Open Research Online

Peer-reviews on the blockchain

Conference or Workshop Item

For guidance on citations see FAQs.

oro.open.ac.uk

Peer-reviews on the blockchain⋆

Zeeshan Jan[0000−0003−3133−8728], Allan Third[0000−0002−0386−1936], Michelle Bachler, and John Domingue[0000−0001−8439−0293]

KMi - Knowledge Media Institute,
The Open University, Milton Keynes, UK.
{first.last}@open.ac.uk

Abstract. Peer-reviewing holds a significant importance in the process of scientific publishing. The process of peer-reviewing has been criticized for its defects, but research communities have *faith* in it, and hence, it is perceived as the backbone of scientific publishing. The process needs improvements in a number of ways, i.e, establishing trust in the process, preventing abuse, bringing transparency in the process and keeping the integrity of data intact. Moreover, the activity of peer-reviewing is carried out without any formal incentives. We present considerations in refreshing peer-review, and our approach to experiment in this space.

Keywords: Peer-review · Decentralization · Blockchain · Incentives

1 Introduction

The practice of peer review is central to the scholarly process, with "peer-reviewed" serving as a commonly-used shorthand for "high-quality trustworthy research". Modern developments in digital publication and communication offer the chance to refresh our understanding of peer review in both its processes and wider context. In particular, we argue that decentralized semantic publishing, coupled with secure distributed ledger technologies such as blockchain, have the potential to open up peer review to be a key part of scientific collaboration and dissemination, beyond being a closed quality control process.

2 Issues in peer-review

There are known issues of the peer-reviewing process including inconsistency, bias and potential abuse (see [13]). [1] describes a study in which 12 already-published articles from prestigious institutions were resubmitted with changed authors' name and fake institutions. Only three articles were identified as already published, and eight of the remaining nine were rejected because of poor quality. The study concluded that this demonstrated bias against less prestigious sources. As a minimum, the study demonstrates a lack of consistency in reviewing. There are a number of ways to abuse the process, by stealing an idea, or unfairly blocking an article's publication [13]. Following are the other issues related to peer-review.

2.1   Socioeconomic context

Peer-reviewing is perceived as a thankless job as peer-reviewers are rarely acknowledged for their efforts. One of the motivations for researchers to take part in peer-review might be to be responsible members of the scholarly community. Moreover, the potential consequences of review decisions are asymmetrical. A careful and constructive review receives the same recognition as a sloppy unhelpful one, while on the other hand, an author's career and reputation depend upon publication, as may the advancement of knowledge, with high-quality research unpublished and poor-quality research published.

The processes of scholarly communication are also changing. Where the traditional model of peer-review was developed in the context of print-based dissemination of articles, digital publication offers more opportunities. Scholarly communication spreads beyond simply papers; presentations, software, and datasets are increasingly considered as relevant material to document the scholarly process and can be included in calls for submissions (see, e.g., [3]). If peer-review is a measure of academic quality, it would be beneficial, therefore, to support its application to forms of publication beyond articles.

2.2   Quality

Reviews can vary from constructive (critical points to address, recommendations for improvement) to cursory (a few lines with little sign of depth or consideration). Studies into the effects of blind review (e.g., [13]) found that it did not lead to improved review quality. Cases of fraud have been documented – for example, using fake email accounts to become the reviewer of one's own articles [5].

2.3   Bias and accountability

The process of peer-reviewing can potentially be prone to bias. Some of the possibilities are gender bias (see [16]), professional bias (groups working in the same research area), renowned authors' names (a reviewer may be reluctant to criticize a well-known figure, for example), personal bias regarding fellow researchers or research groups, "groupthink" affecting openness to new ideas, and so on. The practice of blind review is intended to reduce or limit bias, but, given the increasing specialization of academic research focuses, there is an inherent limit to the level of anonymization blind review can provide.

3   Themes and perspectives on peer-review

Openness The current default process involves closed data: reviewer and author identity, review text and scores. Some venues (e.g., the Semantic Web Journal, ESWC [3]) use Open Review [10] in order to improve quality and reduce bias through transparency. Open Review can be implemented in a number of ways depending on which aspects of the process are made public. What are the effects of these choices on the outcomes? What aspects of review content and process be made public?

Connection and Decentralization Reviews and reviewing tend to be centralized to the publication venue. There is no custom of maintaining a reviewing record similar to a publication record for an individual scholar. Reviews also often contain scientific content (critiques of assumptions, techniques and results, suggestions, and new materials and context). It may be beneficial for scholarly discourse if this content were part of the public scientific conversation, and if it could be linked to publications, presentations, pre-prints, other reviews, data, and so on, much as is done with papers. Decentralization would enable the sharing of and access to data about reviews and reviewers across multiple venues, communities and institutions, enabling larger pools of relevant potential reviewers to be approached, as well as opening up the scientific content of reviews for study and reference. What aspects of the peer-review process can be decentralized, and to what extent?

Incentive and trust Some initiatives have been introduced to provide incentives for peer-reviewing, in order to reward and recognize the effort involved, and improve review quality by motivating extra care to be taken while reviewing (See, e.g, [8], [9]). What is the best way to incentivize peer-review? Will it succeed in motivating constructive reviews? Can life long recognition for peer-reviewing efforts help researchers to advance their careers? Reward and incentive systems can be gamed or manipulated if they are valued. How can such a system be trusted and made secure?

4   Pilot and future plans

Following [6], we have developed a pilot on a private Ethereum [2] blockchain. A blockchain is a *distributed ledger* with decentralized, transparent, cryptographically secure, immutable time-stamped records; Bitcoin [7] is underpinned by one. They have many other applications, such as educational reputation (e.g., [11]).

We have created a "token" – a customized blockchain digital currency – to give as a reward, with a Web user interface. The data of the (open-review) Extended Semantic Web Conference 2018 was used and reward tokens issued to reviewer accounts (3 per review).The details of 168 submissions, their authors, and their reviewers are on the system. Currently tokens are simply a metric of effort; future studies will make them redeemable for rewards.

For the pilot, we wrote and deployed four *Smart Contracts* (blockchain-executed code), shown in Figure 1. (*Person* and *Submission*) contracts define the types for authors & reviewers, and submitted articles. *TokenScienceMiles* defines the ERC20 token [4]. The contract *ScienceMiles* connects all the relevant entities. It keeps the blockchain address of each *Person* and *Submission*.

We aim to use this platform to experiment with various aspects of the openness, decentralization and incentivization of peer-review. By, in future, incorporating Linked Data technologies [14], we can also support the dynamic integration and querying of decentralized peer-review data to enable connections to be made across researchers and publication venues, including open and non-traditional modes of scientific communication, such as dataset publication [15] and collaborative presentation platforms such as SlideWiki [12].
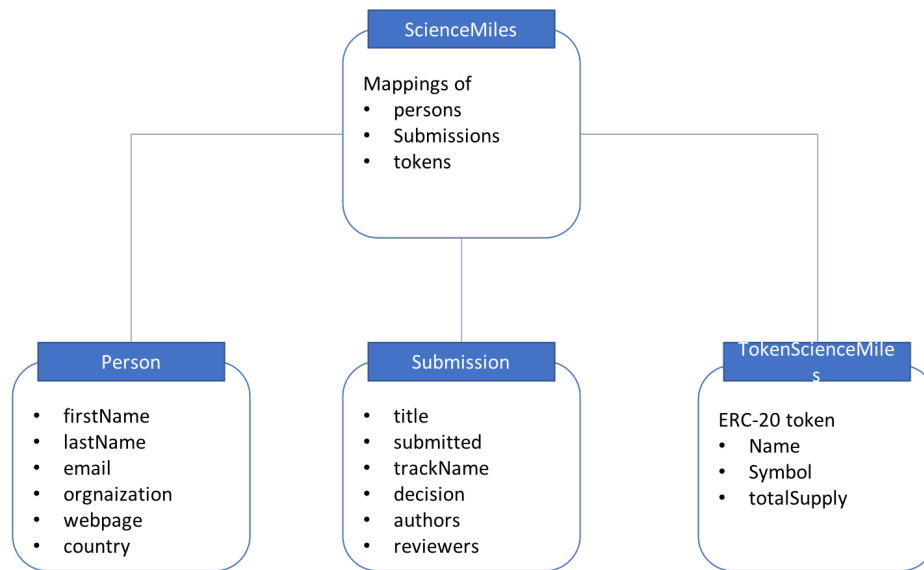
Appendix

Fig. 1. Smart Contracts

References

1. Bartko, J.J.: The fate of published articles, submitted again. Behavioral and Brain Sciences **5**(2), 199–199 (1982)
2. Buterin, V., et al.: Ethereum white paper. GitHub repository (2013)
3. ESWC: ESWC - Call for Papers - 2018 (2018 (accessed October 10, 2018)), https://2018.eswc-conferences.org/call-for-papers/
4. Ethereum: Ethereum Tokens (2018 (accessed October 10, 2018)), https://ethereum.org/token
5. Haug, C.J.: Peer-review fraudhacking the scientific publication process. New England Journal of Medicine **373**(25), 2393–2395 (2015)
6. Jan, Z., Third, A., Ibanez, L.D., Bachler, M., Simperl, E., Domingue, J.: Sciencemiles: Digital currency for researchers. In: Companion of the The Web Conference 2018 on The Web Conference 2018. pp. 1183–1186. International World Wide Web Conferences Steering Committee (2018)
7. Nakamoto, S.: Bitcoin: A peer-to-peer electronic cash system (2008)
8. Publons: Publons (2018 (accessed October 10, 2018)), https://publons.com/

9. ReviewerCredits: ReviewerCredits (2018 (accessed October 10, 2018)), https://www.reviewercredits.com/

10. Ross-Hellauer, T.: What is open peer review? a systematic review. F1000Research **6** (2017)

11. Sharples, M., Domingue, J.: The blockchain and kudos: A distributed system for educational record, reputation and reward. In: European Conference on Technology Enhanced Learning. pp. 490–496. Springer (2016)

12. SlideWiki: SlideWiki (2018 (accessed October 10, 2018)), https://slidewiki.eu/

13. Smith, R.: Peer review: a flawed process at the heart of science and journals. Journal of the royal society of medicine **99**(4), 178–182 (2006)

14. Third, A., Domingue, J.: Linkchains: Exploring the space of decentralised trustworthy linked data. In: Decentralizing the Semantic Web workshop at ISWC 2017 (2017)

15. University, O.: OU Data Science (2018 (accessed October 10, 2018)), https://ouds.org.uk/

16. Wenneras, C., Wold, A.: Nepotism and sexism in peer-review. Women, sience and technology: A reader in feminist science studies pp. 46–52 (2001)