Recognition and Reward System for Peer-Reviewers

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Abstract. Peer reviewing plays an important role in academic publishing process that scrutinizes and provides feedback of the scientific work prior to publication. Peer-reviewers put their efforts in reviewing others research work voluntarily, without any expectations of incentives or rewards. The peer-review process has been criticized for its defects like slowness, bias and abuse of the process. In this paper, we present a model to address these issues by using the approach of recording peer-review data on the blockchain. By using semantic web and linked data technologies, this system would be able to expose its data, and interact with other systems. This system will be used to quantify, recognize and incentivize the peer-reviewing efforts by researchers.

Keywords: Peer-review · Incentive · Linked-data · Blockchain.

1 Problem Statement

Peer-reviewing is the activity when researchers assess the scientific work of other researchers before publishing. The process of peer-reviewing is questioned and criticized for the identified defects in it [12]. The slowness, abuse, bias and inconsistency in the process raise questions about the validity and 'working' of the peer-review process.

Researchers spend their valuable time in peer-reviewing that somehow, is less recognized and quantified by the community. Such efforts of researchers should be recognized, quantified and incentivized at some public platform.

There is a need of defining the actual and potential requirements of the peer-review process, along with a model to address the defects of the process as well as to incentivize peer-reviewers.

2 Relevancy

The modern form of peer-review process used by journals, conferences and publishers is influenced by the review process adopted by the Royal Society of Edinburgh in 1731, when publications were inspected by a selected group of knowledgeable members [13]. Peer-review is at the heart of the processes of science

[12]. The process of peer-reviewing is an important part of scholarly communication process and it has been discussed and criticized for its methods, approaches and defects but yet stands as the backbone of the scientific publication process. Published research work is piled up when new researchers develop their understanding by reading previous studies, identifying research questions and gaps, discovering new research areas of study and contributing their research work [14].

Researchers should get incentives for their peer-reviewing efforts, and these efforts should be quantified at some platform to acknowledge researchers' peer-reviewing contributions. Such platform should ensure transparency and fairness in the process. By bringing improvements in the mechanism of peer-reviewing and making it transparent, fair and attractive for researchers, it will have a constructive impact on research and science. Researchers would be more motivated to do peer-reviewing actively. This linked data of peer-reviews, comments and incentives, can be exploited and used by other scholarly applications.

3 Related Work

In this section peer-review patterns, their problems and incentive models for peer-reviewers are discussed.

3.1 Peer Review Patterns

Peer reviewing practice follows a number of patterns, for instance, in [8], case studies of six peer-review patterns were presented. However, we focus on Open Peer review process for the pilot study.

Closed Review: This process is categorized in two ways, single blind and double blind. Single blind process ensures that identities of reviewers remain unknown to the authors, while in Double blind process, in addition to the withholding of peer-reviewers names from authors, the names of the authors are not revealed to the reviewers. However, peer-reviewers can identify the articles after they are published.

Open Review: Open peer-review process consists of publishing the manuscripts along with the reviews they get, to ensure the transparency in peer-reviewing. In open peer-review, names of the authors and reviewers are mutually revealed, to avoid the potential bias.

3.2 Defects of Peer-review

Smith [12] mentions about a systematic review of all the available evidence on peer-review, that concluded 'the practice of peer review is based on faith in its effects, rather than on facts' [6]. Stephen Lock [7] as an editor of the BMJ, conducted a study in which only he decided about the publication of a consecutive series of papers submitted to the journal, he would publish. Lock, then sent the papers for usual process of peer-review and there was a little difference between

the papers he selected for publication and those selected after peer-review process [7]. Smith [12] enlists a number of defects in peer-review process including being poor at detecting gross defects, almost useful for detecting fraud, slow, expensive, profligate of academic time, highly subjective, a kind of lottery, prone to bias and easily abused [12].

Slowness in the process: There are many journals take even more than a year to review, accept and then publish a paper [12]. That makes peer-review process as the frustrating phase of publishing scientific work.

Prone to bias: Traditionally, peer-review scores are not made public [15] therefore, there are high chances of occurrence of bias. Wenneras finds strong evidence of gender bias against women in the process of peer-review while awarding financial grants [15]. According to the study, peer-reviewers deemed women to be deficient in scientific competence [15].

Abuse of the system: Peer-review process can be abused at many different levels. From stealing research ideas to producing harsh review to block the research progress of competitor, many researchers have been victim of the abuse [12]. Another possible (potential) abuse of the system can be the misuse of the access over peer-review database, as such systems are centralized. Someone can easily alter the data and change the decision if they want to abuse the access over system.

Fake peer-reviews: Haug, explains about the 64 retracted articles from 10 different journals by the publisher Springer. Haug further mentions about a South Korean researcher Hyung-in Moon, who admitted to have email addresses so that he could provide peer-reviews of his own articles using those email and fake identities. Through such editorial checks, more than 250 articles were retracted because of the fake-reviews, about 15% of the total number of retractions [3].

Publons[1] is a platform for peer-reviewers where researchers can add their review records to their profiles by forwarding their review receipt email to Publons. It also allows journal integrations through a formal partnership of journals with Publons. This platform is exposed to the potential abuses listed above.

3.3 Incentive

There have been several approaches to incentivising peer-reviewing, some of which are listed in table 1 below. To improve the peer-review process, punishing the peer-reviewers is also brought under discussion.

Gropp [2] raised a question that if peer-review is properly incentivized, and if peer-reviewers are being asked to evaluate the right things? Gropp proposed an incentive model to filter out the *good* peer-reviewers who produce thorough reviews, submit them timely and are responsive to any query sent about the review. Such peer-reviewers' name are put into a research funds lottery, to give them incentive for peer-reviewing.

[1] https://publons.com/home/

The Winnower is a platform that publishes post-publication peer-reviews and is exploring incentivizing peer-reviewers to highlight their work by elevating the review report to the level of an original research publication [10].

ReviewerCredits[2] came up with an idea to give credit to peer-reviewers. Peer-reviewers would have to contact *ReviewerCredits* which would contact the journal concerned for verification. After receiving verification, a peer-reviewer's profile is credited with *ReviewerCredits*.

Punishing the peer-reviewer submitting after deadline, is suggested by Hauser [4]. Hauser opines, if habitual late-reviewers stick to their habit of being late in submitting the peer-review, another week delay (for their own publication) should be added as a top-up.

Table 1. Comparison of incentive models

Approach	**Punishment Model**	**Incentive Model**
Hauser [4]	Reviewer's article in editorial limbo for a certain period. (even if peer-reviewers refuse to review)	Reviewers' articles in priority queue for publication, if accepted.
Gropp [2]	No	Filter good peer-reviewers and put them in to a lottery fund
ReviewerCredit[3]	No	Credit awards for peer-reviewers' profiles as reputation indicators.
ScienceMiles	No	Digital Currency, to be spent on other platforms, as well as measured as reputation.

4 Research Questions

Given the problems discussed in section 1, we intend to answer these research questions:

Q1: What are the actual and potential requirements of peer-review processes? (e.g., open, closed, blind, double-blind, conferences, journals etc.)

Q2: How are currently implemented processes addressing and failing to address these requirements?

Q3: How does recording data and incentivizing peer-reviewers address and fail to address these requirements?

Q4: How can currently implemented processes be compared with the blockchain-based processes in terms of addressing the requirements answered by *Q1*?

[2] https://www.reviewercredits.com/

Q5: By knowing that the peer-review data would be recorded permanently, does it affect the researchers' behavior in terms of:

i Papers they accept
ii Papers they reject
iii Papers they rate

5 Hypotheses

By having above research questions, we derive hypotheses as:

H1: Blockchain-based data-recording model for peer-reviewing process keeps the data tamper-free, traceable and immutable.

H2: Blockchain-based incentivizing model for peer-reviewing process ensures fair and transparent distribution of rewards.

H3: The features of immutability and transparency ensure tamper-free and traceable data. Therefore, researchers would be more careful in terms of accepting, rejecting and rating papers.

6 Preliminary results

We are in a process to annotate the open-review data from ESWC. We have also deployed Ethereum[4] based blockchain in our private network of the institute. We have written and implemented the *SmartContracts* for Authors, Reviews and Submissions from the ESWC-2018[5]. Our next step is to implement customized *ERC20 Token*[6] SmartContracts for researchers.

7 Approach

We plan to implement Ethereum [1] based blockchain that would record peer-review linked-data. This would allow us to implement an incentive system for researchers, as blockchains are the only generally-accepted trusted way to have exchangeable tokens without a central authority.

Annotation (Linked-data)

The approach would be to annotate the peer-review data by reusing *Conference* [9] and *ScholOnto* [11] ontologies. Annotating the data using linked-data technologies would ensure the integration of third-party applications with the system.

[4] `https://www.ethereum.org/`
[5] `https://2018.eswc-conferences.org/program/submissions/`
[6] `https://theethereum.wiki/w/index.php/ERC20_Token_Standard`

Blockchain

SmartContract is a piece of code embedded and stored in blockchain network, that is responsible for managing the transactions and is protected from any amendments, deletion and tampering [5]. We plan to implement SmartContract(s) enabling storage of linked-data on the blockchain.

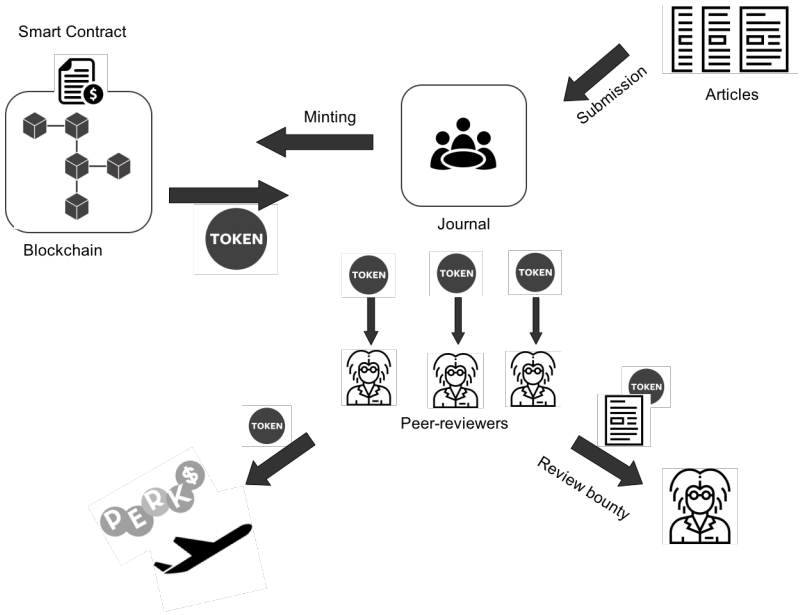

Fig. 1. ScienceMiles Model

8 Evaluation plan

Based on the research questions posed in section 4, the evaluation plan for each question is:

E1: Are actual and potential requirements of peer-review process addressed by currently implemented peer-reviewing processes?

E2: Does blockchain-based data-recording model fulfill these requirements and add the promising features (i.e., transparency, immutability, decentralization) to the peer-review process?

E3: Does blockchain-based incentive model for peer-review process ensure the transparent and fair distribution of awards amongst researchers (peer-reviewers)?

E4: Comparison between currently implemented peer-review processes and blockchain-based peer-review process in terms of the number of:

i Papers accepted by a journal/conference.
ii Papers rejected by a journal/conference.
iii Papers rated by peer-reviewers.

9 Reflections

Existing approaches to incentivize peer-reviewers are based on centralized and manual systems requiring trust in third parties. Apart from the idea of a lottery fund for researchers, these models offer no real-world value incentives. While we mentioned about the defects in peer-review process and identified that we can address these issues by developing a system based on the linked-data and blockchains technologies that ensure data integration, re-usability of data, security and transparency.

Benefits of peer-review process on Blockchain

- **Transparency**: Blockchain offers transparency in recording transactions in the network to make them accountable and audit-able. In peer-review system, the impact of transparency would strengthen the importance, reliability and trust in peer-reviews. With distributed database technology, each member in the network would be able to lookup, trace and validate any record of peer-review submissions and incentives given to peer-reviewers. The novel concept of immutability of data in blockchain would ensure the sanctity of records and prevent any fabrication or tampering of data.
- **Decentralized data**: Blockchain follows peer-to-peer network infrastructure where the network peers(nodes) validate, store and reconcile data. *Consensus* is a concept of reviewing such transactions and taking decisions about their validity. By implementing peer-review system on blockchain, each node of the network would have the same copy of data which makes it persistent, incorruptible, secure and immutable, in the presence of *Consensus*. That safeguards the data from hacking attacks and attempts to manipulate it.
- **Trust in peer-review process**: Features of blockchain ensure immutability, persistence, security and publicly availability of data. These features would enhance the trust in peer-review process.
- **Recognition**: With the implementation of peer-review process on the blockchain, the contributions by peer-reviewers can be quantified as the recognition. Peer-reviewers would get recognition based on their reviews and rewards available publicly. Journals and conferences can also announce the best reviewers of the year title awards to the researchers.
- **Preventing possible abuse**: Currently, peer-review systems are implemented by some centralized third-party entities that share the access to data with conference/journal program committee. The centralized-stored data can be abused potentially. Implementing peer-review system on blockchain can help in preventing any possible abuse of authority over a reviews database. Researchers can be verified through their official (institutional) emails, hence it would be very difficult to create multiple identity. In case they switch their institutes (they can add or amend their email addresses) system can detect the duplicity of a record based on name and date of birth of a researcher.
- **Less bias**: Immutable reviews and comments are publicly available, so reviewers would want to come up with a valid and clear stance about the

article, hence it would help in reducing the bias in the reviewing process if any.
- **Improved quality of the scientific output**: Encouraging timely and well-thought unbiased reviews will improve the quality of the scientific output. Fair and transparent incentive model can help in increasing motivation for peer-reviewing.
- **Rewards**: By participating in the public platform, authors, reviewers and commentators would be entitled to be awarded by *ScienceMiles*. These *ScienceMiles* in the form of a digital currency, are the acknowledgement by the research community, for the research community.
- **Large pool of peer-reviewers**: This system would gather a large pool of well-reputed (verified) peer-reviewers, that would be helpful for journals to find the suitable peer-reviewers for their publications.

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