June 2009

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Library Philosophy and Practice 2009

ISSN 1522-0222

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Introduction

Editorial peer review is widely used to select submissions to journals for publication and is presumed to improve their usefulness (Jefferson, Alderson, Wager & Davidoff, 2002). Publishing a peer reviewed article in a prestigious journal remains the highest validation for a work of scholarship. Peer review has served scholars well for centuries. The concept of reporting and validating research findings began in 1665, with the foundation of the Philosophical Transactions of the Royal Society of London. Peer review has enhanced the rigour and relevance of many scientific breakthroughs (Banks, 2006). Practically no historical accounts of the evolution of peer review exist. Contrary to common assumption, editorial peer review did not grow out of or interact with grant peer review. Editorial peer review procedures did not spread in an orderly way; they were not developed from editorial boards and passed on from journal to journal. Instead, casual referring out of articles on an individual basis may have occurred at any time, beginning in the early to mid-19th century (Burnham, 1990).

Peer review is not perfect, and when it is done sloppily, journals publish research that is flawed. Even when peer review is rigorous, flawed research sometimes gets into the literature. Journals have long relied on peer review, yet concerns about its limitations have often been expressed. Critics point out that some reviewers are unqualified and others, because of personal or professional rivalry, are biased. Editors may even select reviewers on the basis of the reviewers' biases. Furthermore, two or more reviewers may have widely discrepant opinions about a study. Critics also make the point that peer review not only fails to prevent the publication of flawed research but also permits the publication of research that is fraudulent. Some have described peer review as arbitrary, subjective, and secretive. In addition, many critics (including some of the popular press) maintain that it is simply unnecessary and slows the communication of information to the public (Kassirer & Campion 1994). The present study makes an attempt to measure the effect of peer review process on research impact of publications in comparison to those which have not gone through the process via citation analysis.

Objectives

The following objectives are laid down for the study:

- To assess the impact of peer review on citations
- To compare the research impact of refereed and working papers

Scope

The scope of the present study is limited to research articles published in *Information Research: An International Electronic Journal* from 1998-2002.

Hypothesis

In view of the criticism of peer review process from various quarters, let us assume that it does not improve the quality of research output and consequently does not affect the research impact of publications and formulate the hypothesis “The research impact of refereed and working papers does not differ significantly” for the purpose of testing.

Methodology

Information Research: An International Electronic Journal is a high impact factor open access journal in the field of information science publishing working papers side by side with refereed articles. The publication output of five years (1998-2002) was selected for determining their research impact through citation analysis. The details of refereed and working papers were recorded separately across all the issues covering a time period of 1998-2002.

All the 101 articles (74 refereed and 26 working papers) were searched in Scopus database for citations. Two articles (one refereed and one working paper) are not indexed by Scopus are thus not included in the study. The number of citations, self citations and other details were recorded for all the 99 articles. Standard statistical techniques were used to estimate various statistical tests. The data is tabulated and analysed in a systematic manner to reveal findings in accordance with desired objectives.

Related literature

The institutionalization of the peer review process took place mostly in the 20 th century, either to handle new problems in the numbers of articles submitted or to meet the demands for expert authority and objectivity in an increasingly specialized world (Burnham, 1990). Although widely used it is largely untested and its effects are uncertain (Jefferson, Alderson, Wager & Davidoff, 2002).The process being expensive, slow, prone to bias, open to abuse, possibly anti-innovatory and unable to detect fraud (Smith, 1997). It will remain almost impossible to assess or improve its effectiveness, unless the objectives are properly defined (Jefferson, Wager & Davidoff, 2002). However, vigilance can improve fairness in peer review process and alleviate the effects of various pitfalls. The journal editors should conduct periodic internal and external evaluations of their journal's peer review process and outcomes with participation of reviewers, contributors, readers, and owners (Hojat, Gonnella & Caelleigh, 2003).

There is a need for the development of an international online programme for accredation of potential refrees (Benos, Bashari, Chaves, Gagger, Kapoor, LaFrance, et al., 2007). Davidoff (2004) found that quality of many manuscript reviews is excellent, but in many other it is unfortunately still far from optimal. The editors of journals might understandably look for ways to improve reviewer's performance. One such step is the anonymity of peer review which decreases both personal as well as geographical bias (Opthof, Coronel & Janse, 2002). It is found that manuscripts receive significantly higher priority ratings when reviewers and authors originate from the same country (Opthof, Coronel & Janse, 2002). A survey of 873 corresponding authors of manuscripts under consideration by the *Annals of Emergency Medicine* between May 1999 to October 2000 found that author satisfaction is associated with acceptance and not with review quality (Weber, Katz, Waeckerie & Callaham, 2002).

Despite various pitfalls the peer review process assists in improving the quality of the submitted manuscripts, whether the manuscripts are accepted or rejected (Opthof, Coronel & Janse, 2002). It is found that papers rejected by the *Journal of Clinical Investigation* were cited at lower frequency when published by other journals (Wilson, 1978), and similarly manuscripts rejected by *Cardiovascular Research* were cited at significantly lower frequency even if published by journals with a higher impact factor (Opthof, Furstner, Van Geer, Coronel, 2000).

Result and Discussion

Out of 101 research articles published between 1998-2002 in *Information Research*, only 99 are indexed in Scopus (73 refereed and 26 working papers). The total of 568 citations are received by 99 articles (Mean=5.73, S.D. = 8.85), out of which 67 (11.79%) are self citations. 21 articles received zero citations, 17 received one citation each and one article received 65 citations. The highest number of citations i.e., 208 are received by 24 research articles published in 2002 (Mean=8.06, S.D. =13.35) and the lowest number of citations i.e., 56 are received by 14 articles published in 1999 (Mean=4.0, S.D. =6.55). However the distribution of citations in 2002 is highly skewed owing to high Standard Deviation. This is due to the fact that one article has received 65 citations. Almost 50 percent of all self citations are received by the publications of 2002 alone (Table 1).

S.No.	Year	No. of Articles	No. of Citations	Self Citations	Mean	Median	Mode	S.D.
1.	1998	14	67	13	4.78	3	0	5.65
2.	1999	14	56	3	4.0	1	0	6.55
3.	2000	23	139	7	6.04	3	1	8.55
4.	2001	24	98	11	4.08	3.5	0	5.43
5.	2002	24	208	33	8.66	5	3	13.33
Total		99	568	67	5.73	3	0	8.85

Table 1: Citation statistics of research publications

The 73 refereed articles have received 485 citations (Mean=6.64, S. D. =9.66), out of which 65 (13.4%) are self citations. Out of 73 articles 13 received zero citations, 8 received one citation each and one article received 65 citations. The highest number of citations are received for 22 research articles published in 2002 i.e., 194 (Mean=8.81, S.D. =13.81) and the least number of citations are received for 21 articles published in 2001 i.e., 98 (Mean=4.66, S. D. =5.57) (Table 2).

S.No.	Year	No. of Articles	No. of Citations	Self Citations	Mean	Median	Mode	S.D.
1.	1998	11	60	13	5.45	3	0	6.20
2.	1999	3	21	2	7.0	6	-	7.54
3.	2000	16	112	6	7.0	3.5	4	9.77
4.	2001	21	98	11	4.66	2	0	5.57
5.	2002	22	194	33	8.81	5	3	13.81
Total		73	485	65	6.64	4	0	9.66

Table 2: Citation statistics of refereed papers

The 26 working papers have received 83 citations (Mean=3.19, S. D. =5.23), out of which only 2 (2.4%) are self citations. The 7 working papers received zero citations, 9 received one citation and one article received 22 citations. The highest number of citations are received for 2 working papers published in 2002 i.e., 14 (Mean=7.0, S. D. =8.48). The 3 working papers published in 2001 have received no citations (Table 3). All the working papers are cited in reputed peer review journals (Table 4).

S.No.	Year	No. of Articles	No. of Citations	Self Citations	Mean	Median	Mode	S.D.
1.	1998	3	7	0	2.33	3	-	2.08
2.	1999	11	35	1	3.18	1	1	6.40
3.	2000	7	27	1	3.85	1	1	4.63
4.	2001	3	0	0	-	0	0	0
5.	2002	2	14	0	7.0	7	-	8.48

Total	26	83	2	3.19	1	1	5.23

Table 3: Citation statistics of working papers

Name of the journal with no. of citations
Annual Review of Information Science and Technology (5)
Archival Science (1)
ASEE Annual Conference and Exposition Conference Proceedings (1)
Aslib Proceedings (3)
British Journal of Educational Technology (2)
D Lib Magazine (2)
Education for Information (1)
Educational Technology and Society (1)
Electronic Library (4)
Europe Asia Studies (1)
First Monday (3)
Health Policy and Planning (1)
Human Systems Management (1)
Industrial Management and Data Systems (1)
Information Processing and Management (1)
Information Research (13)
Information Services and Use (1)
Informing Science (1)
International Information and Library Review (1)
International Journal of Emergency Management (1)
International Journal of Networking and Virtual Organisations (1)
International Journal of Science and Mathematics Education (1)
International Review of Research in Open and Distance Learning (1)
Journal of Computer Information Systems (1)
Journal of Documentation (3)
Journal of Information Science (6)
Journal of Knowledge Management (1)
Journal of Librarianship and Information Science (4)
Journal of the American Society for Information Science and Technology (2)
Learning Organization (1)
Lecture Notes in Computer Science Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics (1)
Library and Information Science (1)
Library and Information Science Research (3)
Library Philosophy and Practice (1)
Library Review (1)
Management Decision (1)
Medical Informatics and the Internet in Medicine (1)
New Library World (1)
Proceedings Frontiers in Education Conference Fie (1)
Proceedings of the Annual Hawaii International Conference on System Sciences (1)
Proceedings of the Asist Annual Meeting (2)
Program (2)
Quality and Quantity (1)

Table 4: List of cited journals with no. of citations

Verification of hypothesis

The 73 refereed articles have received 485 citations (Mean=6.64, S. D. = 9.66) whereas 26 working papers have received 83 citations (Mean=3.19, SD =5.23). It implies that refereed articles are cited twice those of working papers. However the percentage of self citations amongst refereed papers is much higher than those of working papers. It is also revealed from the results that the distribution of citations in both the cases is somewhat skewed (SD being higher than mean). To test the hypothesis that "The research impact of refereed and working papers does not differ significantly" the Chi Square test is carried out

χ^2 = S (O-E) 2 /E

E = Expected citations

O = Observed citations

Type	No. of Citations (Observed)	No. of Citations (Expected)
Refereed papers	485	418.82
Working papers	83	149.17
Total	568	568

The value of χ^2 is 39.8. At 1 df this is highly significant at .05 level, .01 level and even at .001 level. Thus the null hypothesis "The research impact of refereed and working papers does not differ significantly" is rejected and it is concluded that the research impact of refereed papers is higher than those of working papers. Even if we exclude self citations from the results the hypothesis is still rejected.

Conclusion

The present study reveals that despite criticism from various quarters and pitfalls the process of peer review has significant effect on the research impact of articles in terms of number of citations. Thus it is concluded that the process of peer review will remain an integral part of the scholarly communications system even in the emerging open access environment.

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