Library and Information Services in Astronomy III
ASP Conference Series, Vol. 153, 1998
U. Grothkopf, H. Andernach, S. Stevens-Rayburn, and M. Gomez (eds.)

Publication Costs of Astronomical Research: Economic Considerations

Simon Mitton
Cambridge University Press, Cambridge, CB2 2RU, United Kingdom, e-mail: smitton@cup.cam.ac.uk

Lavinia Mitton
Department of Applied Economics, University of Cambridge, Cambridge CB3 9DE, United Kingdom, e-mail: lavinia.mitton@econ.cam.ac.uk

Abstract. We examine the ways of covering the costs of dissemination of new knowledge in astronomy. We analyse the costs to researchers and research users of the self-publishing made possible by new electronic information systems. We explore whether costs of publication in the astronomical community will in the future be met by the originators of new knowledge (researchers), consumers (libraries and their users) or institutions which provide electronic databases.

1. Introduction

Researchers consider that the principal aim of their writing is to disseminate new knowledge, and to share results of their research findings with other researchers. To fulfil this ambition, new knowledge must be published.

There exist different systems for dissemination of research findings within the astronomical community. Scientists sometimes have to pay twice for dissemination through the medium of journals: once as research producers and again as research users. We show why this apparently "bureaucratic" system meets the needs of the community to gain access to the information that they require.

We also observe the growing trend for new knowledge in astronomy to bypass the traditional outlets provided by learned societies and publishers in favour of internet publishing. We ask why this is happening and who bears the costs of such means of dissemination. We point out that publication routes that appear "free" cannot be assured of a long-term future.

All funding in astronomy is ultimately from government grants. Every dollar spent on publications and libraries is a dollar less for looking at the universe. By contrast, in a subject such as biomedicine, the costs of dissemination can be passed to non-governmental funders (drug companies) who can exercise the option of increasing sales revenue to cover extra costs. In the closed community of astronomers, on the other hand, revenue cannot be generated from sales of research: there is thus a powerful incentive to minimise the costs of exchange of information within the community.

2. Sources of funding and costs: journals

The European system is that journals without page charges recover their costs from library and individual subscriptions, and those subscriptions bear all the costs of operating these journals. Effectively, a charge is levied only on those wishing to access the results of research.

In North America, journals with page charges have two sources of income: from subscriptions, as above, but also from the page charges levied on the authors. For example, about one-third of revenue for Astrophysical Journal comes from subscriptions and two-thirds from pages charges.

Increasingly, print-on-paper subscribers have access without further charge to electronic versions of the established journals. This perhaps gives the individual researcher the impression that the electronic version is "free", although this view does not take account of costs absorbed by the editorial activities of the publisher.

In the hybrid world of paper and electronic publication by learned societies and their publishers, there are the following ways of covering costs:

1. Only the researcher pays (page charges). All forms of the journal are free of charge.
2. Only the user pays (subscription charges). No contribution is sought from the researcher.
3. Researchers and users share costs. Page charges and subscriptions support the journal.
4. Pay-per-view for electronic versions. There are no page charges or conventional subscriptions; those who wish to consult the journal pay on-line charges.

(1) above does not apply to any highly-cited astronomy journal.
(2) above applies, for example, to Monthly Notices.
(3) above applies to Astrophysical Journal.
(4) above is not applicable to astronomy. It is mainly used in disciplines where costs can be passed back to a client, such as law and medicine.

We observe that in practice astronomers use only options (2) and (3). Of these, (3) appears at first the most bureaucratic because it involves a larger number of transactions to collect money. It has the feature that costs are shared between the two groups (researchers and users) for whom the publisher provides a service. At present only the highly rated journals have page charges. The particular service they offer to the researcher is authentication through excellence in reviewing and high visibility.

The costs we refer to here are levied by an intermediary, the publisher. Traditionally, scholars and researchers have accepted the costs because of the special expertise of the publisher. This expert knowledge includes management of the review system, management of the production processes, marketing, and sales. The traditional system is now challenged by the internet which apparently empowers the researcher to assume responsibility for actions such as typesetting and distribution.

3. Self-publishing

We use the term "self-publishing" to describe dissemination which by-passes learned societies and publishers.

In this model, research staff and their own institution assume entire responsibility for such actions as validation, page make-up, and transmission. Arguably this constitutes a regressive step back to the 19th century when observatories privately printed their proceedings and circulated them without charge. What is different today is that use of the internet means that there are no printing or distribution costs for the institution to cover.

Electronic methods of dissemination are now widely used in astronomy. These are apparently less costly for both researcher and reader than established print-on-paper technologies. The intermediaries (learned societies, publishers) with their bureaucracies are out of the supply chain. Fewer of the (fixed quantity) of dollars are going on publication, so more dollars can be used to view the universe.

Nevertheless web publishing of this type is not free of charge. The time the researcher spends on web-publishing instead of engaging in research should be taken into account. Self-publishing on the departmental home-page is in effect equivalent to option (1) above: The researcher (or his institution) in effect is paying for dissemination of new knowledge, but without getting the benefit of the added value which the publisher can give.

A second type of publishing which by-passes the traditional mode of transmission through a learned society journal, and which poses a more significant challenge to journals, is the international website, where one institution takes responsibility as costless service provider to the global community. Examples are the electronic preprint services and the databases. Effectively an institution creates a publishing operation locally and offers a world service. The institution (and its funding agency) bears all the overheads associated with providing publishing service.

This model appears to be a panacea for the trend towards page charges, and the answer to the strain on library budgets brought about by the ever-rising costs of subscriptions which spiral upwards as worldwide fewer subscriptions are taken out, which in its turn encourages libraries to amalgamate and further reduce their combined holdings of journals. The provider institution takes over the function of refereeing papers; distribution is free; access is instantaneous. Users perceive an excellent service at no cost.

However, it is possible to have too much of a good thing. In economic terms, users are "free-riding" on the provider institution. The very fact that the service is free of costs to researchers and users outside the provider institution may potentially destabilise this form of publishing. A funding agency may refuse to finance a service which users around the world can access free of charge. Economic theory predicts that if a good or service is vulnerable to "free-riders," then it may not be provided at all. This may occur with Astronomy and Astrophysics Abstracts (AAA): The German state (Land) of Baden-Wuerttemberg has proposed to discontinue funding for staff at the Astronomisches Rechen-Institut Heidelberg (ARI) who produce AAA on the grounds that it is a service which should cover its own expenses.

When budgets have to be cut for political reasons, any free services whose reach extends far beyond the electorate is bound to be vulnerable. Another example is HM Nautical Almanac Office, which produces the Astronomical Almanac as an act of public service for the worldwide community. The closure of the Royal Observatory (31 October 1998) has forced the Nautical Almanac Office to seek a new home elsewhere.

In order to overcome the problem of free-riding, some form of charging has to be introduced. The astronomy community therefore needs to accept that longevity of "free services" cannot be guaranteed.

Researchers should ask themselves what the future should be for the centralised database and abstracting services. As our examples above suggest, such services are economically unstable in the long term because astrophysicists have no control over political judgements.

In conclusion, it would be a mistake for astronomers to embrace this form of self-publishing, since local funding agencies may be unwilling to continue indefinitely to finance the provision of such services by the institutions that they support.