



Business models for open access journals publishing

Business models
for open access
journals

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Abstract

Purpose – This study aims to summarise the information about open access publishing models and to analyse the strengths, weaknesses, opportunities, and threats (SWOT).

Design/methodology/approach – The paper is based on a review of the academic literature, to conduct a comprehensive SWOT analysis and adopt the multiple case study approach to analyse the open access publishing model.

Findings – Useful results include the findings that the success factors of open access business models are: creating savings in publishing costs, increasing incomes, adoption of innovative technologies and controlling the quality of journals. The open access publishing model makes the research permanently visible and accessible, with sustainable development.

Research limitations/implications – While the findings may be applicable to open access journals for reasons other than impact factor, further research would be required to confirm this.

Originality/value – This study provides results that may enhance one's understanding of the open access publishing model, allowing both the reader and the author to benefit from it. Open access publishing leads to wider dissemination of information and greater advances in science.

Keywords Open systems, Publishing, Serials, General management

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Introduction

The subscription prices of scholarly journals have become increasingly expensive; librarians have called it “Serials Crisis”, but it has become far more than just a library problem. According to the Cornell University statement, “This is not a serials crisis, but rather a broader crisis in scholarly communications” (Atkinson, 2003). Huge increases in subscription fees have meant that libraries and research organisations have needed to decrease the number of journals to which they subscribe. The result has created barriers to scholarly communication. Large publishers also make package deals to continue increasing the price, with libraries sometimes needing to pay more to subscribe to many journals that they do not wish to receive. For as long as most of us can remember journal price increases have far outpaced the growth of library budgets. As a result, libraries cannot afford access to the broad range of information needed by researchers. Rising journal prices have forced libraries to forgo the purchase of new journal titles, to cancel subscriptions altogether and to reduce the number of book purchases made (Johnson, 2004). Between 1986 and 2004 the consumer price index (CPI) increased by 73 per cent, but the subscription prices of journals increased by 273 per cent (Association of Research Libraries, 2005). Thus the library needs to spend three times as much, but has only received a 14 per cent increase in its budget for journals.

The age of the electronic journal has also brought another problem to the library. The library now needs to keep the same journal in both paper and electronic formats.



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The good news is, however, that as the internet develops, access and retrieval of research reports and papers become easier. The internet provides an answer to these problems because it provides global distribution at a reasonable price (Doyle, 2004a, b). Full text materials can easily be translated from the web by researchers. Many scholarly organisations even offer research reports for free in order to promote more effective use of internet resources. Google offers the Google Scholar service (Google Scholar Team, 2005), which can search scholarly journals for papers, research theses and reports. The range covers multiple commerce databases in different platforms, and it is becoming increasingly effective for locating for scholarly communication. Technologically, search engines have removed the barriers of scholarly communication, but for the benefit of commercial publishers they still need to restrict access to full-text papers. At this time both scholars and libraries are promoting the idea of open access. The open access publishing model is a completely new scholarly publishing model, also called the producer-pays business model (Waltham, 2005). This proposes making access to scholarly papers totally free, with the producer covering the cost and the reader able to access it free of charge.

Open access

Scientific publishing is undergoing a revolution (Eisen, 2003). Publishers offer both the traditional and electronic journal forms and raise the price of subscriptions. Scholars need to publish exclusively in scholarly journals and also need to read the journals for communication. To prevent the "Serials Crisis" situation from becoming worse, research organisations and libraries are starting to support open access publishing. The Budapest Open Access Initiative (2005), Bethesda Statement (Suber, 2003) and the Berlin Declaration (Gruss, 2003) all propose the definition of open access, called BBB definition. Both of these statements describe open access from the perspective of its practical implications for information usage. Open access journals allow the reader to read, download, copy, distribute, print, retrieve and link to the full text. Open access greatly reduces the costs of production, distribution, and storage, and of course access and usage are free of charge. Open access removes the barrier of cost, including the journal's subscription fee, authorisation, and single document printing (Suber, 2005a, b). Open access accommodates growth on a gigantic scale and, best of all, supports more effective tools for searching, sorting, indexing, filtering, mining and alerting (Suber, 2004). To provide open access publishers use a non-traditional business model in which the expenses (managing peer review, providing editorial oversight and ensuring the highest production standards) are recovered by imposing a modest charge on the authors or research sponsors for each article they publish. The operation of open access is under copyright protection. The author owns the copyright and can authorise the publisher to publish the paper on the internet and put the papers on his or her own web site. Open access adopts the electronic publishing model, compared with the traditional publishing model, which means the cost is less. The marketing cost and the subscriber's management cost can be reduced. Bypassing the authorisation control to access the paper can also eliminate the cost of document delivery. The content of open access covers the scholar's publishing, including peer-reviewed journal articles, preprints, preliminary findings and data sets (Case, 2002). The main challenge of open access publishing is how to guarantee that scholarly journals can be preserved and allow the reader to access them. How can we ensure that the open access publisher can continue to

operate into the future? Which business model best suits open access publishing? The author and scholarly organisations must recognise the problems with current scholarly publishing, and should introduce a new publishing model to improve scholarly communication (Tamber *et al.*, 2003). Open access journals combine internet and information technology to provide scholarly content to the reader, leading scholarly communication into the new age.

Business models of open access

The definition of the business model is the architecture for the product, service and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; and a description of the sources of revenue (Timmers, 1998). The traditional business model for scientific publishers relies on restricting access to published research in order to recoup the costs of the publication process. This restriction of access to published research prevents full use being made of digital technologies and is contrary to the interests of authors, founders and the scientific community as a whole. The traditional subscription-based model is also becoming increasingly unsustainable, as increasing amounts of research are being published while library budgets remain static.

There are two business models for the journal publisher, the traditional business model and the open access business model. The biggest difference between the two business models is the sources of financial support. There are various sources of financial support for journal publishing, including pay-to-publish, print version subscriptions, membership dues allocation, grants or gifts, voluntary or institutional support, advertising or corporate sponsorship, licensing content to third parties and value-added fee-based services (Tenopir, 2006). The traditional business model is the reader-pays model; the customer pays the cost of publishing. The open access model requires the producer to pay the cost of publishing. Patrick Brown and Michael Eisen believe that many authors would be willing to shoulder the cost of producing a manuscript if it were made available without charge to readers and databases. Institutions could pool resources to help individual researchers pay for publication costs; those scientists and institutions under financial hardship could be subsidised (Brower, 2001). The Association of Learned and Professional Society Publishers (ALPSP) report, *The Facts about Open Access*, found that only a handful of open access journals were supporting themselves with author-side charges – the rest relied on advertising and sponsorship (Kaufman-Wills Group, 2005). Which is the best for scholarly communication? The answer we are looking for depends on the different views of those in different roles, especially from profit and non-profit organisations. This paper tries to analyse cases of commercial and non-profit organisations and proposes to suggest the best open access business model. The business model involves many roles with different positions: the library, publisher, commercial and non-profit organisations, author, reader, and research unit.

From a research point of view, how to permanently preserve the research results and make them available is the most important consideration. We need to consider that the author and the reader both have needs and propose a solution suitable for the library, publishers, author, reader and the researcher. There are many types of open access archives and journals (Willinsky, 2003), such as authors, archive pre-prints and/or post-prints in open access archives, immediate and full open-access publication

of journals, both subscription-print and open access journal editions. Oxford University Press and Britain's Institute of Physics are experimenting with open access (Friedman, 2003). In a practical guide to business models for open access journal publishing Crow and Goldstein suggest that there is rarely a single component within the funding model for any open access journal. Rather, multiple components will typically combine to sustain an open access publishing operation, which is the potential income source for open access journals. There is rarely a single component within the funding model for any open access journal. Typically, multiple components will combine to sustain an open access publishing operation (Crow and Goldstein, 2003). Table I lists open access publishers, indicating the type of organisation: either commercial or non-profit, the range of the publication fee, the quality of the journal which is indexed by Science Citation Index Expanded (SCIE) or Center for Agriculture and Bioscience International (CABI), some which are not available (NA), and the number of journals.

Methodology

The use of qualitative methods is appropriate when studying complex processes (Eisenhardt, 1989; Matthyssens and Vandenbempt, 2003; Yin, 1994). A multiple-case approach was chosen due to the complex nature of the phenomenon of open access, and the need to take into account a large number of variables (Lewin and Johnston, 1997). This study used the multiple case study approach (Eisenhardt, 1989), for richer theory could be generated with multiple case studies. Using the secondary data in each case would help develop rich insights and provide the basis for greater transferability of the findings to other contexts. These methods were adopted in this study.

Cases were selected using theoretical sampling (Strauss and Corbin, 1998) from Table I. Three cases were selected for study: BioMed Central (BMC), Public Library of Science (PLoS) and the Medknow Publications (Medknow). All cases were selected because of their journal publishing successes, the journals being covered in SCIE. Also, the simplicity of each case's competitive scenario is largely different because they belong to different kinds of organisation, profit and non-profit, making them more

Publisher	Type	Publication fee (US\$)	Indexed	Journal No.
BioMed Central	Commercial	0-1,750	SCIE	160
Calicut Medical College	Non-profit	0	CABI	3
Copernicus Open Access Publishing	Non-profit	By pages	SCIE	14
First Monday	Non-profit	0	NA	1
Hindawi Publishing Corporation	Commercial	495	NA	35+
Ivyspring International Publisher	Commercial	595-750	NA	2
<i>Journal of Medical Internet Research</i>	Non-profit	0	SCIE	1
<i>Journal of Postgraduate Medicine</i>	Commercial	0	Medline	1
Medknow Publications	Commercial	0	SCIE	30+
Molecular Diversity Preservation International	Non-profit	600	SCIE	9
<i>Proceedings of the National Academy of Sciences</i>	Non-profit	1,000	NA	1
Public Library of Science	Non-profit	2,000-2,500	NA	7
Springer Open Choice	Commercial	3,000	NA	NA

Table I.
Open access publishers

attractive for comparative purposes. Finally, each case was selected because their programme had largely been developed, and each was now undergoing evolutionary change.

The cases were using the strengths, weaknesses, opportunities and threats (SWOT) method (Jackson *et al.*, 2003; Dyson, 2004) to analyse the SWOT of the open access business model. One approach to identifying a potential open access opportunity is to conduct a comprehensive SWOT analysis. The factors include business conditions, physical infrastructure, IT infrastructure, financial institution and government support, and various labour characteristics specific to the region under study. The data for the analysis were publicly available secondary material and promotional information provided by each publisher's web site.

The SWOT analysis that resulted from this study is shown in Table II. The study provides relevant background information on the state of open access and describes the most important factors that were categorised for the four quadrants in the matrix. The various SWOT factors for the open access are discussed in detail below by column:

(1) *Strengths:*

- *Low operating cost.* The scholar publishing model transforms into open access business model; the most important success factor is the lower operating cost. Without doing the authorisation control the publisher can save the subscriber management cost.
- *Improved impact factor.* The open access journals are scholarly, peer-reviewed, full text and accessible without cost. The policy also aims at making the published research more visible and accessible. The peer-review process will guarantee the quality of the journal, and making the published research more visible might improve the impact factor.
- *Positive attitude of digital archives:* digital archives have become increasingly important in this age, and the open access state of permanent preservation helps people realise the importance of open access.

(2) *Weaknesses:*

- *Producer pays.* The producer plays an important role when deciding on the open access business model. According to the statement of open access, the producer must pay for the publication of the paper. One of the main criticisms of the open access model is that author fees may discourage researchers from publishing in open access journals (Mantell, 2004). The cost will influence the willingness of the author to submit the paper to the journal.

	Internal		External
Strengths	Weaknesses	Opportunities	Threats
Low operating costs	Producer pays	Government support	Commercial publisher
Improved impact factor	Lack of indexing services	Scholarly communication	Permanent preservation
Positive attitude of digital archives	Low business profit	Business organisations involved	Copyright law

Table II.
SWOT analysis for open access

- *Lack of indexing services.* One of the major drawbacks of open access journals so far has been that they have rarely been indexed in commercial indexing services for searching quality-assured publications, which universities provide to their researchers and students (Björk, 2005).
- *Low business benefit.* In general, scholarly journals have low business benefit, unlike the reader-pays business model. As the number of subscriptions increases, the income will increase. The producer-pays business model's benefit is fixed. The number of published papers is limited, so the income of the open access journal is also fixed.

(3) *Opportunities:*

- *Government support.* Government attitude is another important factor in determining the growth of open access, as open access journals allow the reader to download and distribute free of charge. The government's attitude must be supportive.
- *Scholarly communication.* Open access journals remove the barrier of distribution. The results of scholarship should be communicated without any barriers, especially when many research plans are supported by government funding.
- *Business organisations involved.* Many commercial companies, like Google Scholar, provide search and retrieval services for open access materials and support the development indirectly (Suber, 2005a, b).

(4) *Threats:*

- *Commercial publisher.* The big commercial publisher uses the "Big Deal" to restrict the contract between the library and the publisher. Under the Big Deal a journal publisher will grant access to all their titles for a number of years. This will seriously threaten the life of the open access journal.
- *Permanent preservation.* Issues relating to digital archiving include ensuring the quality of the source materials, effective preservation and the physical security of the material (Doyle, 2004a, b). The publisher must run the business model very well to ensure the permanent preservation of research results and to make them available.
- *Copyright law.* Constraints of copyright law mean the author needs to publish exclusively in the journal, and also needs authorisation. Open access prefers the author to adopt Creative Commons (2005) to balance usage and copyright. Creative Commons licences also provide a flexible range of protection and freedom for authors, artists, and educators.

Case study

Along with goodwill in the community the open access movement needs a business model that can work (Malakoff, 2003). This research analyses the open access business model with the case study methodology. As the SWOT analysis result shows, the capability of self-sufficiency is the key factor in publishing-model success. The various business factors for open access (see Figure 1) are discussed in detail below. Three cases were selected for study (see Table III). BioMed Central is the commercial company, and the Public Library of Science is the non-profit organisation. Both of them

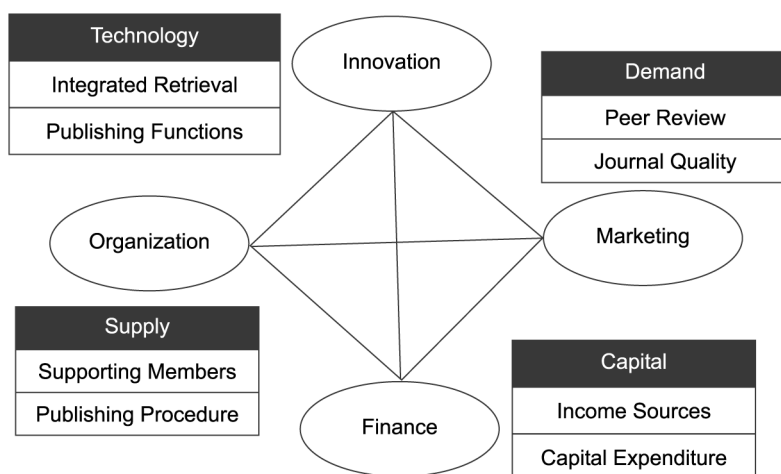


Figure 1.
Open access analysis
model

Publisher	BMC	PLoS	Medknow
<i>Marketing</i>			
Peer reviewed	•	•	•
Journal indexed	•	•	•
Journal number	○	×	○
<i>Innovation</i>			
Integrated retrieval	•	•	•
Publishing functions	○	○	•
Creative commons	•	•	×
<i>Finance</i>			
Income sources	○	○	•
Capital expenditure	○	○	○
Publication fee	×	×	•
<i>Organisation</i>			
Supporting members	○	•	○
Public archive	○	•	•
Publishing procedure	•	○	•

Notes: • Strong; ○ Medium; × Weak

Table III.
Competition capability of
OA publisher

have a publication fee. Medknow Publications is the commercial company and has no author fee for submission or publication. According to an investigation by the National Academy of Sciences (PNAS), over 50 per cent of authors are willing to support open access publishing. Among them 80 per cent of authors are willing to pay US\$500 for the publishing fee (Cozzarelli *et al.*, 2004). Another investigation shows 54 per cent of authors are willing to support open access publishing; 84 per cent of authors are willing to pay US\$500 for the publishing fee, and 12 per cent of the authors are even willing to pay US\$1,000 for the publishing fee. Only 4 per cent of authors are willing to

pay more money for publishing (Gedye, 2003). Therefore, how to reduce publishing charges is the key success factor.

BioMed Central

BioMed Central (BMC) is an independent publishing house committed to providing immediate open access to peer-reviewed biomedical research. BMC began publishing open access journals in 2000 and now publishes more than 100 journals, primarily in the biomedical sciences (Doyle, 2004a, b). It needs 2,000 to 2,500 articles every month to cover expenditure since January 2005. BMC's portfolio of 158 journals includes general titles such as the *Journal of Biology* alongside specialist journals. Many, including Scopus and Google Scholar, track all of BMC's journal articles, making it possible for authors to see how many times their own research has been referenced.

Marketing

Peer review. All journals published by BMC operate a system of peer review for their research articles and for most other article types. The precise form of peer review is left to those responsible for editorial control of the journal. In some cases, including all the medical BMC journals, reviewers are asked to sign their reviews, and the pre-publication history of each paper (submitted versions, reviewers' reports and authors' responses) is posted on the web with the published article. BMC is also a member of the Committee on Publication Ethics (COPE).

Journal quality. Publisher marketing analysis seeks to determine the interaction between the reader and author, the so-called two-sided market. The author needs to know that their research has been cited, and the reader needs more knowledge content and high journal quality. One of the important measurements is the Institute for Scientific Information's (ISI) impact factor. BMC titles are tracked by ISI, and several have already achieved impressive impact factors, such as *Respiratory Research*, *Arthritis Research Therapy*, *Breast Cancer Research*, *Oncology titles*, *Cell Biology*, and *Critical Care*.

Innovation

Integrated retrieval. There are many commercial search engines that can integrate electronic scholarly resource retrieval, such as Google Scholar and Yahoo CC Search (Yahoo Search – Web Search, 2005), and one can also search papers using Creative Commons. The open access publisher can consider outsourcing the retrieval function. All BMC journal articles are tracked by Scopus (Elsevier, 2005) and Google Scholar, making it possible for the authors to see how many times their own research has been cited.

Publishing functions. BMC's journals use an electronic submission and peer review process designed to facilitate rapid peer review. Using a highly automated manuscript management system makes open access work and is affordable and allows the company to become profitable within several years as submissions grow at current rates (Mantell, 2004).

Organisation

Supporting members. BMC's supporting members include: Dana-Farber Cancer Institute, Harvard University, National Institutes of Health, World Health

Organization, Memorial Sloan-Kettering Cancer Center, Columbia University and numerous other leading scientific and medical institutions throughout the world.

Publishing procedure. When publishing research, the hard work of writing and editing the paper, peer reviewing it, and even making the editorial decision to accept it or not is traditionally performed by the scientists themselves. Publishers simply coordinate the process. With many thousands of manuscripts being submitted, and with the peer review of each manuscript being an intricate process involving many people (authors, editors, co-authors, peer reviewers), dozens of workflow steps and dozens of files (related by a complex version history), the ability of the automated manuscript management system to let us manage the data files within the database, along with the relational data, allows the new publishing model to scale and provide the required level of security and reliability.

Finance

Income sources. BMC defrays the costs from article processing charge (APC). The price of APC can range from US\$605-US\$1,750 (BioMed Central, 2006) because different titles have a different price. BMC's standard APC is US\$1,350. There is no article processing charge if this journal is newly-launched for a promotional period, since the journal covers the cost of publication.

Capital expenditure. To make the open access business model viable it is necessary to keep costs to a minimum. The capital expenditure includes immediate worldwide barrier-free open access to the full-text document, developing and maintaining electronic tools for peer review and publication, preparation in various formats for online publication, securing inclusion in PubMed as soon as possible after publication, securing full text inclusion in a number of permanent archives such as PubMed Central, and securing inclusion in CrossRef.

Key to success. The success factors of BMC's business model are saving on publishing costs and controlling the quality of journals. Many BMC titles have already achieved impressive impact factors, resulting in more authors wanting to contribute their research outcome to the open access journal. The editors and invited reviewers receive e-mails containing web links that allow them to download and view the PDF and the original files as needed. When a manuscript is accepted, web-compatible versions of the figures are generated automatically and stored in an appropriate location in the database. All the publishing procedures can be done through the internet. BMC's publishing system saves time and money, which in turn improves the service quality.

Public Library of Science

The Public Library of Science (PLOS) is a non-profit organisation of scientists and physicians committed to making the world's scientific and medical literature a freely available public resource (Albanese, 2003). Under the open access model PLOS journals are immediately available online, with no charges for access and no restrictions on subsequent redistribution or use, as long as the author(s) and source are cited, as specified by the Creative Commons Attribution License (Public Library of Science, 2006).

Marketing

Peer review. PLoS publishes peer-reviewed, open access scientific and medical journals that include original research as well as timely feature articles. All PLoS articles are immediately freely accessible online and are deposited in the free public archive of PubMed Central.

Journal quality. Many PLoS journals have exceptional significance in all areas of biological science, from molecular biology to ecosystems, including works at the interface with other disciplines, such as chemistry, medicine and mathematics. *PloS Biology* is ranked as the most highly cited general biology journal by the ISI, with an impact factor of 14.67 in 2005 Journal Citation Reports (JCR) Science Edition.

Innovation

Integrated retrieval. PLoS recently announced PLoS ONE, a new approach to open-access publishing. PLoS ONE is for the publication and creative use of scientific and medical knowledge and returns control of scholarly publishing over to the research community by bringing together research from all areas of biology and medicine, offering authors an efficient and highly effective means to communicate their results and ideas, and providing the community with powerful new tools for navigating and adding value to the published research literature (Public Library of Science, 2006).

Publishing functions. The sustainable open access publishing system, PLoS ONE, is one in which publishers are paid a fair price for the peer review, editing and production services they provide, and the complete contents of every journal are made freely available online from the moment of publication. PLoS ONE couples efficient and objective peer review with a streamlined electronic production workflow.

Organisation

Supporting members. PLoS's supporting members include: the Gordon and Betty Moore Foundation, the Sandler Family Supporting Foundation, the Irving A. Hansen Memorial Foundation, the Open Society Institute, the Doris Duke Charitable Foundation, the Joint Information Systems Committee (UK), the Burroughs Wellcome Fund, the Ellison Medical Foundation, the David and Lucile Packard Foundation, Genentech and many other institutions and individuals.

Publishing procedure. The efficient editorial process that results in timely publication provides a valuable service both to authors and to the scientific community at large. Communicating the results of research quickly and efficiently is a high priority. PLoS strives to publish papers within weeks of submission.

Finance

Income sources. The PLoS, which has been campaigning to produce free access scientific research via the web rather than conventional print publication, has obtained a \$9 million grant over five years from the Gordon and Betty Moore Foundation, enabling it to publish two peer-reviewed online journals (Eaton, 2003). To provide open access PLoS journals use a business model where publication fees reflect more closely the costs of publication. The publication fee for *PLoS Biology* and *PLoS Medicine* will be \$2,500; for community journals *PLoS Computational Biology*, *PLoS Genetics*, and *PLoS Pathogens* it will be \$2,00. *PLoS Clinical Trials* is priced at \$2,500.

Capital expenditure. The expenditure of PLoS included those expenses of peer review, of journal production and of online hosting and archiving.

Key to success

The success factors of PLoS's business model are evident during this time of transition from traditional to open access publishing. PLoS explores creative ways to develop a sustainable open access publishing operation while continuing to exploit new technology to improve the cost-efficiency of the publishing process, such as the open access publishing system, PLoS ONE. The new system offers a different approach to the way that scientific research is communicated. The purpose of PLoS is that any future increases in publication fees will be as reasonable as possible.

Medknow Publications

Medknow Publications (2006a, b) is the largest publisher in India for academic and scientific biomedical journals. Medknow Publications is committed to improving the visibility and accessibility of science from the developing world. Its endeavour in continuously re-inventing the publishing methodology for about a decade has resulted in high quality peer-reviewed scholarly journals. The unique feature of these journals is its immediate open access policy without charging the author or author's institution for submission, processing or publication of the articles.

Marketing

Peer review. The journals are the official publications of various societies and associations and are delivered to all the members of the respective associations. Medknow Publications publishes high quality peer-reviewed scholarly journals. All of these journals provide immediate free access to the full text of articles.

Journal quality. Medknow Publications's online free access journals are listed and indexed in a larger number of bibliographic databases with high visibility and research impact. The journals are collected by Index Medicus, ISI Current Contents, Science Citation Index, EMBASE and CAB Abstracts. The journals also permit authors' self-archiving.

Innovation

Integrated retrieval. Each journal published by Medknow has its independent web site. The websites use the OpenURL standard, making it easy for libraries to link users as directly as possible from citation to the full text of the article. The open access policy has resulted in more than a half a million article downloads in a month for all the journals. Most of the journals published by Medknow are archived at multiple places included OAI-compliant e-print repositories and sites such as Bioline International (2006). Medknow Publications ensures the long term archiving and accessibility of the published content.

Publishing functions. Medknow has successfully put in place an original electronic manuscript submission and peer review system (Medknow Publications, 2006a, b) for the first time in India. This system has been in use since 2001 by authors and peers across the globe, and over 10,000 manuscripts have been processed through it.

Organisation

Supporting members. Medknow's supporting members include: Neurological Society of India, Indian Cancer Society, Indian Society of Oncology Staff Society, Seth GS Medical College and other societies/associations.

Publishing procedure. Medknow's publishing procedure is an online manuscript management system. Manuscripts can be received and processed any time and from anywhere, and editors and reviewers can work from any PC. The net result is decreased time in peer review and processing of submitted manuscripts. The journals have an easy-to-use electronic manuscript submission system, eliminating use of postal or hard copy submission. The online submission and processing of articles have resulted in a considerable decrease in the submission-to-decision time.

Finance

Income sources. None of the journals charges an article submission, processing or publication fee from the authors or authors' institution. The cost for publishing is shared by subscriptions to the print journals, advertisements in print and online media, association membership fee and author reprints (Sahu, 2006).

Capital expenditure. The open publishing model adopted by Medknow is unique where the author or authors' institutions do not pay a fee for submission, processing or publication of the articles – "Fee-less-Free". The income sources cover those expenses of peer review, of journal production and of online hosting and archiving. Many journals which were running at a loss are now self-sufficient and able to run their own operations.

Key to success

The success factors of Medknow's business model are that the author or authors' institutions do not pay a fee for submission, processing or publication of the articles. The open access policy of the Medknow journals aims at making the published research more visible and accessible. The journal will benefit from all the efforts in fulfilling this aim. Whether it is automation of the subscription process, online payment gateway or more features added on journal web sites, the ultimate beneficiary will be the journal. Most potential audiences have no access to primary literature; the economics are based on an old print and paper system; connectivity and search ability are limited; and copyright restrictions limit uses and dissemination (Doyle, 2004a, b).

Conclusion

Scholars will choose the target journal according to its impact factor, service quality, delivery mechanism and cost. There are four critical factors in the sustainable solutions to open access:

- (1) *By saving costs.* The publisher can set up an expenditure reducing plan to decrease expenditure, including those expenses of peer review, of journal production and of online hosting and archiving, decreasing the publishing fee, or saving the money that any author and employing have to pay for their submission, processing and publication.
- (2) *By increasing incomes.* Try to increase incomes by not only subscribing to print journals, printed advertisements and online advertisements, but also the fee of association membership and author reprints.

- (3) *Through the adoption of innovative technology.* By utilisation of creative ways of developing a sustainable operation of open access publishing and continuing to exploit new technology to improve the cost-efficiency of publishing.
- (4) *By control of the quality of journals.* The high quality of journals makes the author willing to publish research in those journals.

These four factors can guarantee the open access publishing model with sustainable development and make the research permanently visible and accessible, ensuring permanent preservation and making the research results available. A successful open access publishing model has many important benefits. First, doing away with authorisation control can save the publisher the cost of subscriber management. Second, as more scholarly journals adopt the publishing model, the library and research organisation can reduce the budgets for journal subscriptions. However, some research organisations probably increase the fee, because the author must pay for publishing; be that as it may, the cost will still be lower for the whole research organisation. Third, researchers can distribute the research result as comprehensively as possible. Finally, the producer-pays publishing model can form another marketing mechanism. The reader and author will both benefit from the open access publishing model and have a variety of services. Published research results and ideas are the foundation for future progress in scholarly communication. Open access publishing therefore leads to wider dissemination of information and increased efficiency in science.

Limitations and further research

This paper has explored the critical factors in industry-sustainable solutions to open access. However, this research is subject to a number of limitations. The research method presents limitations of generalisation to other open access publishers without a high impact factor, and therefore further research is required to explore the publishers within the context of different scope and capacity. It may be fruitful to explore these themes within different types of open access business models. Further research might also address the limitations of this study, with its reliance on qualitative data and employ quantitative methods to explore the relationships between the different dimensions of the publishing process and business model development.

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