Straive™

Connecting the dots

Leveraging Technology to Innovate the Peer Review Process

WHITEPAPER

1. Introduction

Peer review of research papers has today become one of the cornerstones of knowledge dissemination.

The process is used to assess and enhance the quality, originality, validity, and outcome of submitted articles and the research that underpins them. Despite the fact that peer review is often regarded as the gold standard for research certification, there is growing evidence that the goal of peer review is not matched by its method or practice.

The world of scholarly publishing has witnessed an upsurge in innovation and experimentation in peer review over the past decade. The advent of web technologies has driven this, and the fact that there is considerable opportunity for improving the peer review process is becoming increasingly evident.

1.1. Key Challenges

While peer review can help journals maintain their integrity and publish information that enhances research, it cannot be considered to be without flaws. A common criticism of peer review is that the entire process is very time-consuming. In cases where reviewers reject applications based on their workload, the search continues for available or ad hoc reviewers. Most journals mandate at least two peer reviews before an editorial judgment can be made, further enhancing the time frame to ensure a complete and proper peer review procedure is conducted.

Persuading reviewers to remain on their editorial review board is another challenge for editors. Editors are continuously looking for competent reviewers while at the same time trying to inspire current reviewers for further assessments. Another key criticism is that peer review is not transparent enough.

Despite these complications, peer review continues to be a crucial and decisive part of the publishing process.

1.2. An Efficient Peer Review Process

Peer review has traditionally served as a screening mechanism to aid in the allocation of scarce resources. With the advent of Web technologies, we are currently experiencing a phase of experimentation and innovation in peer review. There exists substantial scope to develop new peer review initiatives, each with its own set of benefits and challenges.

It is common for authors in disciplines like mathematics, physics, and economics to send either paper or e-copies of their articles for pre-submission review to their peers. ArXiv (arxiv.org), founded in 1991, standardized this procedure by establishing a centralized network, enabling easier access to such preprints. In this case, preprints are not technically peer-reviewed before publication. They, however, go through some moderation by professionals to weed out non-scientific information. This method signified a major shift from a defined editorial peer-review procedure.

The 2001 launch of Open Journal Systems took a step toward reverting journals and peer review to their community-led origins by providing the technology to execute a variety of potential peer review models. As of 2015, the OJS platform supported over 10,000 journals with technological infrastructure as well as editorial and peer review workflow management.

The last decade or so has witnessed an accelerating wave of innovations in peer review. Advancements in web-based technologies as well as initiatives like the San Francisco Declaration on Research Assessment (DORA), which advocated for universal changes in the way scientific research outputs are assessed, are likely facilitators for such innovations.

Developments in cross-publisher annotation platforms like PaperHive and PubPeer were spurred by initiatives such as the PLOS series of journals that allowed commenting on published papers. Additionally, BMJ's Rapid Responses has been successfully providing a platform for structured comments. Journals such as F1000 Research, solely rely on a model where peer review is performed only after the papers are made public. Other platforms, such as Publons, allow reviewers to receive credit for their work as referees. Platforms such as ScienceOpen provide advanced search and discovery functions, combined with post-publication peer review, recommendation, social sharing, and collection-building features.

Currently, an estimated 75% of peer-reviewed academic publications use a web-based editorial management system. It should come as no surprise that communication has become faster. It is essential to have a platform that defines the roles of authors, reviewers, and editors. Most web-based systems provide a basic set of capabilities, including role-based functionality that may be tailored according to the needs of the journal. Such functionalities help improve transparency, set clear expectations, and automate as many procedures as feasible. This results in a quicker time to publication, which is in the best interests of all stakeholders in the process.

As organizations seek to retain submissions inside their publishing ecosystems, the need for a quick and flawless transfer of review information, submission files, and metadata between publications has become increasingly evident. Leading workflow management systems like Editorial Manager (EM) and ScholarOne Manuscripts (S1M) are owned by companies like Elsevier and Clarivate, respectively. While this provides some assurance that investments in technology will continue, there are concerns that there may be an uneven playing field. It would be advantageous to have stand-alone applications that can interface with the workflow system.

Transfer functionality iterations have resulted in a comprehensive and open set of options that allow manuscripts to move easily between publications leveraging workflow management systems like EM and S1M. No two implementations will be similar when it comes to transfer. To cater to user demands, EM permits transfers between EM-enabled publications and also EM and non-EM destinations. The metadata for these submissions is transferrable. There is no limit on the number of times a submission can be transferred from one publication to another. Straive offers an automated system for the transfer of rejected journals to other suitable journals. Straive's Transfer Desk Suite allows for a seamless, scalable, and efficient transfer process. It features an AI-based journal recommendation engine, customizable modules that allow for a set of journals to participate in the program with defined roles.

These configuration options are available at the system as well as the user-role levels, allowing for diversity within a publication's workflow.

2. Quality of the Review Reports

The peer-review process is widely regarded as the most effective approach for assisting scientific editors in determining whether or not an article is suitable for publication. Administering high-quality peer review is any scientific journal's primary responsibility. The quality of the peer-review process can impact the journal's reputation. Scientific publications that publish peer-reviewed manuscripts rely significantly on scientific reviewers or referees. In most cases, a submission is evaluated by at least two reviewers. However, some publications seek three or more reviews.

The review report is the primary evidence that the research was subjected to peer review. For several years now, the quality of review reports has been put through evaluation and classification. There is little evidence that peer review can ensure accurate and high-quality research. Even though some journals have mechanisms to categorize reviews or reviewers, not much is known about how this is done. Reviewers find it challenging to determine if their evaluations were valuable and suitable to the author and/or editor, considering no official feedback concerning the review's quality is provided.

There is an immediate need for a validation tool that can clearly define the quality of the peer review report. Editors could make use of such a tool to evaluate the work of reviewers.

3. Technology to Enhance the Peer Review Process

Several technological breakthroughs set the ground for innovative development of the peer review system, beginning in the 1990s. This opened up new opportunities for a range of innovative peer review formats. The most significant change brought about by digitization is undoubtedly the technological infrastructure that facilitates review. It was now be coming possible to contact and identify qualified reviewers much more efficiently and swiftly. Gaining access to researcher webpages and emails enabled faster dissemination of submissions and review reports, thereby increasing the efficiency and speed of the review process significantly.

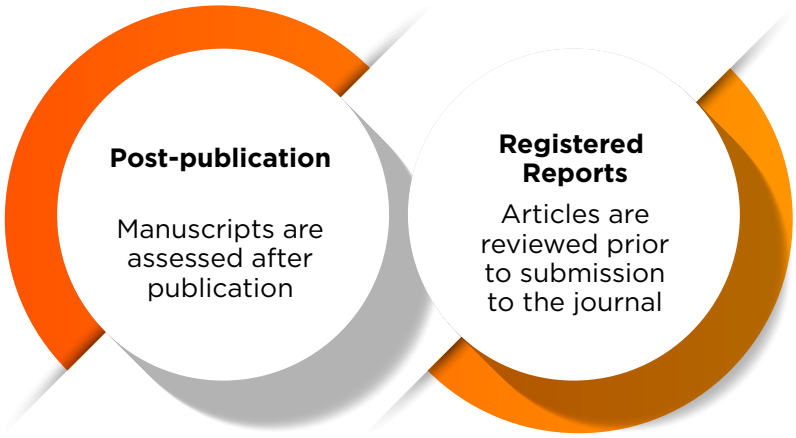
Straive recently hosted a roundtable discussion to discuss challenges, opportunities, and what the future of peer review may look like, bringing in perspectives from across the scholarly community.

Responding to a question on the challenges in implementing technology into their peer review operations, the panellists noted that peer review is such a well-developed process that the bare minimum is already a high bar. Any attempt to roll out anything new in terms of technology must ensure that it is sophisticated enough to handle the volume of submissions without sacrificing quality or timeliness, as well as managing people's expectations of what they can receive from it.

Further, the panellists dealt with what is holding back the “submit to accept” phase, while “Accept to Publish” has transformed greatly from a technology perspective. All panellists agreed that while some of the tools that could lead to automation are promising, none of them are at a point where they can replace human intervention.

3.1. Emergence of New Forms of Peer Review that Changed the Chronology of Reviewing

Traditionally, the peer review process is conducted between the submission and publication of a paper. Two new forms of peer review have emerged in the last two decades. The post-publication peer review, a format in which manuscripts are assessed after publication; and registered reports, a system in which articles are reviewed prior to submission to the journal.



The advent of digital technologies led to the formation of fast-operating archives where authors could bypass publishers and submit their manuscripts for free. Manuscripts submitted to these archives are generally subjected to a brief review to ensure that they fulfil the bare minimum of academic writing requirements. The paper is then reviewed by members of the community who provide their comments. Comments from community members help authors to improve the paper and publish the updated version to the archive. Preprint servers, which originated in physics, mathematics, and astronomy, have now spread to other scientific fields, with analogous servers set up for engineering, biology, and psychology.

Post-publication review has steadily gained traction among journals and publishers, in addition to being utilized in preprint servers. The purpose of introducing this new review form was primarily to expedite knowledge transfer. A number of journals have now moved to this post-publication peer review model. Many independent platforms, such as PubPeer, were created to allow for post-publication evaluation of any published paper, regardless of the type of review it received during the publication process.

The journal, Cortex, first introduced the registered reports system in 2013. This type of peer review continues to be restricted primarily to psychological and medical disciplines. Manuscripts are reviewed in two stages. The most significant review phase starts once the research has been designed, but before data collection. Only the purpose of conducting the research, research questions, and the methodology are reviewed at this stage. A study is either accepted or denied based on these criteria. Following data collection and analysis, authors prepare their paper by incorporating their findings and analysis into the registered report. The final paper is then evaluated for consistency and drawing sufficient inferences from the data.

3.2. The Evolving Peer Review Standards

In addition to establishing a system of pre-print archives, the internet and large databases enabled journals to publish a vast amount of articles. The launch of open-access journal PLoS ONE by the Public Library of Science (PLoS) in 2006 was a significant step forward in this regard. As part of the journal's review process/business model, reviewers were asked to base their acceptance or rejection recommendations merely on the soundness and validity of the study. PLoS ONE has been one of the fastest-growing publication platforms ever since. Other publishers and journals, including SAGE Open and BMJ Open, followed suit to adopt the same non-restrictive review model.

The scholarly community witnessed a sudden surge in the number of manuscripts published in outlets using this non-restrictive review model. This sudden surge could be primarily attributed to the less restrictive review procedure, resulting in new challenges in the publication process. Finding enough qualified reviewers to manage submissions is one of the challenges. Additionally, the large number of published papers raised concerns that the scientific literature may become unmanageable due to an oversupply of papers. This generated an increasing need for further screening to guarantee that academics can deal with the massive quantity of potentially relevant papers. With this came the need to develop innovative techniques to direct readers' attention to papers that are most likely to benefit them.

3.3. Implementing Software Tools in the Review Process

New digital technologies provided specialized technical assistance in determining whether or not articles were publishable.

The plagiarism detection software was the first essential component of technical aid to be employed in peer review. The initial versions of plagiarism detection algorithms were developed in the context of computer code copying rather than literary plagiarism. Only later did this grow into plagiarism detection systems for publications to detect unjustified copying in research articles. A majority of publishers and journals today utilize some sort of plagiarism detection programme to support peer review.

Apart from plagiarism detection, online tools have lately emerged to help reviewers in a variety of different ways. Artificial intelligence technology is being widely used to create software algorithms to analyse the comprehensiveness, uniformity, and validity of statistical tests in

academic writing. This initiative especially addresses the deliberate misuse of statistics in research, which is claimed to be a key contributor in the alleged reproducibility and integrity crisis.

Furthermore, some journals have successfully adopted algorithms to aid in identifying image manipulation, which is known to be a growing type of fraud in various research domains.

Automated computer software may be well set to play a more significant role in the review process. It is now possible to check for data falsification, image manipulation, and poor reporting using machine-learning algorithms. In the future, software will be able to perform subject-oriented paper assessment, paving the way for a completely automated publication procedure.

Digital technology and software tools are not forced on reviewers but are managed by the journal's editorial team. The review process, therefore, now includes much more than individual reviewers just doing quality evaluation. Accordingly, the use of such techniques should be seen as an alternative method in the review process rather than an essential component of the real review by a 'peer.'

3.4. Peer Review of Data Sets

The last decade has witnessed an upsurge in the sharing of research data. A data-sharing culture is emerging. A number of publications and organizations are implementing policies requiring data disclosure in some form.

Research initiatives necessitate data collection; nevertheless, some inference is necessary to correlate experimental results with the hypothesis. While papers are subjected to peer-review, the original data quality is not subject to the same scrutiny. The actual data is essential to the scientific process as it allows peers to comprehend the researchers' thought process. However, the nature of peer review of data sets remains unclear.

Both funding and publication policies have been encouraging data sharing. The number of titles that mandate such sharing in some manner is also fast growing. SpringerNature, AGU, PLOS, and the American Economic Association, among others, have all proposed data-sharing rules in recent years. Furthermore, data access has been a focus of other initiatives such as the COPDESS Statement of Commitment. Like the Gates Foundation, the Arnold Foundation, and the Wellcome Trust, several funding organizations have made data sharing a cornerstone of their funding policies. Additionally, several government agencies are covered by the 2013 OSTP memo on improving access to federally funded research.

There is growing public interest in reproducing data. Researchers, therefore, have the responsibility to publish data sets generated during their experiments. Considering peer reviewers already spend more than 9 hours per review, peer review of data sets might well be taxing on the peer review process.

3.5. Peer Review is Becoming More Specialized as New Players Emerge

Over the last few decades, new players have entered the review process.

As part of these new efforts, the review is separated from the journal in which the paper is published. Several models have evolved. One of these arranges for independent third-party evaluation of papers before publication. Platforms like Axios Review, Peerage of Science, and RUBRIQ offer tools and solutions for conducting reviews and submitting articles with referee reports to journals.

Besides the systems that provide a pre-publication review, independent platforms such as PubPeer have evolved, allowing readers to comment on any published paper. These developments have redefined the scope of a peer. The terminology now refers to everyone who believes they can comprehend and assess a specific piece of research, rather than only a small group of specialists chosen by the editor.

The formation of such an extended peer community raises new concerns about the role of expertise in peer review. Questions regarding who has the right and ability to assess the relevance, quality, and soundness of scientific research also need to be addressed.

Adopting the concept of ‘cascading peer review’ is another way to reduce the strain on peer review. First used at the beginning of the twenty-first century, this model is widely used among publishers today. This system intends to avoid the ultimate rejection of a manuscript by transferring rejected papers to potentially more relevant journals within their portfolio, thereby saving cost and improving efficiency. In addition to eliminating the duplication of having a paper steered through the peer-review process multiple times, internal manuscript and peer-review referral services can provide authors with the advantage of faster publication.

These peer review models are intended to eliminate the need for a single manuscript to go through numerous rounds of peer review. This also addresses a long-standing worry that perhaps the peer review system is becoming overburdened.

3.6. Increased Communication During the Review Process

To conclude, the advent of digital technologies has allowed for greater transparency in the assessment process. Some publications have sought to enhance editorial decision making by including interactive phases in the review process where reviewers and editors may exchange or debate their reports and thoughts on a submission before conveying a final decision to the author. This procedure offers a review platform for authors and reviewers to communicate. Such platforms allow authors and reviewers to discuss the article online until they reach a consensus on the most effective method to enhance its quality.

4. AI can Help Meet Global Demand for High-Quality, Unbiased Peer-Review

Demand for peer-review is rapidly increasing. With the rise in the volume of academic publications, journal editors are constantly under pressure to quickly locate reviewers to evaluate the quality of academic work. Data from Dimensions reveal that over 4.2 million papers were published in 2019 compared to only 2.2 million just a decade ago. The growing volume of scientific manuscripts published, as well as the increasing need for high-quality peer-review, necessitates the adoption of innovative decision support technologies to ensure these manuscripts are assessed efficiently, thoroughly, and consistently.

The potential of Artificial Intelligence (AI) to enhance productivity and minimize reviewer workload has garnered significant attention. AI is increasingly being deployed to help review manuscripts and also support the peer-review process.

Artificial intelligence enables scalability while maintaining stringent quality standards. Correcting language errors, verifying ethics statements, and finding flaws in images are all time-consuming activities that can contribute to reviewer fatigue. Other tasks, such as screening for conflicts of interest amongst authors and reviewers or detecting plagiarism, are only possible with technological support. Machine learning algorithms can help identify such problems to help authors, editors, and reviewers make better editorial decisions.

AI-enabled platforms ensure that papers submitted for peer review comply with the standards essential for high-quality scientific research. This technology assists editors

and reviewers by drawing their attention to possible flaws in manuscripts. These concerns can then be addressed or clarified during the manuscript review process. Tagging possible concerns that need to be tackled enables human specialists to make more efficient and effective editorial choices, cutting down the time to publication for authors, as well as providing the highest quality standards.

A suite of automated technologies are now available to help with peer review. A software called StatReviewer validates the accuracy of the statistics and methods in the manuscripts. The tool can evaluate statistics in standard formats and presentation styles from a number of scientific disciplines. To do this, it ensures that publications accurately provide information such as sample sizes, information regarding subject blinding, and baseline data. StatReviewer can also detect indicators of fraudulent behavior.

In 2018, ScholarOne, a peer-review platform utilized by numerous publications, partnered with UNSILO. UNSILO automatically extracts important concepts from the manuscript to summarize its content. Automatic plagiarism checks are currently available on several platforms, including ScholarOne. Penelope.ai, for example, examines if a manuscript's references and structure satisfy the standards of a journal.

Earlier this year, open-access publisher Frontiers developed the state-of-the-art Artificial Intelligence Review Assistant (AIRA) to help editors, reviewers and authors evaluate the quality of manuscripts. AIRA examines each manuscript and can provide up to 20 recommendations in seconds, including assessing the quality of the language, the integrity of the statistics, detecting plagiarism, and identifying potential conflicts of interest.

While these tools can ensure that a manuscript is up to standard, they are not intended to replace the work of a reviewer in terms of evaluation. One cause of concern is that machine-learning algorithms, trained on already published manuscripts, may reinforce existing biases in peer review. Furthermore, because the algorithms are highly domain specialized, they lack scalability in limited domains. Algorithms are not yet intelligent enough to allow an editor to accept or reject a manuscript purely based on the data extracted. While the algorithms will take some time to perfect, it would make sense to automate a lot of things for the reason that a lot of things in peer review remain standard.

Straive has invested technology and SMEs as part of its Innovation labs and deployed solutions around reviewer search and transfer management. Our long-term engagements with our partners clearly demonstrate our capabilities across the publishing value chain. Be it our work with upstream solutions such as Transfer Desk, or Reviewer Search or downstream solutions like our MARC distribution platform, we have a comprehensive portfolio that allows us to drive change seamlessly.

5. Conclusion

Even though we are in the digital era where fast-track publication is the norm, the principle behind peer review remains the same. The highest level of integrity and the fastest turnaround to being accessible are the standards in research publication. The Internet has transformed our expectations about how communication works, allowing us to change how we communicate and connect online using new technologies.

Several online applications currently include all the basic features necessary for developing a large-scale, diversified peer review ecosystem. The technology we need already exists. There is, nevertheless, a lot to be done in integrating new technology-mediated communication standards into successful, broadly recognized peer review models and smoothly interconnecting them to make them interoperable in a viable scholarly communications infrastructure.

About Straive (formerly SPi Global)

Straive is a market-leading content technology enterprise that provides data services, subject matter expertise (SME), and technology solutions to multiple domains, such as research content, eLearning/EdTech, and data/information providers. With a client base scoping 30 countries worldwide, Straive's multi-geographical resource pool is strategically located in eight countries - the Philippines, India, the United States, China, Nicaragua, Vietnam, the United Kingdom, and Singapore, where the company is headquartered.

www.straive.com
info@straive.com

References:

The peer review process/ https://authorservices.wiley.com/Reviewers/journal-reviewers/what-is-peer-review/the-peer-review-process.html

Technological Support for Peer Review Innovations/ Jessica Polka/ https://scholarlykitchen.sspnet.org/2019/03/26/guest-post-technological-support-for-peer-review-innovations/

The changing forms and expectations of peer review / S. P. J. M. (Serge) Horbach & W. (Willem) Halffman / https://researchintegrityjournal.biomedcentral.com/articles/10.1186/s41073-018-0051-5/

A multi-disciplinary perspective on emergent and future innovations in peer review [version 3; peer review: 2 approved]/ Jonathan P. Tennant/ https://f1000research.com/articles/6-1151

A multi-disciplinary perspective on emergent and future innovations in peer review [version 1; peer review: 2 approved with reservations]/ Jonathan P. Tennant/ https://f1000research.com/articles/6-1151/v1

Reviewer Roles and Responsibilities/ Anna Trudgett/ https://www.councilscienceeditors.org/resource-library/editorial-policies/white-paper-on-publication-ethics/2-3-reviewer-roles-and-responsibilities/

A Closer Look at the Common Challenges in Peer Review / https://www.econtentpro.com/blog/common-challenges-in-peer-review/49

Challenges in Peer Review / https://redlink.com/challenges-in-peer-review/

Achieving quality at scale: here's how we do it with our Collaborative Peer Review / https://blog.frontiersin.org/2016/08/21/frontiers-collaborative-peer-review-quality-at-scale/

Four reasons to feel good about the future of peer review/ Eric Hall / https://www.researchinformation.info/analysis-opinion/four-reasons-feel-good-about-future-peer-review

Purposes of peer review: A qualitative study of stakeholder expectations and perceptions / Anna Severin, Joanna Chataway/ https://onlinelibrary.wiley.com/doi/full/10.1002/leap.1336

We have the technology to save peer review – now it is up to our communities to implement it / Jon Tennant, Daniel Graziotin and Sarah Kearns/ https://blogs.lse.ac.uk/impactofsocialsciences/2017/09/11/we-have-the-technology-to-save-peer-review-now-it-is-up-to-our-communities-to-implement-it/

Transferring Manuscripts Between Publications in Editorial Manager/ Michael Di Natale, Alison McGonagle-O'Connell, Kathleen Horgan/ https://www.ariessys.com/wp-content/uploads/March_2016.pdf

Should your peer review move online?/ https://manuscriptmanager.com/peer-review-editorial-management-system/

Artificial Intelligence to help meet global demand for high-quality, objective peer-review in publishing / https://blog.frontiersin.org/2020/07/01/artificial-intelligence-peer-review-assistant-aira/

AI peer reviewers unleashed to ease publishing grind/ Douglas Heaven/ https://www.nature.com/articles/d41586-018-07245-9

What Constitutes Peer Review of Data? A Survey of Peer Review Guidelines / Todd A Carpenter/ https://scholarlykitchen.sspnet.org/2017/04/11/what-constitutes-peer-review-research-data/