Papers Receive More Citations After Rejection

This column considers the relationship between manuscript rejection and citations received.

If your manuscript is rejected but you still feel that your research is worthy of publication after reading the reviews, you should keep improving the manuscript and submitting to journals until the work is published.

A recent survey of 923 journals that were published between 2006 and 2009 reported that papers that had been initially rejected for publication received more citations on average than papers that were immediately accepted for publication [1]. Further, on average, manuscripts that were rejected by one journal and then submitted to and published in a different journal garnered more citations than manuscripts that were published in the second journal on the first attempt. This study received a large amount of press (for example, [2]–[5]). This column discusses some of the proposed explanations for why journal papers that were originally rejected can ultimately receive more citations.

One plausible explanation is that the authors of a rejected manuscript typically rewrite and improve the manuscript based on the comments received from editors and reviewers during the first review, so that the final paper has a higher impact.

Another reason that has been proposed [1] is that the longer time before publication allows more time for communication about the paper at conferences, increasing the citation rate after journal publication.

Another proposed cause is that manuscripts that challenge the status quo are often rejected the first time. Quite a lot of evidence has been published to support this explanation. A significant proportion of the papers that described Nobel Prize-winning discoveries were rejected during the first submission [6]–[7]. More than 20 Nobel laureates are reported to have had the key manuscripts rejected the first time. The topics of these papers include

- the Krebs cycle, the series of chemical reactions used by all aerobic organisms to generate energy
- Cerenkov radiation, the electromagnetic radiation emitted when a charged particle passes through a dielectric medium faster than the phase velocity of light in the medium
- mesons, subatomic particles consisting of one quark and one antiquark
- photosynthesis, the process used by plants to convert light into chemical energy
- Hawking radiation, the black body radiation predicted to be released by black holes.

If Nobel Prize-winning discoveries are routinely rejected the first time that they are submitted, then it is reasonable to conclude that non-Nobel Prize-winning contributions that challenge the status quo are also often squelched in the review process. While the number of citations is a measure of a paper's popularity rather than its quality [8], the initial rejection of papers that are both high quality and popular would contribute to the observation that rejected papers tend to be cited more.

Of course, a statistical analysis that averages over all journals considered in any particular study does not necessarily imply that the conclusions hold for specific journals, especially for journals not listed in the original study. For example, consider the journal *Angewandte Chemie International Edition*, which has a high impact factor (IF $>$ 10) that occasionally publishes papers on feedback control systems. An analysis of manuscripts submitted to *Angewandte Chemie International Edition* indicated that papers published in the journal receive about 43% more citations than papers that were rejected and subsequently published in other journals [9]–[10]. Similar results have been reported for some other journals [11]–[12].

While researchers may quibble about the details of the implementation of the statistical analyses of [1] or

Digital Object Identifier 10.1109/MCS.2014.2320335
Date of publication: 14 July 2014

other researchers [9]–[12], the overall body of evidence does strongly support one conclusion: If your manuscript is rejected but you still feel that your research is worthy of publication after reading the reviews, you should keep improving the manuscript and submitting to journals until the work is published.

REFERENCES

[1] V. Calcagno, E. Demoinet, K. Gollner, L. Guidi, D. Ruths, and C. de Mazancourt, "Flows of research manuscripts among scientific journals reveal hidden submission patterns," *Science*, vol. 338, no. 6110, pp. 1065–1069, Nov. 23, 2012.

[2] P. Ball, "Rejection improves eventual impact of manuscripts—A study of papers' histories from submission to publication unearths unexpected patterns," *Nature News*, Oct. 11, 2012.

[3] J. Bohannan, "Scientists may feel rejected, but rejection is rare before publication, study finds," *ScienceInsider*, Oct. 12, 2012.

[4] M. Banks, "Rejected manuscripts receive citation boost," *Phys. World*, vol. 25, no. 11, p. 8, Nov. 2012.

[5] R. Williams, "The benefits of rejection—A survey of the prepublication histories of papers reveals that manuscripts that are rejected then resubmitted are cited more often," *Scientist*, Oct. 11, 2012.

[6] J. M. Campanario and E. Acedo, "Rejecting highly cited papers: The views of scientists who encounter resistance to their discoveries from other scientists," *J. Amer. Soc. Inf. Sci. Technol.*, vol. 58, no. 5, pp. 734–743, 2007.

[7] Anon, "Coping with peer rejection," *Nature*, vol. 425, no. 645, Oct. 16, 2003.

[8] R. D. Braatz, "Chasing impact factors, or making an impact on technology?" *IEEE Control Syst. Mag.*, vol. 32, no. 6, pp. 6–7, Dec. 2012.

[9] L. Bornmann and H.-D. Daniel, "Selecting manuscripts for a high-impact journal through peer review: A citation analysis of communications that were accepted by *Angewandte Chemie International Edition*, or rejected but published elsewhere," *J. Amer. Soc. Inf. Sci. Technol.*, vol. 59, no. 11, pp. 1841–1852, Sept. 2008.

[10] L. Bornmann and H.-D. Daniel, "Erratum Re: 'Selecting manuscripts for a high-impact journal through peer review: A citation analysis of communications that were accepted by *Angewandte Chemie International Edition*, or rejected but published elsewhere'," *J. Amer. Soc. Inf. Sci. Technol.*, vol. 59, no. 11, pp. 1841–1852, 2008.

[11] J. L. Jackson, M. Srinivasan, J. Rea, K. E. Fletcher, and R. L. Kravitz, "The validity of peer review in a general medicine journal," *PLOS ONE*, vol. 6, no. 7, Article e22475, July 25, 2011.

[12] R. J. McDonald, H. J. Cloft, and D. F. Kallmes, "Fate of manuscripts previously rejected by the *American Journal of Neuroradiology*: A follow-up analysis," *Amer. J. Neuroradiol.*, vol. 30, no. 2, pp. 253–256, Feb. 2009.

Richard D. Braatz