the scholarly communication landscape), operational [e.g. situatedness of an OAMJ within a portfolio of titles, article processing charges (APCs), and scalability], and technical (e.g. systems and infrastructure) challenges associated with OAMJ production. In doing so, it addresses the following questions:

- To what extent have publishers' strategies relating to OAMJ been realized and in what ways have they evolved over time?
- What have been the challenges in implementing these strategies?
- What is the perceived role of OAMJ within the wider scholarly communication landscape?

Key points

- There are significant cultural, operational, and technical challenges associated with megajournals.
- Running a successful megajournal requires significant investment, combined with an ongoing commitment to the megajournal model.
- Embeddedness of journal prestige and reputation in academic practices means there is likely a limit to open access megajournal (OAMJ) growth.
- An ongoing shift towards an article, rather than journal-level, unit is supported by OAMJs and offers some hope of change away from current journal-centric publishing.

A third paper (Spezi *et al.*, 2017) deals with the specific issue of soundness-only peer review as employed by megajournals in more depth than is possible here. This is perhaps the most controversial element of the OAMJ model and the one that has generated the most heated debate (Spezi *et al.*, 2017).

SUMMARY OF METHOD

A detailed description of the method can be found in paper one (Wakeling *et al.*, 2017). Results are based on a series of 31 interviews, with senior individuals involved in publishing and editorial operations at 16 major publishers, 10 of which operate megajournals. The interviews, which were conducted between April and November 2016, were recorded and transcribed and the resulting transcripts were subjected to a thematic analysis. This paper, which examines perspectives on the realities of operating a megajournal, draws primarily on those interviewees involved in running an OAMJ. However, where relevant, the view of non-OAMJ publishers are reported as they offer an interesting perspective on perceived challenges associated with the model.

FINDINGS

Business strategy

Journal brand and reputation

Most publishers agreed that a megajournal's long-term sustainability is dependent on it developing a positive reputation among researchers, with many suggesting that the success of the larger OAMJs was largely driven by authors' awareness of publisher brand and prestige. There was recognition that successful high-impact journals confer a reputational subsidy on that publisher's megajournal, and indeed, a subset of interviewees representing newer publishers described how their organization had taken a deliberate step to publish high-quality, traditionally selective journals before launching a megajournal, essentially employing the model demonstrated by *PLoS*. Several interviewees perceived some hypocrisy in this model, particularly from publishers who publicly disavow traditional publishing models in favour of the OAMJ model, yet relied on their traditional operations for their reputation. This phenomenon, however, was couched in rather different terms by one interviewee:

> I guess it's a bit like Picasso having to show that he can paint in a realist's style before cubism is allowed to be accepted as an art form. [Not-for-profit non-megajournal (MJ) publisher]

Interviewees representing publishers without well-established portfolios of selective journals (i.e. those with high rejection rates) described other methods of attempting to build a reputation, particularly the appointment of distinguished and well-known academics to the megajournal editorial board. There was, however, recognition from these publishers that this strategy had not proved particularly successful in transferring reputation to the megajournal. In general, interviewees, particularly those associated with newer OAMJ titles, spoke of the challenges associated with differentiating their journal from other megajournals. There was a sense from these participants that creating a distinct brand could be difficult in what is now a competitive OAMJ market.

It was also noted that reputation is fragile and that the mistaken publication of even a single erroneous paper can have serious consequences – in part, due to a perception amongst authors/readers that OAMJ editorial policies are less rigorous and therefore more prone to error than traditional peer review. This factor was cited by several publishers as a key reason why rigorous quality-control processes had been put in place by their OAMJs. As well as impacting general perceptions of the journal, retractions were also observed to significantly affect reputations within the sub-discipline of the retracted paper.

Several interviewees noted that reputational subsidy works both ways, both positive and negative. Some noted that the launch of a megajournal by their organization had been considered a risk, not least because of the potential for it to perform poorly and thereby negatively affect the publisher's reputation (and by extension, the reputation of its other titles). Examples were provided of branding and marketing decisions made to ensure some separation between the megajournal and the rest of the portfolio, although other OAMJs clearly carry the publishers' imprint in their titles.

Perspectives on journal impact factor

There was little disagreement among participants regarding the importance of the JIF to publishers. As one interviewee put it:

> Impact factor is still a primary gauge of quality in the academy... In China, impact factor is the only thing. People

don't care about h-indexes or Eigenfactors, they may know about them but that's not going to get you tenure and promotion. (Society non-MJ publisher)

Several publishers also argued that JIFs are particularly important for OA journals:

It's not actually quite so important in a subscription world; it matters but it's not critical to the financial success of a journal because people make assessment about the fact that a journal is good quality and generally good quality journals have good impact factors. (Not-for-profit MJ publisher)

While the measure's importance to publishers and embeddedness in academic life were generally accepted, its flaws were also widely acknowledged. The overall perspective on JIF is, therefore, best described as one of resignation. This was particularly the case as it was also recognized by many interviewees that megajournals are particularly unsuited to obtaining and maintaining a high JIF. Not only do their editorial policies remove the layer of selection intended to identify significant (and therefore highly cited) work, but their multidisciplinary scope can limit JIF growth (as citation rates vary significantly across disciplines).

Several participants also highlighted the apparent contradiction between some megajournal publishers' position at the vanguard of opposition to JIF and their apparent benefiting from the JIF eventually awarded to their journal (in terms of submission rates rising as a consequence). These publishers acknowledged the tension whilst taking a realist position: 'the fact is we're in this game, it doesn't necessarily mean you approve of the game' (Society MJ publisher). Several publishers suggested that, in time, most megajournals might converge at a JIF of between 2 and 3 – this seemingly based on the evidence of the longer running OAMJ titles. It was also suggested that the JIFs of individual titles might oscillate – this being a function of the JIF calculation itself and the role of JIF as an author incentive. The argument proposed that authors are attracted to OAMJs with higher JIFs, thereby increasing submissions to the journal and eventually lowering JIF (by raising the denominator in the JIF calculation). Reduced submission in light of the lower JIF would eventually cause the JIF to rise again for the same mathematical reasons.

The interviews yielded no direct evidence that JIF was a factor in editorial decision making – indeed, all the editors involved stated that publishers had never discussed JIF with them, and they felt no pressure to accept or reject submissions based on their likely citation rate. It should of course be noted here that publishers would be unlikely to admit to editorial interference with the goal of boosting a journal's impact factor, especially in the context of megajournals, and therefore, some caution should be exercised in concluding that such practices do not exist. In fact, some publishers did suggest that other organizations were tightening acceptance criteria with a view to maintaining a higher JIF. One participant argued that 'most megajournals don't publish

negative results, because they bring citations down', while another provided anecdotal evidence that a particular journal's in-house editorial staff took practical steps to filter out weaker submissions despite them apparently meeting stated standards of scientific soundness.

One final point related to JIF merits mention. One publisher spoke at length about the importance of balancing the JIFs of journals within the publisher's overall portfolio, arguing that large gaps between the JIFs of selective journals and the OAMJ could be 'too big for the market to jump' (Commercial MJ publisher). The implication here was that authors might negatively view those megajournals that are obviously 'lower quality' than the rest of the publisher's portfolio – thereby limiting submissions to the megajournal.

The role of the OAMJ within a wider portfolio

As discussed above, many interviewees agreed that some megajournals benefited significantly from the reputational subsidy transferred by well-established selective journals within the publisher's portfolio. Several interviewees identified a complementary subsidy flowing in the opposite direction – namely, the revenue generated by a large megajournal operation supporting expensive, highly selective, OA journal titles. *PLoS One* was once again identified as the exemplar of this approach, which one interviewee described as the 'haute couture model' as it was analogous to fashion houses 'spending thousands and thousands of dollars on producing a run way show … to build the brand for the ready to wear stuff that then turns up at Zara' (Commercial non-MJ publisher). Surpluses generated by a large and profitable OAMJ operation can also be invested in infrastructure and innovations of benefit to the whole portfolio. A small number of interviewees expressed some reservations about the ethics of certain megajournal publishers operating with this cross-subsidy model whilst simultaneously arguing against selective titles.

While many interviewees agreed that this model accurately describes certain publishers' operations, some sounded a note of caution. The model is not without risk, they argued, because it lacks diversification; any significant drop in submissions to the OAMJ would be likely to affect the viability of the other journals being supported by that megajournal's APC revenue. Participants following this line of argument believed that long-term security lay with journals all being essentially self-sufficient: 'I just don't think it's a healthy way to exist, so I think they all have to survive on their own merits and connect' (Commercial MJ publisher). Success occurs when 'the whole thing is working together as a kind of ecosystem' (Not-for-profit MJ publisher). At the other extreme, two publishers spoke positively of the possibility of transitioning from a diverse portfolio to a single OAMJ model, although both acknowledged the challenges and risks associated with such a move.

It should also be noted that several participants described situations where the opposite was true – that OAMJs were not supporting other titles, or even themselves, but were instead being subsidized by subscription revenue from more established

journals. This was particularly true of the largest publishers and those where the megajournal was either small or new.

Cascade policies

Many publishers considered the cascade of articles rejected by more selective journals in their portfolio to the OAMJ as an extremely important factor in the growth and sustainability of the megajournal. Some were willing to divulge the proportion of megajournal-published articles that had originally been submitted to another journal, with figures ranging from 5% to 65%. Most, however, cited a figure of 20–30%. There was a clear sense that an OAMJ relied more heavily on cascade articles in the period directly after launch, and that as the journal matured, it was better able to attract direct submissions. No publisher described a fully automatic process – all explained that in the case of potential referral of a rejected article to a megajournal, authors were given an option whether to proceed or not. There was, however, some variation in the extent to which referral policies were formalized within organizations. Some publishers described the cascade of articles as the default, with all authors of rejected articles given the option of resubmission to the megajournal. In other cases, the process was said to rely on the discretion of the editors of non-OAMJ titles. There was a view that this *ad hoc* process could be inconsistent, with significant variation across editors in their awareness of the cascade option and their willingness to refer. Several publishers described improving this process as a priority.

There was a clear consensus that the selling point of the cascade model to authors was the efficiency of the process – in some cases, just a single click is required for a rejected article to be submitted to the megajournal. Some publishers also agreed that additional peer review was not always required, further streamlining the OAMJ publication process. Nonetheless, some interviewees took a distinctly cynical view of cascade policies. As one interviewee put it when asked about the phenomenon: 'Well it's a good money making machine, right?' (Not-for-profit MJ editor). Intent seemed to be an important factor here, with particular scepticism reserved for publishers thought to have launched a megajournal solely for the purpose of 'hoovering up' rejected articles. The not-for-profit publishers of OAMJs were not subjected to the same level of criticism, despite clearly operating under similar policies. Such publishers were more likely to be perceived as recouping costs rather than generating revenue.

Several interviewees made the important point that the prestige and quality of journals from which articles cascade is significant. One participant spoke of a 'cross subsidy of editorial content' (Not-for-profit MJ publisher) and explained that many articles rejected from very highly selective journals were likely to be of a high quality – higher than most articles submitted directly to an OAMJ. Publishers better able to capture these articles for publication in a megajournal were likely, therefore, to see an improvement in the standard of articles being published, with attendant benefits such as an increased JIF.

Article processing charges

Publishers were asked to explain how APCs were set for megajournals. Six factors emerged:

- Production costs (all costs associated with producing the OAMJ).
- Competitor rates (what other OAMJs are charging).
- Anticipated volume (how many articles the OAMJ is expected to publish).
- Article acceptance rate (the proportion of articles accepted and rejected).
- Journal prestige (the reputation of the journal).
- Market sensitivity (the extent to which authors view the APC amount as a factor influencing their choice of journal).

It was clear, however, that few publishers had developed formal calculations for setting their megajournal APC. This was in part due to the difficulties in calculating costs and the margin of error for variables such as output volume and acceptance rate. In practice, the rates of other megajournals seemed the most significant influencing factor, while a certain degree of trial and error and testing of the market was also reported.

It was interesting to note that many publishers believed that the market was not particularly sensitive to the APC amount. As one put it: 'authors have money or they don't. It doesn't really matter how expensive it is' (Commercial MJ publisher). Several interviewees observed that when APCs had been raised, submission rates had not been affected. A more balanced view was offered by others who suggested that authors were insensitive to price only in the case of relatively small differences and below certain key thresholds. Thus, 'it doesn't make any difference if it's $1,000 or $1,500 or $2,000' but 'above the $3,000 mark it starts getting prohibitive for everybody' (Commercial non-MJ publisher). However, this was not the case for all publishers; one noted that authors in non-scientific disciplines were much more sensitive to price, most likely because of the lower level of grant funding in non-STEM disciplines. However, there was little said by any interviewee to suggest that issues surrounding APC amounts were uniquely a megajournal problem; all seemed to view such issues as affecting OA publishing in general.

Author incentives and marketing the OAMJ

Interviewees described a range of factors they felt acted as incentives for authors to publish in an OAMJ, with many of these also informing strategies for marketing megajournals to academia. Most identified the JIF as the most significant. As one put it:

> Publishers will have done surveys of their audience and asked them what are the most important things you are looking for in a journal … and you know the number one answer is always impact factor of course. (Not-for-profit MJ publisher)

For this reason in particular, persuading authors to submit to a new megajournal was considered a particular challenge as, naturally, it takes several years to obtain a formal JIF. Several other publishers acknowledged that being awarded a high JIF, or the JIF of their journal rising, coincided with large increases in submissions. There were, however, some interviewees who stated that their journal had not seen similar rises, despite achieving a broadly similar JIF. Some participants noted that while their organizations are signatories to the Declaration on Research Assessment, which encourages publishers not to use JIF as a marketing tool, and that JIFs are, therefore, not displayed on journal websites or explicitly used in publicity material, this does not seem to greatly hinder author awareness of JIF values.

JIF was seen by some participants as a driver of reputation or brand, another key factor incentivizing submissions. Several interviewees stated that establishing their megajournal brand was a significant challenge, not least because of what they felt were widely held misconceptions about the model (particularly the core editorial policies). There was a consensus from publishers at other organizations that both *PLoS One* and Nature's *Scientific Reports* now had strong-enough brands to transcend the suspicion of the OAMJ model. For other organizations, the lack of a strong brand was viewed as a key limiting factor to growth. A strong brand was seen as important, not just as a means of attracting submissions in general but also of attracting higher-quality papers.

A number of other characteristics of OAMJs were considered attractive to authors. A review process seeking only to assess scientific soundness was likely to appeal to authors of traditionally hard-to-publish papers (such as null results or replication studies) as well as researchers unsure of the significance of their paper or working in emerging fields. A related point was that OAMJ reviews were potentially less likely to request additional experiments or data collection. Several interviewees felt that it was important to recognize the combination of a less selective review process and relatively high JIF offered by some OAMJs – a combination, it was agreed, that many authors would likely find attractive. Also mentioned were the reach and visibility of megajournals: as well as their open access status, which removes barriers for readers, many publishers emphasised the effectiveness of the promotional support (via social media as well as traditional media outlets). Speed of publication was also mentioned as a key selling point for OAMJs, both in terms of promising short lead times from submission to publication as well as cascade policies helping to reduce the time spent resubmitting rejected articles. A counterpoint to this was offered by one interviewee, who argued that publication in a megajournal is, in reality, no quicker than many selective titles and that the promotion by OAMJs of speedy publication was essentially a 'marketing ploy' (Society non-MJ publisher). Finally, it was argued that the open data mandates of some megajournals, and the support for publishing research data offered by others, was attractive to some authors.

Some interviewees also emphasized that author motivations and incentives were dependent on several factors, particularly discipline and geography. Researchers working in the arts and humanities, for example, were believed to be less motivated by the promise of quick publication and less influenced by quantitative journal metrics. It was also noted that authors from some regions (examples specifically mentioned by participants included the Middle East and South Africa) were unconcerned by impact factors, while in others (e.g. China), they were. Some interviewees were also keen to emphasize the benefits of OAMJs for researchers in developing nations. As one put it:

> Researchers from communities that are not respected by the global north often find that they can get their work into mega journals in a way that they struggle to do in conventional journals for various reasons to do with language, expression, race, identity etc. (Not-for-profit MJ publisher)

While some respondents noted that APCs could present a barrier to publishing in OAMJs, most were keen to emphasize that fee waivers were available to such authors. Megajournals were also perceived to provide a relatively high-profile venue for localized research (e.g. geographically limited disease research).

Scalability

For a large number of the interviewees who had been involved in the launch and development of an OAMJ, the challenge associated with managing rapid growth and high article output was seen as the key operational issue. Many interviewees noted that most publishers are not equipped to handle the large numbers of articles published by a successful megajournal, a problem exacerbated by the rapid pace of growth that can be a feature of OAMJ development.

Two related issues emerge. The first is the infrastructure required to support such rapid scaling, both in terms of systems and staff. Standard submission and publishing workflow systems were found to be inadequate, requiring expensive and technically challenging upgrades and patches (see below for further details). Recruitment emerged as a key issue for several publishers, who noted that in periods of rapid growth, they were required to explore innovative approaches to attracting and training staff. One publisher recalled that during a period of intense growth, more than 80% of the journal's employees had been with the organization for less than 6 months. This issue was also said to apply to the recruitment of academic editors. That successful megajournals operate with a growing and relatively inexperienced workforce was said to lead to the second issue – ensuring consistency of editorial standards and maintaining quality control. Several interviewees recognized that this issue proved difficult to manage and resulted in the publication of some articles that were later retracted. Training for and monitoring of academic editors was introduced to address the problem, with most interviewees now believing their processes to be sufficiently robust to handle high numbers of submissions.

It was noted that the gold OA approach is much more conducive to rapid scaling than a subscription model as revenue grows

in direct proportion to article output. To emphasize this, one interviewee associated with a growing subscription journal observed that they felt unable to raise subscription prices in proportion to the growth, concluding: 'so, the bigger it gets, the more money it's losing and it's simply not sustainable' (Society non-MJ publisher).

Interviewees were asked specifically whether megajournal operations offer economies of scale. Responses were mixed. Some felt that in some ways the opposite was true – that large article numbers led to dis-economies of scale. As one publisher noted, 'staff are always the most expensive bit of any publishing' (Commercial non-MJ publisher). If editorial work requires substantial human intervention, the headcount has to increase in proportion to article numbers. With higher staff numbers, the organization becomes less efficient and management more challenging. IT infrastructure and systems also require significant investment, with such investment being non-linear and occurring at certain key stages of the journal's evolution. There was also an acknowledgement that strategic and financial planning becomes increasingly difficult. As one interviewee explained:

> It can be a terrifyingly cash flow intensive business at times ... as things grow ... the balance between not having the staff to be able to cope, versus this enormous flood of money coming in and trying to understand where it will be at some point in the future, is a rollercoaster. (Not-for-profit MJ publisher)

Nonetheless, opportunities for economies of scale were identified. Some interviewees noted that many of these – such as overheads and vendor negotiations – were not unique to megajournals but common to any large publishing operation. Megajournal publishers with smaller portfolios were also considered more likely to benefit from standardized workflows and integrated systems. Overall, it was possible to divide perspectives on the economies of scale in megajournal operations into three broad camps. Interviewees associated with the largest megajournals acknowledged the potential for savings in certain areas while emphasizing the costs and difficulties associated with publishing at such a scale. Participants with medium-sized OAMJs were the most positive about economies of scale, while those with the smallest megajournals viewed the relationship between growth and cost as essentially linear: 'your costs go up with the number of articles broadly speaking' (Society MJ publisher).

Journal production

Organizational structure and workflows

A majority of OAMJ publishers described a 'distributed', 'flat', or 'federated' editorial structure utilizing large numbers of academic editors – typically active researchers – who are assigned editorial responsibility for submissions in their area of expertise. These academic editors are responsible for the standard editorial functions: identifying and contacting reviewers, collecting and assessing the reviews, communicating with authors, and ultimately accepting or rejecting papers. Some interviewees stated that papers underwent initial in-house assessment prior to assignment to an academic editor, although this was apparently not true of all journals. Editors-in-chief at most megajournals were generally said to be focussed on broader operational and strategic issues, with little or no contact with individual submissions.

Several interviewees identified strengths and weaknesses with this model. One made the point that while the model represents a departure from the traditional organizational structure of a journal, the author experience remains essentially the same:

> I am not so sure the megajournal inherently changes the transactional dimension of publishing, which you see in traditional journals. You still submit, you're still evaluated and you still have room for revisions and you re-submit and then so on ... Articles come back and forth in a very traditional manner. (Not-for-profit non-MJ publisher)

Several interviewees noted that this distributed structure helped to support rapid growth; increases in submissions require the appointment of additional editors rather than large numbers of in-house staff. Others noted that the involvement of a large number of essentially independent editors – with numbers running into the thousands for the largest OAMJs – inevitably creates challenges associated with ensuring consistency of process and decision making. This was said to be exacerbated by issues with the interpretation of OAMJ 'soundness-only' peer review policies. Publishers and editors both noted that, in practice, reviewers often appeared to consider significance and novelty in their reports, and that these factors influenced their recommendations. Editors were therefore seen to play a crucial role in filtering out the out-of-scope aspects of such reviews. For a more detailed discussion of findings relating to soundness-only peer review, see Spezi *et al.* (2017).

On a related note, it was recognized that the OAMJ model cedes significant decision-making control to large numbers of individuals outside the publishing organization. The control wielded by editors over acceptance decisions is substantial, and there is risk associated with this: 'you could have one editor who can do a lot of damage to a journal's reputation' (Not-for-profit MJ editor). Thus, as one publisher put it, 'there's a meta layer of quality assurance that needs to go into the process' (Not-for-profit MJ publisher). The academic editors and publishers interviewed for the project in fact described varying levels of governance, monitoring, and training. This included the calculation of individual editor acceptance rates (with particularly high or low rates noted and fed back to editors), online fora for editors to discuss decisions and processes, the in-house review of articles prior to publication, and introductory training (primarily online) for new editors. All editors, however, clearly understood that their role was related only to individual submissions, with little or no impact on overarching editorial policy or journal strategy.

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The devolution of control of editorial processes to large numbers of academic editors does not of course remove the need for in-house staff. In general, staffing levels at OAMJ publishers were described as lean, but at high publishing volume, the numbers can still be substantial. One interviewee described their megajournal's headcount rising from 18 to 70 in the space of 2 years. In-house staff were typically involved with the recruitment and governance of editors, as well as carrying out copy and layout editing. It was acknowledged by several interviewees that megajournals spend less time on these latter tasks than traditional subscription journals – something these participants felt was potentially problematic given the reported quality of language and formatting of many papers submitted to megajournals.

Ethics and integrity

The ethics and integrity of research being published were identified by many participants as crucial issues requiring attention in the journal production process. Such issues were recognized as being common to all journals, but the implications were magnified for megajournals because of the widely perceived deficiencies in their peer review and editorial processes. The size of the larger megajournals was also understood to multiply the chances of inappropriate articles being published. Several publishers mentioned specific stages of the publication workflow intended to check for ethical issues, with one describing long checklists, often discipline-specific, against which submitted articles were assessed. As well as common issues such as plagiarism, several interviewees described instances of authors 'gaming' the megajournal system, particularly the absence of an evaluation of article significance or importance affecting what can be considered the 'least publishable unit' of research:

> They are like here I am going to submit a paper on the tooth of this dinosaur and oh look next week I am going to submit a paper on the you know the finger bone of this dinosaur and so on. (Not-for-profit MJ editor)

Geographical differences were also identified as problematic by some publishers, who acknowledged that what might be considered an ethically sound research method in one country might be deemed unsound in another.

Systems and discoverability

Many participants suggested that the technical infrastructure of megajournals was extremely important, and linked it to author satisfaction, scalability, consistency, speed of publication, discoverability, and transparency. Megajournals, it was argued, needed to invest heavily and early in systems. This point was made most forcibly by interviewees associated with publishers who had, to some degree, failed to do this and believed they had suffered as a consequence. Most manuscript-handling systems, it was suggested, simply cannot cope with the volume of submissions received by some megajournals. Deficiencies in systems

sometimes led to 'constantly adding people as a sticking plaster solution' (Not-for-profit MJ publisher).

Such concerns were typically centred on systems supporting the production of the journal. It was notable that most interviewees were far less exercised by the capabilities of delivery systems – typically the journal website. When asked about the discoverability of articles, most interviewees suggested that the information-seeking behaviour of most researchers is centred on database and web searches. Few seemed to feel that their own sites were used often for systematic searching, and there was a commensurate low level of significance placed on the functionality of journal websites. The few participants who did discuss potential developments to discoverability functionality described three broad approaches: improved personalization (e.g. recommendation systems), greater cross-journal and cross-publisher linking, and search functionality operating at a higher level of content granularity.

All interviewees were also asked for their perspectives on the role of altmetrics and the extent to which current altmetrics tools supported user needs. Responses were mixed, with some believing they are too limited to be truly useful. The key point of this argument was their lack of a qualitative element, with a number of publishers suggesting that very high altmetrics scores were most often an indication of funny, quirky, or controversial papers. Advocates of altmetrics argued that such criticisms, while occasionally valid, were frequently overstated. They suggested that altmetrics were of particular use to authors as a means of tracking the dissemination of their work.

Interdisciplinarity and knowledge transfer

Interviewees were generally circumspect about the extent to which megajournals enhance and support both interdisciplinarity and knowledge transfer beyond the academy. On the former point, there was a general consensus that interdisciplinary work was becoming more important, and cross-disciplinary collaborations were more common. Most participants recognized that megajournals could play an important role as a venue for interdisciplinary research, and had particularly succeeded in providing a 'home' for authors of new or niche sub-disciplines that fell between traditional subject boundaries. One interviewee provided an example:

> My feeling was that we were getting papers where people would say 'we couldn't find a journal that would take this because the genomics people said it was computational and computational people said it was genomics'. (Not-for-profit MJ publisher)

Another interviewee felt that his or her journal had not seen as much of this material as he or she had expected. As they explained, 'there have been lots of surprises but one of them is that [the megajournal] is not nearly as interdisciplinary as we thought it was going to be. It's becoming quite siloed'

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(Commercial MJ publisher). In general, however, most participants felt that OAMJs were not working as a catalyst for interdisciplinary collaboration: 'I don't think people are getting together and saying 'let's collaborate because we could publish this in [a megajournal]'' (Commercial MJ publisher). Two interviewees noted that a potential advantage of megajournals was the collocation within the same journal of articles across a broad range of subjects, although others questioned whether readers were likely to be exposed to such articles given the predominance of keyword search as an information-seeking strategy.

Finally, several interviewees suggested that an important challenge and opportunity for publishers was to develop tools and systems to link articles and authors across disciplines in sophisticated ways. The larger megajournals facilitate this aim as they represent large collections of articles with standardized formats and metadata. As one publisher noted, 'that in theory should lead to the easier possibility that the data can be charted or can be linked and that pathways can be found' (Commercial MJ publisher).

On the question of knowledge transfer beyond the academy, most recognized that OA publishing was an important means of ensuring that the public is able to access peer reviewed research. Few, however, felt that megajournals supported this any more effectively than other OA publications. Indeed, it was suggested that the streamlined and low-cost publishing models of OAMJs actually restrict their ability to offer value-added services, such as summaries for lay readers. It was also noted that the public consumption of science is driven primarily by journalism. While some OAMJs were perceived to have strong media liaison operations, in general, it was felt that OAMJs as a group do not support this transition any better than traditional journals.

The future of OAMJs

All interviewees were asked to reflect on the future of OAMJs. As with other questions, participants revealed a diverse range of opinions. A small number of interviewees suggested that it might be possible for the scholarly communications ecosystem to evolve into one driven by 'fifty to a hundred' megajournals responsible for the totality of scholarly output. While acknowledging that such a view was extremely optimistic, proponents did argue that change might be driven by the economies of scale potentially offered by such a model, combined with a potential shift in author perceptions over time.

However, the vast majority of participants, while predicting some modest growth in megajournal output, felt a mixed-economy would be the most likely outcome, that is, one in which megajournals continued to operate alongside selective journals. Most publishers felt that the megajournal model was gaining traction and awareness and that popular misconceptions – particularly about the nature of OAMJ peer review – were being challenged. They saw no reason, therefore, why overall OAMJ output should fall, even if the performance of individual titles varied. It was deemed highly unlikely, however, that OAMJs would ever completely replace selective titles. Numerous reasons for

this were cited, the most important of which related to the extent to which journal prestige was embedded in academic reward systems. In addition, it was felt that authors retained strong attachments to particular journals in their field – an effect that was deemed particularly strong for society publications. Some interviewees also noted that successful megajournals were almost exclusively in scientific fields and that the potential for their growth into the arts and humanities was significantly limited by the difficulties of translating the concept of technical soundness to these 'softer' disciplines. Finally, there was widespread recognition that selective journals do serve an important purpose for the academic community. As one participant explained:

> What I don't think is that there is no place for highly selective journals, because of course there is. It's a filter system and you choose to read the very filtered stuff, or you choose to look at something much broader, and it depends what you are doing, or what you are publishing. So as author or as reader you want two different things. I don't see why there's not space for both. (Commercial MJ publisher)

While certain interviewees were somewhat regretful that megajournals were unlikely to replace selective journals, they noted that the continued success of key megajournals had already had a significant impact on the scholarly publishing world. Several participants described the OAMJ as a catalyst for change – a 'Trojan horse' serving to shift attitudes towards OA and prepare the ground for emerging innovations, such as widespread pre-print server use, open data, and post-publication peer review.

Only one interviewee suggested that megajournals may already be past their peak. That publisher cited the sustained prevailing importance of the JIF as the principal reason why megajournals will cease to grow, arguing that large numbers of authors will be reluctant to publish in OAMJs while research evaluation and professional advancement is so heavily influenced by impact factor. While few believed that megajournals would decline in the medium term, several participants noted that other innovations, particularly pre-print servers, might eventually come to serve a similar purpose.

DISCUSSION AND CONCLUSIONS

The results presented in this paper, when combined with those discussed in paper one (Wakeling *et al.*, 2017), reveal a complex and sometimes contradictory picture of megajournal publishing. While the various factors influencing decisions to launch megajournals and affecting the operations of the titles themselves can be presented individually, it is also clear that they are, in many cases, firmly interlinked. The complexity of the resulting picture contrasts strongly with the certainty of the voices proclaiming most loudly both for and against megajournals.

Operational challenges

It is clear that launching, developing, and maintaining a successful OAMJ is a far-from-trivial undertaking. Indeed, it is notable that a business model that ostensibly relies on a relatively rapid scaling of operations brings with it a host of challenges relating to managing increasing publication volumes. These challenges manifest themselves in a number of ways: technically, operationally, and culturally. From a technical perspective, there is the requirement to ensure that systems and infrastructure can cope with the high and often fast growing volume of submissions, with associated cost and management implications. Operationally, the high reputational cost associated with errors, combined with the distributed editorial structure of many megajournals, means constant and careful governance is required. This in turn requires policies and procedures that are often unique to a megajournal, as well as the personnel who enact them. Interviewees were in broad agreement that meeting these challenges while maintaining the societal benefits of the model required not just significant financial investment but an ongoing commitment to the principles of the megajournal concept. As one observer has put it, 'why would you expend resources on readability and discoverability when the business incentives are around more submissions?' (Anderson, 2016). The extent to which megajournal publishers make such a commitment is perhaps the most important factor governing the future of OAMJs.

OAMJ peer review

Culturally, most publishers appear to believe that OAMJs offer something valuable to researchers as both authors and readers. While the broad scope of megajournals is believed to support interdisciplinarity, and secondary factors such as speed of publication are considered attractive to authors, the most significant benefits can be closely linked to megajournal peer review policies. As noted in paper one, the perceived societal benefits of OAMJs – the democratization of knowledge, the improved efficiency of the wider system, and the opportunity to challenge traditional publishing models – all stem from the removal of the evaluation of significance and impact as a barrier to publication. The opportunities megajournals afford publishers in terms of revenue generation and retention are likewise born in large part out of this editorial policy. Perhaps the central contradiction at the heart of megajournal publishing lies in the fact that while soundness-only peer review is viewed as the model's greatest strength, it also serves as its greatest perceived weakness. Evidence from the interviews suggest that JIF is central to many publishers' thinking, and even those organizations firmly opposed to the measure's use acknowledge its central role in researchers' decision making. Reviewing only for technical soundness is not only counterproductive from a JIF perspective but also perhaps responsible for perceptions of megajournals as somehow being lower-quality titles. Thus, the element of OAMJs that drives incentives both for authors to publish in a megajournal and publishers to launch them in the first place is also perceived to be the key reason some authors choose not to publish in them. Publishers appear to believe that many researchers' perceptions fall on the 'dumping ground' side of the megajournal (Spezi et al., 2017). Given this, it is ironic that our findings suggest that, in practice, peer reviewers often do incorporate judgements of significance and novelty in their reports and recommendations. An in-depth analysis of publisher views on the principle and reality of soundness-only peer review that emerged from these interviews can be found in Spezi et al. (2017).

Shift to an article-level focus

There was little optimism from interviewees that the pervasiveness of journal-level quality measures being used as surrogate measures of article quality will change soon. However, one potential driver of this change in the longer term might be the continued development of a trend already recognized to be at work: the shift of the key unit of focus from journal-level to article-level (Neylon, Wu, Reichelt, Bettencourt, & Chute, 2009). This shift – a consequence of improving discovery systems and associated information-seeking practices – is inherently acknowledged in the development of the OAMJ model itself. As some publishers noted, OAMJs are not journals in a sense that the term might once have been understood, that is, as a carefully curated collection of articles created by, and for, a narrowly defined community. Instead, they are in many senses more akin to repositories or even databases – containers for articles linked only by a shared access platform and broad editorial policy. The distributed editorial structure of many OAMJs is a manifestation of this – academic editors are charged with managing individual articles rather than journals (or even sections). Megajournals are, therefore, in a position both to help drive this change of perception and to benefit from it.

The future of OAMJs

More generally, it can be argued that the future of megajournals is, to a large degree, dependent on how publishers balance, and are perceived to balance, business and societal drivers. Paper one noted that many of the motivations for launching an OAMJ could be seen to have either societal or business benefits, depending on the underlying intent of the publisher. The results presented in this paper suggest that this intent can be at least partially inferred from the operational strategies relating to the OAMJ. In practice, this is focused on the question of the extent to which publishers are willing to prioritize investment in quality assurance, editorial consistency, and long-term sustainability over maximizing publishing volume and, by extension, revenue. Even more significantly, the arguments made by megajournal publishers and advocates in favour of changing the prevailing research culture will not be convincing if they are perceived to be motivated by self-interest. Megajournals in essence represent a challenge to the cultural *status quo*, one whose value proposition requires shifts in the behaviour, working practices, and expectations of authors, readers, reviewers, publishers, and funders. Encouraging and supporting changes to long-established and deeply embedded conventions is perhaps the most difficult task for publishers. As Nosek et al. put it, 'nudging scientific practices toward greater openness requires

complementary and coordinated efforts from all stakeholders' (2015, p. 1423). The challenge for megajournals is whether a diverse group of publishers, each with their own goals and motivations, can present a unified and convincing argument.

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