

E-publishing development and changes in the scholarly communication system

Patricia Nascimento Souto

Information, Technology and Society Research Group Department of Information Science Loughborough University.

E-mail: psouto1@hotmail.com

Abstract

New and alternative scientific publishing business models is a reality driven mostly by the information and communication technologies, by the movements towards the recovery of control of the scientific communication activities by the academic community, and by the open access approaches.

The hybrid business model, mixing open and toll-access is a reality and they will probably co-exist with respective trade-offs. This essay discusses the changes driven by the e-publishing and the impacts on the scholarly communication system stakeholders' interrelationships (publishers-researchers, publishers-libraries and publishers-users interrelationships), and the changes on the scientific publishing business models, followed by a discussion of possible evolving business models. Whatever the model which evolves and dominates, a huge cultural change in authors' and institutions publishing practices will be necessary in order to make the open access happen and to consolidate the right business models for the traditional publishers. External changes such as policies, rewarding systems and institutions mandates should also happen in order to sustain the whole changing scenario.

Keywords

E-publishing. Open access. Scholarly communication. Scientific communication. Business models.

O Desenvolvimento das publicações eletrônicas e as mudanças no sistema de comunicação científica

Resumo

Os novos e alternativos modelos de negócio no sistema de publicação científica no formato digital compõem uma realidade conduzida, na sua maior parte, pelas tecnologias de informação e de comunicação, pelos movimentos para a recuperação do controle das atividades de comunicação científica pela própria comunidade acadêmica e pelas abordagens de acesso aberto ou livre (open access). O modelo de negócio híbrido, o qual combina o acesso aberto e o acesso restrito / pago (toll-access), é um modelo que provavelmente coexistirá. Esse artigo discute as mudanças que as publicações eletrônicas geraram no interrelacionamento entre os atores na cadeia de comunicação científica (interrelacionamento entre editores-pesquisadores, editores-bibliotecas e editores-usuários) e também os impactos gerados nos modelos de negócio no sistema de publicação científica. Em seguida, discutem-se os modelos de negócio que possivelmente podem evoluir e coexistir. Qualquer que seja o modelo de negócios que predomine, será essencial que ocorra profunda mudança cultural nos autores e nas práticas de publicação das instituições, de forma a permitir que o modelo de acesso aberto (ou acesso livre) desenvolva-se e também a possibilitar a consolidação um modelo de negócio adequado e viável para os publicadores tradicionais. Igualmente essencial e visando a sustentar esse cenário em contínua evolução, é a necessidade de mudanças em aspectos externos ao processo de publicação, tais como nas políticas, nos sistemas de recompensa e nas regras institucionais relacionadas à comunicação e publicação científicas.

Palavras-chave

Publicações eletrônicas. Publicações digitais. Comunicação científica. Modelos de negócio. Acesso aberto. Acesso livre.

INTRODUCTION

E-publishing has undoubtedly affected all stakeholders' interrelationships in the scholarly publishing value chain* *pressuring publishers in their value delivery* to libraries and users, it has enabled a *powerful function* for libraries and it has *challenged market forces and actors* which have orchestrated how science has been communicated until recently. Crow (2002, p.20) emphasised that each stakeholder involved in the system of scholarly communication has been affected by the digital publishing technologies. Likewise, *new and alternative business models* have emerged in order to cope with the challenging open access models and the disaggregating potential of e-publishing.

On top of these, the movements towards the recovery of control of the scientific communication activities by the academic community can be seen, as well as a reaction to the publishers' economic** and operational models, to the copyright practices and to the effects of the publishers' monopolistic performance on institutions and libraries.

Within this scenario, *diverse changes on the stakeholders' interrelationships and on the business models* in the scholarly communication system have been primarily lead by the impacts of e-publishing on this system. These *changes* include the following: (a) the lowering of entry barriers in the supply side, (b) the emergence of the alternative open access (OA) models, (c) the potential for disaggregation of publishing activities, and (d) the threat of products and services substitution represented by OA alternatives (figura 1).

The whole changing scenario outlined above has promoted an increased the participation of academe in the processes of scientific communication and it has also injected some competition into the monopolistic nature

* Value chain is the set of activities performed in order to run a business. They are divided in technological and economic activities. These activities are called "value activities" (Porter & Millar, 1985, p.3).

** In the last 30 years, the prices of scientific journals have been steadily increasing. Between 1975 and 1995, they increased 200%-300% beyond inflation (Dewatripont *et al.*, 2006, p.5).

of the scholarship industry. Coordinated action and effort to change the status quo have arisen, including efforts to change the rules and forces of that govern the logic of the market. Underlying this, e-publishing has enabled access models that actually privilege the wider socialising of science, supporting inclusion of institutions and academics in disseminating their own intellectual creation.

Within this context, this essay discusses the changes on the stakeholders' interrelationship and on the business models in the scholarly communication system, which were driven by e-publishing. Following this discussion, possible evolving business models are also presented.

IMPACTS OF E-PUBLISHING

Impacts on stakeholders' interrelationships

New entrants in the supply side of the scholarly communication system were enabled by the OA, strongly challenging the relationships among publishers, libraries and authors. Competitiveness has been gradually injected to the market, since the new entrants are now performing some of the scientific publishing functions, such as registering, archiving and dissemination¹¹. The online resources promote a way for authors to increase their work dissemination and its consequent usage and impact (Harnad, 2005). Additionally, the academic actors have been realising that they can assume the performance of some processes in the scholarly communication system, for which they have been actually responsible for years (Crow, 2002, pp. 7-9).

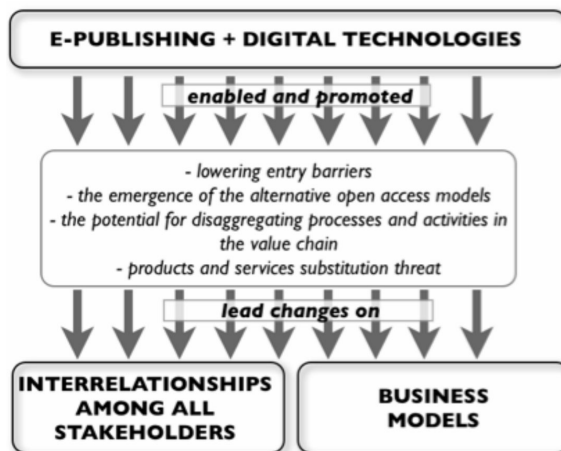
Impacts on the publishers-researchers (as authors) interrelationships

The major e-publishing impacts on the *publisher-researcher interrelationship* have been observed on the controversial issues about copyright ownership and on the inclusion of researchers as the disseminators of their own work in any stage of its development.

In an OA model, the copyright ownership is required to remain with authors or with the institution, which license specific rights to publishers. According to Crow (2002, pp. 21-22) the authors' retention of the copyright and the retention of the right to publish copies of their articles in OA journals or in institutional repositories (IRs) are essential elements of the changes which have been occurring in the scholarly publishing system.

FIGURE 1

Changes enabled and promoted by e-publishing which affected the stakeholders' interrelationships and business models.



Currently, authors are still dependent on publishers for reusing their own material and for publishing it on the open access models. The authors' recovering of their copyright ownership affects this current relationship of dependence, because instead of assigning total copyright to publishers, authors can assign only specific rights to publishers, using licenses like the Creative Commons. Actually, publishers do not need copyright transfer agreements either to publish or to exploit the article commercially (Gaad *et al.*, 2003, p.266, Hoorn, 2005, p.63). Therefore, the returning of the copyright ownership to authors' *reduces their dependence* on publishers freeing them to the dissemination and exploitation of their own research work for educational and commercial purposes.

In addition, the OA strategies have enabled researchers and institutions to become disseminators of their own intellectual production and to breach the distribution channel exclusivity owned by publishers. The dissemination of their own intellectual production can be made in any stage of its development as pre-refereed (pre-print) and refereed published articles (post-print). This has promoted the exchanging of ideas and comments about a work, its informal quality certification, and mainly its wider and free of charge dissemination. These new practices affect the relationship publishers-researchers, since researchers as authors start demanding the possibility to self-archive pre-prints of their work without affecting the possibility having it published further. Additionally, the use of OA

journals as a complement to traditional publishers* work can be identified by the growing participation of authors in OA journals, rising from 11% (in January 2004) to 29% (in July 2005) (Rowlands & Nicholas, 2006, p.44).

Within this scenario, the growing of free online scientific content which is resulted from authors' dissemination can pressure traditional publishers to refocus their offerings and to offer more valued services beyond the single content delivery.

Impacts on the publishers-libraries interrelationships

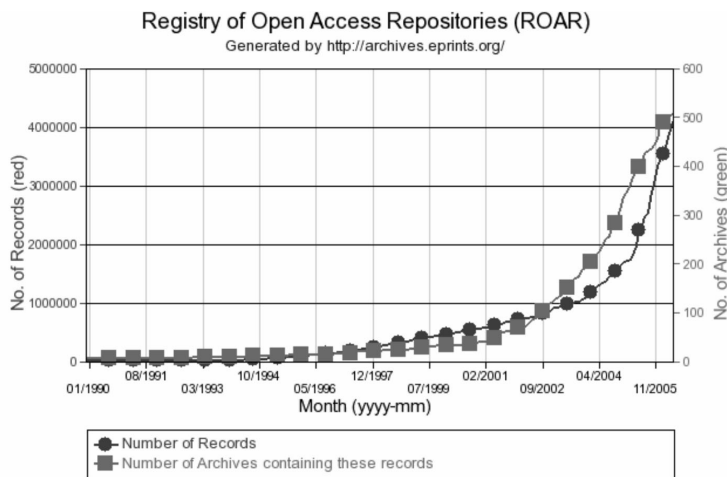
The *publisher-library interrelationship* has been affected because with the IRs, libraries are becoming actively involved and heavily responsible for the dissemination and archiving of the research outputs of their institution. All these changes have increased librarians' visibility and promoted a more strategic importance for them inside the institution.

With the growth in adoption and use of IRs (figura 2) libraries have a leading role in the management of IRs since they are responsible for organising, archiving and disseminating the intellectual creation of the institution. It should be remembered that peer-reviewed archives with an efficient search engine perform the functions of journals (Wellcome Trust, 2004, p.24). Consequently, the new position of libraries threatens publishers, since they can publish their own scientific work and intermediate the work from other universities.

Within this new context, librarians acquire new roles such as facilitators of some of the attitudinal changes required to support the IR results, and as pointed out by Johnson (2004) and Bosc & Harnad (2005, p.99), librarians acquire the role of promoters of OA journals and self-archiving, including OA resources and services in the library gateways. Additionally, libraries will have more knowledge in relation to the users than publishers will do, because they will continue to be the main gateway for the whole distributed scientific content access.

The publishers-libraries interrelationship has also been affected by users' article-based consumption behaviour. Waltham (2003, p. 10) has pointed out that "readers are

FIGURE 2
The growth of OA Repositories (<http://celestial.eprints.org/cgi-bin/eprints.org/graph>)



interested in smaller units, individual articles" and that they purchase information in smaller units than those in print-based market. This change demands that the negotiation between libraries and publishers be based on articles, rather than on larger packages of information, making libraries budget more flexibly managed. Thus, the publishers-libraries interrelationship should become more flexible and be governed by lower and more manageable costs, because the exchange unit will be based on articles and on the effective combination of articles that can match users' needs and libraries budgets. The article-based consumption will also demand new services (e.g. search tools, citation linking, single interface) from publishers and libraries, influencing on the practice of a more cooperative interrelationship between both.

Impacts on the publishers-users interrelationships

The *publisher-user interrelationship* has been affected by the increased usage of digital scientific information and user's article-based consumption behaviour. Consequently, users demand convenient access to qualified scientific information and increasingly sophisticated digital services to navigate through and use this information. Moreover, users want "to select and access distilled and well-written arguments" using a common interface without having to access different interfaces from different systems and publishers in order to access content (Waltham, 2003, p.8).

As an answer to these changes, the scholarly publishing has gradually become more *services-oriented*, supporting expectations of users in finding qualified information,

* Traditional publishers are considered those who are based on subscription-based-libraries-pay.

and the required accessibility, searchability and navigability for scientific information. Thus, sophisticated services have been developed to enable searching across databases* (Houghton *et al.*, 2004, p.236), to make correlation between complementary information, to improve navigability through the content interconnecting subjects, documents, citations, authors or keywords, to deliver summaries, to give off-campus access, and to also make hyperlinks to referenced material, dynamic commentaries and social filtering (MacKie-Mason *et al.*, 1999, MacKie-Mason & Riveros, 2000, pp. 211-212).

The articles-based consumption of users requires the unbundling of journal components and the rebundling in different, customised and customisable packages. On top of this, there is the low importance that journals brand can have to the new students and researchers generation, which will value articles, their authors and content more than the journal in which they were published. Houghton (2004, p.181) has pointed out that journal databases availability and the practice of searching by author or keywords have shown that users have been seeking for articles apart from the journal, evidencing that the journal itself has less importance to them.

Within this context, publishers will have to support the availability of high quality and carefully sorted information (Waltham, 2003, p.8) and digital services. However, firstly they need to know their customers' better. Waltham (2003, p.13) have emphasised that publishers should know users and interact with them in order to discover what they want and value and how they really use the online information. This will demand to keep closer to libraries and mainly, to make a substantial shift from publishers' product-centred focus to a more customer-centred perspective.

Impacts on business models

A financial perspective** of business models was adopted in this study to outline the major impacts of e-publishing

* Specialized search tools that harvest metadata with a focus on scientific information such as Google Scholar, Yahoo, OAIster and Scirus.

** The financial perspective encompasses answers that describe how money or how the financial sustainability is expected to be made.

TABLE 1

The comparison of broader e-publishing effects on business models.

Business Models Questions	Before e-publishing	After e-publishing	
Who pays? (consumer, producer, or third parties?)	<ul style="list-style-type: none"> Libraries, institutions *Paid by the consumer, the demand side - subscription fees *PAY TO READ 	<ul style="list-style-type: none"> *Authors' institution or founder *Government *Funding / grants institutions *Private foundations *Third parties *Advertisers, sponsors *Paid by the producer, the supply side - publishing fees *PAY TO READ AND/OR PAY TO PUBLISH 	Adaptation to an OA World
What for? (e.g. goods, services, expertise, assurances of quality or security)	<ul style="list-style-type: none"> *Print journals – bundled + databases (Big Deal) *Certification of quality and validity of the findings (peer review) *Management of the process of quality control (peer review) *Distribution of research work (restricted access to subscribers) 	<ul style="list-style-type: none"> *Print + online version of journals – bundled and unbundled *New product unbundling (articles) and rebundling on customized/customizable packages *Individual article access and use *Pricing schemes (nonlinear) *Online OA journals *Online services – basic and complementary *Management of the process of quality control *Dissemination on paid and open access journals/publications 	Adaptation to a digital world
To whom?	<ul style="list-style-type: none"> *Subscription agents *Publishers 	<ul style="list-style-type: none"> *Publishers *Subscription agents *Independent agents in a desegregating / deconstructed model 	Adaptation to the potential of disaggregating
Why? (e.g. perceived value, or being locked in.)	<ul style="list-style-type: none"> *Necessity + value *Dissemination *Inclusiveness and appropriateness in relation to peer group (peer-review) *Short/medium-term preserving of intellectual creation 	<ul style="list-style-type: none"> *Necessity + value *Wider dissemination → To benefit from: the principle of free access to research information, the fact that OA journals are faster than traditional journals, and that they promote a larger readership and potential for higher numbers of citations to their work. (Swan & Brown, 2004, p.24) *Formal and informal certification (peer review) *To benefit for the long-term preserving of intellectual creation 	Adaptation to an OA World

(Table 1) and to guide the subsequent analysis of some of these business models. The framework for e-business models which was proposed by Clarke (2004) was used to basis the analysis.

The changes produced by e-publishing on the business models in the scholarly communication system have been primarily related to the need for adapting to the following: (a) the increasing online delivery of scientific information, (b) the emergence of the open access, and (c) the potential for disaggregating publishing activities. All these changes are discussed in the following items.

Adapting business models to an increasing digital world

The revenue streams have been changing with the online delivery of scientific information because the selling unit has become articles and the marginal costs of performing this delivery is near zero, demanding a different pricing strategy based on value perceived by users, rather than be based on costs. Chuang & Sirbu (2000, p. 138) pointed out that the aggregation of articles in journals is a strategy that works in the paper-based market because of the economies of scale. Reinforcing the increase of an article-based market, Waltham (2003, p.11) pointed out that print-only materials will not be part of the reality for a generation of students and researchers that practically was born or has much experience with digital technologies to access information.

In addition, Chuang & Sirbu (2000, pp. 140-161) demonstrated that the *offering of both individual articles*

and journal subscriptions (i.e. the mixed bundling) is the dominant strategy and it *can increase publisher surplus*. The analysis developed by the authors suggested that a scholarly publisher “should expand its online products by offering to include unbundled articles in addition to traditional subscriptions”.

Therefore, the increasing delivery of scientific information on a digital format affects pricing and selling practices, demanding a publishers’ review on their strategies and a stronger partnership with libraries in order to make more information-based decisions. The print journals enabled great deals for publishers, and guaranteed their business revenue for the period of contracts, but now, in an article-based digital economy this guarantee is weakened.

Adapting business models to the emergence of open access

E-publishing and OA models have enabled lower costs for disseminating researchers’ work, breaching the bargaining power originated from the publishers’ exclusivity in this dissemination. E-publishing and OA models have also challenged publishers’ comfortable pricing position, which is only possible in a monopolistic-basis market. The report developed by the Wellcome Trust (2004, p. 19) has pointed out this issue as follows:

“...question facing publishers is not whether to offer open access or not, but how to position their journals so that they are able to continue to play an important part in a world in which open access, through open archives and very cheap or free document delivery, is the norm”.

Within this context, the business models vary according to the OA strategy as shown in the following items.

(a) The [full] OA Journals

OA journals make peer-reviewed content freely available to all users, using *other sources of funding to cover the costs*. In their funding model users can download, copy, read, distribute and print research outputs free of charge. Their costs are funded by the following sources of income:

(i) *Membership fees* – this model is encountered in SPARC, which has over 300 research institutions, libraries and organisations in the United States and 100 institutions in 14 European countries which are considered as members (Lustria & Case, 2005, p.238).

(ii) *Author-pays model* – under acceptance of the article, the author’s institution, research grant or funding organisation pays a fee in order to finance the publication. Seventeen percent of journals listed by DOAJ are author-pays (Regazzi, 2004, p.276). This fee covers the peer review, production and the online publishing processes (Cox, 2004, p.65). Current *author-pays* models have their costs funded *only by accepted-articles-authors* and they are insufficient to cover publishing costs. Most of the costs are fix (Wellcome Trust, 2004, p.3) and authors-pay models cover about 40 % to 60% according to Regazzi (2004, p.278). The Wellcome Trust report (2004, p.3) has suggested the separation of the peer-review and the publication processes, applying two different fees: *submission fee* (U \$175) to pay the peer-review costs for all articles, both accepted and rejected, and an additional *publication fee* to be paid in case the article is accepted.

This model has been much discussed because it can promote judgements by means not by merit, favouring those institutions which can afford to pay.

(iii) *Sponsorship or advertising* – a study performed by Kaufman-Will Group (2005, p.8) has shown that over 40% of the OA journals do not have their costs covered yet and that they are more dependent on sources of income such as advertising and sponsorship (in kind and financial). As a very important and innovative representation of this type of full OA journals, SciELO* – Scientific Electronic Library Online – is a very successful Brazilian project with the Latin American and Caribbean Centre on Health Sciences Information (BIREME) and it is funded by the Brazilian government through a funding agency called FAPESP (The State of Sao Paulo Research Foundation). Currently, SciELO Network provide access to high qualified scientific publications, from ten certified collections of online journals from eight countries (Argentina, Brazil, Chile, Colombia, Cuba, Portugal, Spain and Venezuela), and six other certified collections are under development from Costa Rica, Mexico, Paraguay, Peru and Uruguay. SciELO enables open access to over 450 titles and more than 130 thousand online full-text articles in the public Health and Social Sciences fields**.

According to Kuramoto (2006), in developing countries such as Brazil, in which the investments to the development of scientific research are limited but its potential is high, the incentive for adopting an open

* <http://www.scielo.br>

** Source: SciELO website: <http://www.eventos.bvsalud.org/scielo10/presentation.php?lang=en>

access approach should be a compulsory action by the government.

(iv) *Subscription to the print version of the journal* – represents 28% of journals listed by DOAJ (Regazzi, 2004, p.278).

(v) *Direct or indirect public funding* – 55% of the journals listed by DOAJ rely on this model (Regazzi, 2004, p.278).

Moreover, the experimentation and adaptations of the traditional business models to deal with the changes led by OA have been the following:

(i) *Immediately OA* – authors can post the final refereed version accepted by the journal immediately after this acceptance (e.g. Elsevier).

(ii) *Delayed OA* – this is based on the subscription model and refers to the publication of the article online free, after a certain period (e.g. Journal of Biological Chemistry).

(iii) *Optional OA* – publishers offer the option of posting the author's article online, on a free way (to the end user) and immediately after publication, since the author pays a fee.

(iv) *OA according to population or country or low gross national income.*

Results from a survey performed by the Kaufman-Will Group (2005, pp.13-24) showed that 60% of the full OA journals plan to adopt or test a new business model in the next three years. Also, a report developed by the Wellcome Trust (2003, p.20) showed that publishers of any size and type are in transition to OA models, trailing them by using one or more of their journals or the entire list.

(b) The Self-Archiving

This OA strategy refers to the publishing of research outputs on institutional or subject-based repositories and also on authors' or institutional websites.

Although the access to these research outputs is free, the self-archiving development and maintenance are not free of costs. According to a report of the European Commission (Dewatripont et. al., 2006, p.62), the installation costs for open archives are low and generally funded by institutions and government funding*.

* For example, in the UK, the JISC is funding a series of projects for institutional repositories under the FAIR (Focus on Access to Institutional Resources) Programme, which has created e-print repositories in 20 institutions in the UK.

However, it is difficult to plan for the maintenance costs because they depend* on the number of records and on the strategies related to their long-term preservation.

The *financial sustainability of self-archiving* has been greatly facilitated by volunteer work, by funding from the higher education institutions and other organisations and also by public funding. According to Jones et al. (2006, p. 42), a university library can fund the institutional repository by *asking the parent institution for funding*. This strategy has been facilitated by the announcements of support for OA research publishing from funding bodies like Wellcome Trust and Research Councils in the United Kingdom (UK), and the possibility of using a repository for the UK's Research Assessment Exercise 2007-8. Another way is by *funding the project using the library budget*, which has a greater chance of success according to the Jones et al. (2006, p. 42).

In a recent survey, findings showed that the use of IRs has doubled since 2004, the usage for subject-based repositories has increased to almost 60%, and 49% of the respondents stated that they have self-archived at least one article during the last three years (Swan & Brown, 2005). As IRs adoption grows, it complements and at the same time it threatens the dissemination of the scholarly work made by publishers, because users can gradually move to access articles by using the IRs, since they often access scientific information by the institution gateway and they rely on libraries indications.

Therefore, the IRs challenge the established revenue streams because they can be used to access scientific content freely, decreasing the usage of the toll-access journals. According to Crow (2002, p. 24) the open access nature of IRs "threatens the existing subscription-based business models and the attendant revenue streams of many scholarly publishers".

Similarly, the growing of IRs risks the existing subscription-based model of commercial publishers and of non-profit scholarly societies because of the potential loss of subscribers, which can affect prices and margins. It has been noticeable that the dependence of commercial publishers on the subscription model is still high, which risks their adoption of alternative ways of revenue generation. Waltham (2005) has observed that the number of institutional subscriptions is decreasing, but publishers still highly rely on them.

* For example, the DSpace is MIT's IR costs are around \$285,000 per year to maintain ongoing costs for technical maintenance, server space and promotion (www.ebrary.com/corp/newspdf/ebrary_EPS_Insights_24Nov2005.pdf) [accessed 18/04/2006 2:39pm].

Adapting business models to the potential of disaggregating of activities

A publishers' subscription-based business model is substantially affected by the potential of disaggregating publishing activities, because these can be performed by different and separate agents, and also because competition can be engendered, undermining traditional publishers' monopolistic bargain power and pricing practices. Crow (2002, p.24) has pointed out that the high price practices allowed by the current integrated value chain will be "impossible to sustain in a disaggregated, less monopolistic environment".

The functions in scientific communication such as registration, awareness, archiving* and certification are highly vertically-integrated (Roosendaal & Geurts, 1999, pp. 14-20). The first three functions are performed by OA strategies, and the certification function gives publishers' respectability and increases their attractiveness, but it is actually performed by academics. Thus, it is not difficult to empower academics with the right resources in order to enable them to be an independent player and perform the certification activities. According to a report of European Commission (Dewatripont et al., 2006, p.43):

"Recent evolutions suggest that certification could be done through other means than journal publishing. It is an open question at this point whether future business models will continue to bundle these two activities [certification and registration], or whether a separate certification service will emerge, distinctly from dissemination of peer-review".

The IRs and the overlay journal (figura 3) are signals of the disaggregation of functions in the value chain (e.g. Biomed as the digital repository for all the funded-research publications, and HighWire Press). Overlay journals (Fig.3) are those which "point to articles and

* Functions: registration is the establishing the intellectual priority of an idea, concept, or research; certification is about certifying the quality of the research and/or the validity of the claimed finding; awareness is ensuring the dissemination and accessibility of research, providing a means by which researchers can become aware of new research; and archiving is preserving the intellectual heritage for future use (Crow, 2002, p. 7).

FIGURE 3
Examples of the overlay journals. The first one is the Journal Perspectives in Electronic Publishing, and the last one is the Journal Applications of Superconductivity.



research hosted by one or more repositories" and these articles may have been published in refereed journals or may be preprints (Crow, 2002, p.13).

EVOLVING BUSINESS MODELS

In the discussion about which business models can evolve, little interest for the author or reader facing charges has been evidenced. According to survey performed by Rowlands & Nicholas (2005, p.38), libraries should not be the largest contributor to the journals costs as they currently do. The preferred model was that one in which the research funders, commercial sponsors and central government are committed with the charges (in this order) (figura 4).

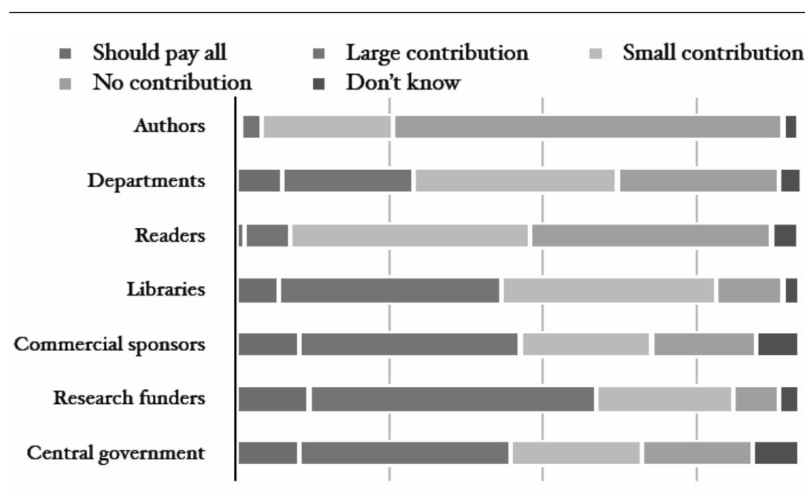
The hybrid business models, which mixes the open- and toll-access is a reality and they will probably co-exist with respective trade-offs. In this context, the authors-pay model has been equally controversial as it may risk quality standards of articles publishing, because pressures may happen if publishers do not have enough to publish and pay the bill. Additionally, this model requires a huge cultural change by authors, which creates barriers for its development.

On the other hand, the Wellcome Trust proposition about adopting separate submission fees (peer-review) and publication fees seems to be reasonable and this proposition minimises the potential disincentive to the model. Additionally, this model is attuned to the disaggregating nature of e-publishing and OA, and also attuned to the natural movement in this industry (even in long-term). The unbundling of the certification and dissemination functions can be operationalised by the repositories and the browsing/ searching services, and the peer-review process can be performed by an independent academic agent.

Equally probable is the growing of the adoption of IRs, considering the concretization of strong support from funding agencies, research institutions, rewarding systems, librarians, the changes in researchers' publishing practices and the clear institutional policies regarding this issue. IRs will probably increase in use, and thus, developing the broad mass of OA research articles which is required to give consistency to the most effective business and operational models. Promoting this growth are also the external movements like the European Commission (2006, p.87) 'AI' recommendations (see in appendix 1). IRs will not substitute the commercial publishing. Both will co-exist and the value delivery from both should go beyond the content access and should support users in navigating through the best quality scientific information.

Whatever the model that evolves, a huge cultural change in authors' and institutions publishing practices will be required in order to make the open access happen and to consolidate the right business models for the traditional publishers. Some external changes should also happen in order to sustain the whole changing scenario, such as policies, rewarding systems and institutions mandates.

FIGURE 4
Who should meet publishing costs? (n=5,513) (Rowlands & Nicholas, 2005, p.38).



All the stakeholders should be highly flexible and adaptable and, on top of that, they should be partners because the changes affect the whole scholarly publishing system. The evolving business model will prime for the most effective way that science deserves to be communicated to society and for financial, operational and strategic sustainability.

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