

OECD Scientific Publishing Study

by

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OECD Scientific publishing study - Summary¹

This study of *scientific publishing* spans both scientific and scholarly research publishing. The analysis covers:

- Scientific, technical and medical (STM), social sciences, humanities and arts publishing.
- Journals, research monographs, reference books and research databases as forms of content.
- Academic publishing and some aspects of professional publishing.

It focuses on the transition from print to digital delivery, to shed light on that transition, and it recognises scientific publishing as a central element in the creation and dissemination of knowledge and in innovation systems.

Advances in digital technology are radically changing capabilities to reproduce, distribute, control, and publish information (see OECD, 2005). These advances are increasingly central to scientific activity, but they may conflict with some existing practices and policies that shape traditional publishing. The key issue is whether there are new opportunities for science communication systems to better serve researchers, and communicate and disseminate research findings to users.

The importance of scientific publishing

The importance of scientific publishing lies in its role in the production and diffusion of scientific and technical knowledge, and how this diffusion of knowledge drives economic growth and further research. Publishing is also a significant economic activity in its own right, and scientific publishing has the lead in digital delivery and in the emergence of new digital content business models in the print media.

OECD countries spent USD 638 billion on R&D in 2001, and all OECD countries have paid increasing attention to both research and its dissemination and commercialisation. Scientific publishing is

1. This summary is drawn from a comprehensive OECD study on scientific publishing: OECD (2005), "Digital broadband content: Scientific publishing", internal document DSTI/ICCP/IE(2004)11/FINAL, Directorate for Science, Technology and Industry, Committee for Information, Computer and Communications Policy, Working Party on the Information Economy, OECD, Paris, available at: www.oecd.org/sti/digitalcontent.

central to the efficiency of research, to the dissemination of research findings and the diffusion of scientific and technical knowledge. Scientific publishing plays a key role in innovation, and underpins economic growth and social development (*e.g.* education, health, environmental management, etc.). Scientific publishing is at the forefront of the digital delivery of content, and scientific and professional publishers have invested heavily in digital publishing. In 2003, an estimated 75% of scholarly journals published were available on line.

High and increasing use of digital content has led to fundamental changes in research practices and the dissemination of scientific and technical knowledge. The US National Research Council in 2001 noted that: “the rapidly expanding availability of primary sources of data in digital form may be shifting the balance of research away from working with secondary sources such as scholarly publications... New automated systems, and perhaps new intermediary institutions for searching and authenticating information, will develop to provide these services, much as libraries and scholarly publications served these roles in the past.” The UK’s Joint Information Systems Committee in 2002 suggested that: “multimedia and distributed computing grids are developments which extend the processes of scholarly communication, while at the same time presenting considerable management challenges.” They pointed to new pricing and publishing models, new applications of intellectual property law and new approaches to the preservation of digital content.

Responses have seen the development of new publishing business models, including: the so-called “Big Deal”; open access publishing; open access archives and repositories; and a variety of mixed and hybrid models. These responses put scientific publishing at the forefront of the development of new digital content business models.

The scientific publishing industry

The scientific publishing industry is a sub-part of the larger printing and publishing industry. The printing and publishing industry in the United States recorded shipments of EUR 260 billion in 2000, while production value in the EU-13 countries exceeded EUR 234 billion. According to the US Census Bureau, print publishing accounted for USD 143 billion or around one-third of the gross revenues of the US copyright industries in 2002. By comparison, motion picture and video publishing gross revenues were USD 62 billion (*i.e.* less than half of print publishing), and sound recording and music publishing gross revenues were USD 14 billion (*i.e.* one tenth of print publishing). The core scientific publishing market is estimated at USD 7 – 11 billion.

Scientific publishing produces a range of content products and related services. Primary content products traditionally include: journal articles and books in text form; journal articles published as collections grouped together into regular journal titles; and research monographs typically published on a one-off basis, although in many cases as a part of a series or thematic collection. Three main types of organisations are publishers of scientific content: *i)* commercial, for-profit firms; *ii)* membership-based societies; and *iii)* institutional publishers. The business models adopted by each of these organisations vary, although the underlying economics of publishing and the changes in economic forces are the same for each.

The use of ICTs in research has led to a proliferation of data, new forms of research output and reporting, and new modes of presentation and analysis. Researchers are now producing a wide range of “born-digital” objects integral to their work, in addition to journal articles and research monographs. These include: collections of observations and data, some of which are the result of automated observation and data collection (*e.g.* from the Hubble Telescope); data rich results, which take the form of data that others can use (*e.g.* gene sequences); algorithms and elements of computer software that can be used by others (*e.g.* open source and object libraries); and a range of digital compositions (*e.g.* audio, video, still images,

maps, etc.). The ongoing challenge is to use ICTs to provide an integrated and sustainable science communication system that encompasses all forms of research output, and that makes it easy for researchers to communicate their results and interpretation and for users to access and exploit these outputs.

Digital delivery and online access

This report analyses the adoption of e-commerce in publishing, digital delivery, and the use of e-journals, e-books, databases, archives and repositories by research authors and research users. It analyses the drivers of, and potential for, digital delivery and online access for authors and users, as well as publishers, levels of adoption and use, barriers to further adoption, and some of the impacts of digital delivery and online access to scientific and scholarly content. ICTs are transforming the products and services that are produced in content publishing industries, as well as changing the organisational processes in these industries. Thus the impacts of ICTs and digital delivery on scientific publishing are two-fold. First, there are impacts of digital content and digital delivery on the nature of the content publishing business – impacts that are unique to content publishing industries. Second, there are impacts of e-commerce and e-business activities on processes within and between businesses – impacts that are felt by all industries to a greater or lesser degree.

The impacts of e-commerce and digital delivery on media and publishing enterprises include: changes to workflow and the value chain, with some steps in the value chain becoming obsolete and some being taken over by other players; increased opportunities to collaborate with suppliers, customer and competitors; changes in product and service possibilities, and related changes to business models; and changes to corporate strategies to take advantage of new challenges and opportunities. At the industry level, impacts include: the possibility of economies of scale and greater market reach increasing concentration; digital delivery opportunities encouraging cross-media ownership; and the potential for the industry to diverge into two quite separate groups of very large multinational enterprises and smaller players.

ICTs, e-commerce and digital delivery in publishing are both *sustaining technologies* that improve the performance of established products and business models, and *disruptive technologies* that bring different performance characteristics, enable the introduction of alternative business models and change the ways that industries function. New sustaining technologies (*e.g.* more efficient editorial production systems, cheaper colour print technologies, and the use of e-business technologies to improve production and communication between supply chain partners) lead to economies and efficiencies. However, disruptive technologies have the potential to introduce new combinations of media, erode existing revenue models, develop new business models and change relationships with the user/consumer. There are opportunities for disintermediation within the supply chain and for the creation of new intermediaries, combining resources, assets, knowledge and information to create new business models and to develop new relationships with the consumer.

There is both disintermediation and the emergence of new intermediaries – with publishers increasingly dealing directly with their research library customers and some subscription agents being squeezed out, and the emergence of new intermediaries between providers of research outputs and users, including hosted distribution service (*e.g.* HighWire Press) and a range of open access archives (*e.g.* arXiv and CogPrints) and institutional repositories (*e.g.* ANRO and CERN Document Server).

New value chains and business models

This report analyses recent developments in scientific publishing value chains and business models (see OECD digital content analysis available at www.oecd.org/sti/digitalcontent). Three major business models depending on digital delivery are emerging:

- The so-called “Big Deal” – where institutional and other subscribers pay for access to an online digital content aggregation of journal titles through consortia or site licensing arrangements.
- Open access publishing supported by author charges or other forms of institutional support on the research output supply-side – where authors and/or their employing or funding organisations contribute some or all of the costs of publication (*e.g.* BioMed Central).
- Open access archives and repositories – where organisations support institutional repositories and/or subject archives (*e.g.* CogPrints, eScholarship, etc.).

Each is analysed in terms of what is happening and how it works, impacts on publishing value chains and business models, impacts on science and scholarship (supply and use of research outputs), advantages and disadvantages, and arguments in the literature on their sustainability. Mixed and hybrid alternatives are also discussed.

In the immediate future there is likely to be a period of experimentation around the “author pays” version of open access publishing, combined with the emergence of a range of hybrids based around mixes of subscription-based and different forms of open access. In the longer term, some of the objects and activities that have been central to scientific publishing in the print era may gradually be replaced. Many developments in research practice, communication and publishing are emerging from increased use of ICTs and Internet that may enhance and/or replace current practices, activities and objects. Any changes in the current system of research journals and peer review will depend on: the roles of existing stakeholders, objects and activities; changing needs of researchers and the impacts of e-science and the “data deluge”; the opportunities afforded by rapidly developing information and communication technologies; and the underlying economic characteristics of information.

Emerging issues

With digitisation, digital delivery and changing ways of accessing and distributing scientific information and the associated impacts on scientific publishing, there is great interest in continuing to realise and enhance the benefits of digital delivery and maximising returns on R&D investments through the breadth and quality of access to research results, findings, and digital data of all kinds by both researchers and users. Fundamental changes in generation, organisation and access to information are the context for the issues outlined below. In this context, OECD Science Ministers in January 2004 adopted a Declaration entrusting the OECD to work towards the establishment of access regimes for digital research data from public funding.²

2. Meeting of the OECD Committee for Scientific and Technological Policy at Ministerial Level, 29-30 January 2004 Final Communiqué. In the Communiqué, Ministers emphasised the importance of ensuring the long term sustainability of the research enterprise and the need to involve civil society and business more effectively in the governance of public research. They concluded that “Coordinated efforts at national and international levels are needed to broaden access to data from publicly funded research and contribute to the advancement of scientific research and innovation. To this effect, Ministers adopted a Declaration entrusting the OECD to work towards commonly agreed Principles and Guidelines on Access to Research Data from Public Funding”. Final Communiqué available at: www.oecd.org/document/15/0,2340,en_2649_33703_25998799_1_1_1_1,00.html

There is a wide range of commercial, not-for-profit and public sector organisations involved in the production, dissemination and use of scientific publications, and in a framework of established practices, businesses and business models, publishers have rapidly adopted digital delivery and adapted their business models as new ICT related developments have opened new opportunities. However, there are also much broader issues involving new expectations of research, increased focus on accountability for R&D expenditures, increased awareness of the importance of knowledge creation and distribution, and the emergence of broader ICT related opportunities (e.g. e-science), and there may be opportunities to develop new and improved systems to serve research, research users and research funders more effectively and efficiently, that better integrate actors and activities in innovation systems and increase returns to investments in R&D and enhance the innovative capacity of OECD economies.

Areas where governments and other stakeholders can contribute to improve access and dissemination of research findings cover the general framework for research, diffusion of research results and skills development. More specifically for scientific publishing and publications, they cover development of infrastructures, improved information and analysis, removal of specific barriers to digital content supply and use and standards and interoperability issues.

Research funding. Public funding and funding agencies (including private agencies) are very important in R&D and related activities that generate research data, databases and scientific publications. Access to public and government-funded research content is a crucial issue, and there is considerable potential for governments to provide a lead in enabling digital delivery and enhanced access to publicly funded scientific and technical information. The principle is to enable maximum access to findings from publicly funded research to maximise social returns on public investments. This general approach is captured in the “Declaration on Access to Research Data from Public Funding” adopted by OECD Science Ministers meeting in January 2004, which recognised “that open access to, and unrestricted use of, data promotes scientific progress and facilitates the training of researchers” and “will maximise the value derived from public investments in data collection efforts”, and entrusted the OECD to work towards the establishment of access regimes for digital research data from public funding.

- *Research evaluation.* Funding agencies (public and private) set ground rules for research evaluation, as well as being major funders of research. They can play important roles in digital research content development and dissemination by: encouraging research evaluation that is neutral across different forms of publishing, while maintaining or raising quality; developing new ways of measuring the significance and use of open access archives and repositories to improve research evaluation by funding organisations, research suppliers and users; working with other institutions and researchers to respond to new challenges in disseminating research results in new media; and contributing to a climate that promotes diversity of public and private sector sources for information, in order to enhance access to scientific and technical information.
- *Skills.* Governments play a role in ensuring that there are the necessary education and training programmes for basic ICT skills and advanced skills, although full-time education is not currently the main source of many specialist ICT skills. Given rapid changes in technologies and skill needs, new strategies, partnerships and programmes may be needed focusing on the ICT and related business skills necessary to support sustainable digital delivery and the development of new business models that enhance access.
- *Infrastructure.* Various publicly funded programmes support the development of hard and soft infrastructures that enable digital delivery and enhance access, including data bases, archive and preservation initiatives, and various kinds of legal deposit requirements.

- *Information.* High quality, independent information and analysis are crucial in rapidly evolving digital content applications. Industry associations, learned societies and publicly funded specialised research and dissemination agencies can provide information on new developments in scientific digital content publishing, and the supply, purchase and use of online content (*e.g.* support for case studies, research into emerging business models, and dissemination of information to the providers of research results and the purchasers and users of this information).
- *Technology neutrality.* Digital delivery and access can be enhanced by removing barriers and disincentives to use by minimising regulatory differences between digital content and other forms of content. These include regulatory impediments or differences in treatment of physical/print and online/digital alternatives (*e.g.* different taxation treatment of print and electronic content to the extent that the products are the same). Similarly, research evaluation systems may need to ensure that there is equal treatment of equivalent research outputs in various forms.
- *Standards and interoperability.* Standard-setting bodies play an important role in ensuring the framework for dialogue and co-operation in setting new standards and ensuring interoperability to the extent possible among new technologies. Governments help set the supportive frameworks necessary for cross-industry co-operation among standards developers and users. Specifically they can encourage co-operation within the publishing industry on interoperability across access systems and platforms; encourage co-operation among publishers, research libraries and users more generally to facilitate development of business models that suit all parties; and work with industry and professional associations to ensure that all stakeholders are appropriately involved in new developments.

A combination of these informing, enabling and facilitating initiatives can support continued development of sustainable digital delivery business models that enhance access to scientific and technical information, improve the efficiency of research and increase returns on the very substantial public investments in R&D.