

## Peer Review

### Toward a Blockchain-enabled Market-based Ecosystem

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## Peer Review: Toward a Blockchain-enabled Market-based Ecosystem

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### Abstract:

The scientific enterprise relies on a peer-review process to maintain the quality of academic discourse and to ensure researchers develop a valid and consistent cumulative body of knowledge. In recent years, it appears that the review capacity in the IS field has decreased, which indicates that the community's hunger for publication accompanies only a modest appetite for providing the necessary support to sustain the consequent increase in peer-review load. The advent of blockchain technologies and the proliferation of cryptocurrencies presents an opportunity to develop a token-based peer-review payment system that can clear the congested review pipelines while also controlling for quality and spreading the equity that peer review generates in a fair fashion through market-regulation mechanisms. Despite the digital transformation of the publishing industry, little has been done thus far to address the chronic inefficiency of the review process. The typical review cycles, which are measured in years, suggest that something needs to change. Developing a token-based peer-review payment system may be an opportunity not only to address the apparent challenge in the peer-review process but also to assert our proclaimed role as stewards of the digital revolution.

**Keywords:** Peer Review, Review Process, Market Control, Blockchain, Peer-review Coin (PRC).

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## 1 Introduction

The scientific enterprise requires communities of self-regulated experts who practice peer review as a governance mechanism (Chubin & Hackett, 1990). Peer review became a part of the scientific discourse shortly after the Royal Society of Edinburgh introduced it in scientific journals in 1731 (Shema, 2014). Over the years, peer review has developed into not only a primary quality control mechanism of knowledge production but also an instrument of resource allocation and institutional control. The merits and pitfalls of the peer-review mechanism have been discussed time and again in the scientific discourse at large (Resnik & Elmore, 2016). Nonetheless, despite the mounting criticism of peer review, no substitute mechanism has thus far gained significant traction.

Although demanding and time-consuming, academia needs the peer-review process to develop a valid and consistent cumulative body of knowledge. Willing and (hopefully) able members of the field's community of scholars conduct reviews voluntarily as a service. As a closed system, the review process is sustainable only if the pool of available reviewers can handle the flow of submissions in a timely manner. The central role of peer review in facilitating the formal discourse of thriving scientific communities calls for a periodical examination of its functionality and subsequent action if needed (Avital et al., 2015; Gray et al., 2006).

In recent years, however, perhaps due to the increased institutional pressures to publish and the increased rejection rates in most journals, it appears that the review capacity in the IS field has decreased. Journal editors have found that it has become harder to retain a sufficient number of qualified reviewers who can handle the ever-growing flow of submissions. It seems that the community's hunger for publication accompanies only a modest appetite for providing the necessary support to sustain the consequent increase in peer-review load (Avital et al., 2015; Stafford, 2018).

Building on his personal experience as a journal editor, Stafford (2018) calls for immediate action. He draws attention to the "tragedy of the commons in scientific publishing" and calls for a debate about how to address the challenges ahead because "our scientific commons cannot much longer support the rising demand for a scarce and valued resource in the form of skilled peer review" (p. 627). Evidently, so far, researchers have offered merely anecdotal evidence to support the claim that the review capacity in the IS field cannot support the rising demand for peer-review services for much longer. Regardless, Stafford's call to action provides a good opportunity to examine the outstanding issues and weigh in on the debate.

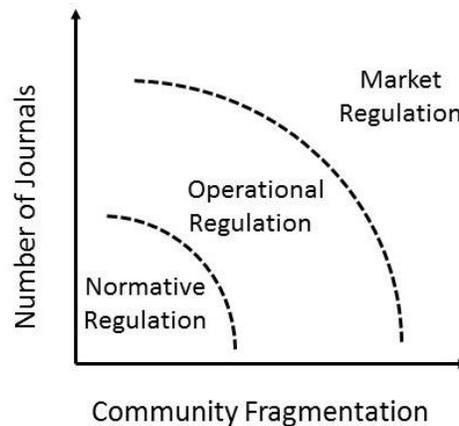
### 1.1 Peer-review Regulation

Peer review regulates publication quality, and one can understand it in the context of the three organizational control mechanisms: clan, bureaucracy, and market mechanisms (Ouchi, 1979). Overall, clans rely on a socialization process and are governed by traditions, bureaucracies rely on a close evaluation and are governed by rules, and markets reinforce control through their ability to measure and reward individual contributions and are governed by prices (Ouchi, 1980).

For the most part, peer review in the scientific enterprise has been controlled by clan mechanisms, which rely on a socialization process and apply normative regulation based on shared values, norms, traditions, and relational proximity. Governing peer review with normative regulation works well in a fairly small and cohesive community of scholars.

Natural growth in a scholarly community's may result in its fragmentation into subcommunities of interest, which, in turn, will likely result in a larger portfolio of journals that serve that community. Unsurprisingly, increased fragmentation reduces the sense of comradery between members of distant subcommunities and loosens the grip of the normative regulation. A clan's transformation into a community of loosely coupled affinity groups with blurred boundaries can diminish the effectiveness of normative regulation as a control mechanism of peer review.

Adopting operational regulation represents a typical response to normative regulation failure. Operational regulation is based on bureaucracy mechanisms, which rely on rules and administrative barriers. Governing peer review with operational regulation allows larger scholarly communities to facilitate effective peer review without having to rely heavily on a sense of commitment to the clan and its values. Figure 1 illustrates the conceivable change in peer-review regulation mechanisms as a function of community fragmentation.



**Figure 1. Peer-review Regulation Mechanisms**

Applying operational regulation often relies on fee-based publishing schemes as a corrective action when the normative regulation fails to sustain an effective peer review. For example, imposing “submission fees” or “publication fees” requires authors to pay pre- or post-acceptance fees, which journals can use to pay for expert reviewers. Finance and economics journals commonly adopt submission fees, while medical journals commonly adopt publication fees. While normative regulation treats peer review as stewardship, operational regulation considers peer review a service that entitles expert reviewers to get paid for their work. Such payment underscores the reviewers’ commitment to delivering a professional review in a timely manner. However, hefty fees inhibit submissions from authors who have insufficient resources and create inequality of opportunity, which, in turn, only increases the equity gap and its undesirable repercussions.

Peer review on a quid pro quo basis represents another potential variant of operational regulation, which prescribes paper-submission schemes that require prospective authors to review other papers submitted to the journal. This yet-unpracticed scenario translates the implied expectation of reciprocity under normative regulation into an explicit requirement. While peer review on a quid pro quo basis may mitigate the inequality of opportunity that fee-based schemes introduce, it may lead to review quality issues when inexperienced or incompetent reviewers are coerced to conduct reviews.

If the normative regulation is eroding in the IS field and the review capacity has indeed decreased as Stafford (2018) argues, then perhaps we need corrective action. Overall, although not perfect, operational regulation can certainly alleviate congested review pipelines and eliminate free-riders that cripple peer-review systems governed by normative regulation.

Stafford (2018) evokes the tragedy of the commons (Hardin, 1968) as a reference to the limited and overused review capacity in the IS field. This analogy works to some extent, especially because it implies that the review capacity is a limited resource that scholars can deplete and ruin if they overuse it. However, given that scholars serve as both authors and reviewers, the analogy has limitations. In real commons (e.g., a grazing field or water rights), the collective needs to manage the “distribution of a shared resource” (i.e., manage the “consumption” of the given resource via government-based, market-based, or community-based mechanisms as Ostrom (1990) and Marshall (2005) explore). Conversely, in the case of peer review, the collective (i.e., a community of scholars) needs to balance between the “consumption” and “production” of review work. The two challenges differ because the latter requires controlling both the consumption (i.e., submitting papers for review) and the production (i.e., accepting review assignments).

Although the tragedy of the commons is not a perfect analogy to describe the academic peer-review capacity challenge, it does highlight the fact that review capacity is not merely a resource but rather a market subject to supply-and-demand mechanisms. As such, we can envision a new form of peer-review governance based on market regulation.

Applying market regulation relies on market mechanisms that reinforce control through their ability to facilitate value exchange and reward individual contributions. Governing peer review with market regulation would allow even larger and more fragmented scholarly communities to facilitate effective peer review without the need to rely heavily on a sense of commitment to the clan or administrative controls.

## 2 Market-based Peer Review

The rise of blockchain technologies and the proliferation of cryptocurrencies (Tapscott & Tapscott, 2016) present an opportunity to use a token-based peer-review payment system to resolve the apparent shortage or inefficient use of reviewers in our publication ecosystem. A few years ago, applying market regulation would have required a centrally managed platform that would impose standards and assert control over the process. Centralized governance architecture of that sort would not cohere with the culture of scholarship and, therefore, would likely fail. In contrast, blockchain-based decentralized market-regulation mechanisms would offer all key stakeholders a platform to manage the supply and demand for competent reviewers in a favorable fashion that is compatible with academia's prevailing socio-cultural practices.

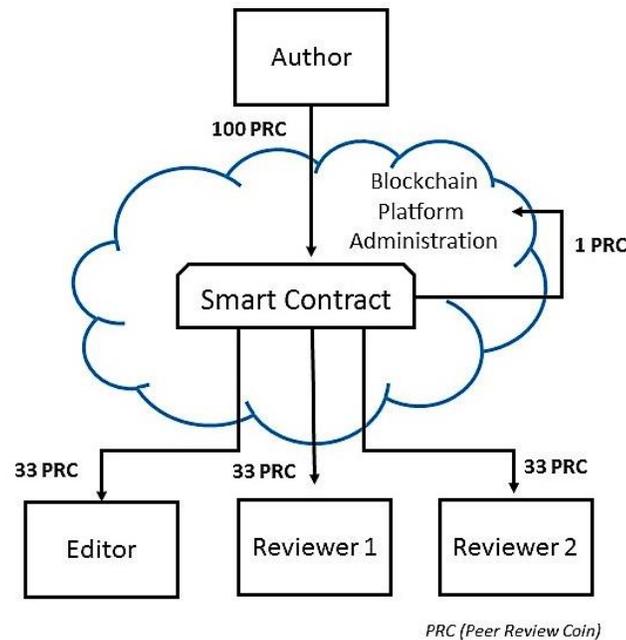
Cryptocurrencies such as Bitcoin use blockchain-based tokens that enable users to represent and exchange value and tangible externalities without the need for centralized governance architecture to facilitate clearing and to maintain the market's integrity. The diffusion of self-governed decentralized value-exchange solutions marks the advent of various open-Web services that allow users to exchange goods and services without the need for intermediation or central management. In other words, blockchain-based distributed governance models have emerged to emancipate users from the grip of monolithic, often inefficient, entrusted third parties and replaced them with cryptographic verification.

Building on the advent of blockchain technology, a token-based peer-review payment system could provide market regulation of reviewers' availability while maintaining the full independence of the journals and catering for authors' and reviewers' interests. In the envisioned token-based peer-review scheme, authors pay submission fees with peer-review coins (PRC) and reviewers receive PRC for their services. Thus, PRC is a cryptocurrency that fuels a peer review market in which PRC is exchanged, paid, and earned for review services.

Token-based market regulation uses external market mechanisms such as price and competition to establish peer-review standards that can measure and reward individual contributions. Token-based market regulation can mitigate the drawback of normative regulation and avoid the drawbacks of operational regulation. The market mechanism can clear the congested review pipelines and eliminate free riders while controlling for quality and spreading the equity generated through the peer review in a fair fashion.

Figure 2 illustrates the basic mechanics of a blockchain-enabled peer-review payment ecosystem. For example, an author pays a submission fee of 100 PRC: the paper's three reviewers each receive 33 PRC, and the party that maintains the blockchain platform that facilitates the exchange receives 1 PRC. A smart contract encoded to adhere to preset terms of payment administers the transaction. In its basic form, a smart contract in this context refers to a script that defines how and when the submission fee is split among the different members of the review team. A more complex smart contract may pay reviewers a premium for delivering their review ahead of time or any other desirable service and charge a fee for late delivery or any other undesired deviance.

In its generic form, blockchain technology provides a secured and commonly shared ledger that records transactions of value to the participants in an exchange network. In the case of peer-review regulation, a blockchain platform can record the PRC balance of all authors and reviewers and provide escrow and clearing services for exchanging PRC, which journals can use to reward and incentivize competent reviewers.



**Figure 2. Blockchain-enabled Peer-review Ecosystem (Simplified Model)**

Whereas blockchain-enabled peer-review payment platform can facilitate market regulation of peer review, it can also be designed to provide some new features that current publishing ecosystems do not afford.

**Transparency:** PRC transactions and balances can be as transparent as desirable. I envision PRC as an open-source project on a public blockchain where all transactions are transparent in a public ledger and where privacy is maintained in a similar fashion as in the case of Bitcoin. However, if needed, PRC may be developed on a permissioned variant of blockchain that requires registration and only authorized people can join the network. Such a system allows for a selective view of information based on predetermined rules. For example, while authors and reviewers may see only their own PRC balance, journal administrators may see all the transactions associated with their respective journals. The degree of transparency and the choice between public or permissioned blockchain platforms are matters of design and public debate.

**Scalability:** PRC can facilitate peer review in all or a subset of IS journals. In fact, any journal regardless of field can use the envisioned blockchain-enabled peer-review platform.

**Extensibility:** users can use PRC to facilitate any exchange. For example, users may use PRC to pay for journal subscriptions, to obtain access to read a single paper, or anything else that one would be willing to trade for PRC.

**Exchangeability:** users can exchange PRC like any cryptocurrency for fiat currency, which allows authors with financial means to purchase PRC and provides an opportunity for skillful reviewers in need to receive pay for review services. The rate of exchange between PRC and fiat currency will fluctuate based on supply and demand as in the case of other currency.

**Resilience:** PRC uses blockchain technology, which can provide a tamperproof record of authenticated and encrypted transactions.

I realize that the depiction of the token-based peer-review market in Figure 2 is a simplistic and low-fidelity description that leaves many conceptual, administrative, and technical issues that require further elaboration. However, in this paper, I merely present the opportunity for a token-based peer-review payment system and suggest that such a system could be an effective way to mitigate the apparent decline in review capacity in the IS field.

### 3 Conclusion

In response to Stafford (2018), I examine peer review as a socio-technical phenomenon in the context of three organizational control mechanisms: clan, bureaucracy, and market mechanisms. Overall, the prevalent clan mechanisms rely on normative regulation of the peer-review process. A common response to normative regulation failure is to adopt operational regulation. However, given the drawbacks of operational regulation, if peer review in the IS field needs corrective action, I argue that leapfrogging from normative regulation to market regulation would yield a better outcome.

Consequently, I suggest that we experiment with a token-based peer-review payment system in IS journals as a way to revitalize the archaic peer-review ecosystems and, perhaps, also as a preemptive tactic against the potentially unmet rising demand for reviewers.

I appreciate the radical attempts to speed up publication turnaround time and to make the review process more transparent by abolishing double-blind peer review and relying on post-publishing quality control processes (e.g., arXiv and PLoS ONE). Indeed, one can improve “live papers” through ongoing exchange with readers and can determine papers’ quality post hoc through impact indicators that may range from citations indices to straightforward “likes”. However, post-publishing quality control-based schemes will not likely gain traction in the near future given the institutional lock-ins of peer review and the economic interests that back it up. In that sense, although a token-based peer-review payment system may seem a radical change, it is actually a practical solution.

Given the IS field’s demonstrated cohesion and increased density (Liu, Li, Goncalves, Kostakos, & Xiao, 2016), one may ask whether the review capacity in the IS field will inevitably be unable to support the rising demand for peer-review services. Are we in the danger zone? Following a panel debate on this topic in ECIS 2015 (Avital et al., 2015), I asked some editors of IS journals if they had concerns with free-riders. Most of them said that this issue is not a problem that threatens the livelihood or quality of their respective journals. Although the latter is admittedly anecdotal evidence, we lack better evidence that supports the contrary. Of course, I do not mean to suggest that our field lacks free-riders; rather, the open question concerns whether the number of free-riders has (or is about to) become untenable. With that in mind, perhaps we should not merely debate the issue as Stafford (2018) suggests but rather conduct a study to assess the extent of the phenomenon before we formulate drastic changes and marshal resources to realize them.

Regardless, despite the publishing industry’s digital transformation, which has radically changed journals’ production process and how they deliver papers to readers, little has thus far been done to address the chronic inefficiency of the review process as indicated by the low-yield and rather lengthy review process. The typical single-digit acceptance rates and review cycles measured in years suggest that something needs to change. Nowadays, with the emergence of blockchain technologies, a token-based peer-review payment system may be an opportunity to address not only a challenge in the peer-review process but also an opportunity to assert our proclaimed role as stewards of the digital revolution.

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