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COSTS AND BENEFITS OF RESEARCH COMMUNICATION: The Dutch Situation

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Introduction

A knowledge economy has been defined as one in which the generation and exploitation of knowledge has come to play the predominant part in the creation of wealth. It is not simply about pushing back the frontiers of knowledge; it is also about the more effective use and exploitation of all types of knowledge in all manner of economic activities (DTI 1998). Scholarly publishing plays a key role as it is central to the efficiency of research and to the dissemination of research findings and diffusion of scientific and technical knowledge. But advances in information and communication technologies are disrupting traditional publishing models, radically changing our capacity to reproduce, distribute, control and publish information. One key question is whether there are new opportunities and new models for scholarly publishing that might better serve researchers and more effectively communicate and disseminate research findings (OECD 2005, p14).

Building on previous work, this study looks at the costs and potential benefits of alternative models for scientific and scholarly publishing. The work began in Australia in 2006 with a study of *Research Communication Costs, Emerging Opportunities and Benefits* (Houghton *et al.* 2006). This was followed by a major study of the *Economic Implications of Alternative Scholarly Publishing Models* for the Joint Information Systems Committee (JISC) in the UK (Houghton *et al.* and Oppenheim *et al.* 2009). The aim of this study is to apply the same basic approach to exploring the costs and benefits of alternative models for scientific and scholarly publishing in the Netherlands.¹

Approach and methodology

The JISC study focused on three emerging models for scholarly publishing, namely: subscription publishing, open access publishing and self-archiving.

- *Subscription publishing* refers primarily to academic journal publishing and includes individual subscriptions and the, so called, Big Deal (*i.e.* where institutional subscribers pay for access to online aggregations of journal titles through consortial or site licensing arrangements). In a wider sense, however, subscription publishing includes any publishing business model that imposes reader access tolls and restrictions on use designed to maintain publisher control over that access in order to enable the collection of those tolls.
- *Open access publishing* refers primarily to journal publishing where access is free of charge to readers, and the authors, their employing or funding organisations pay for publication, or the publication is supported by other sponsors making publication free for both readers and authors. Use restrictions can be minimal as no access toll is imposed.

¹ The authors would like to acknowledge the support of the UK Joint Information Systems Committee (JISC) in the development of the modelling approach underpinning this study, and the SURFfoundation for enabling its application in the Netherlands.

- *Open access self-archiving* refers to the situation where academic authors deposit their work in online open access institutional or subject-based repositories, making it freely available to anyone with internet access. Again, use restrictions can be minimal.

As self-archiving, of itself, does not constitute formal publication analysis focuses on two publishing models in which self-archiving is supplemented by the peer review and production activities necessary for formal publishing, namely: (i) 'Green OA' self-archiving operating in parallel with subscription publishing; and (ii) the deconstructed or 'overlay journals' model in which self-archiving provides the foundation for overlay journals and services (*e.g.* peer review, branding and quality control services). Consequently, all of the publishing models explored include all the key functions of scholarly publishing (*i.e.* registration, certification, dissemination / awareness, and preservation).

Phase I: Identifying the costs and benefits

The first phase of the JISC study sought to *identify* all the dimensions of cost and benefit associated with each of the models, and examine which of the main players in the scholarly communication system would be affected and how they would be affected by the adoption of alternative publishing models. In order to provide a solid foundation for analysis, we developed and extended the scholarly communication life-cycle model first outlined by Bo-Christer Björk (2007).

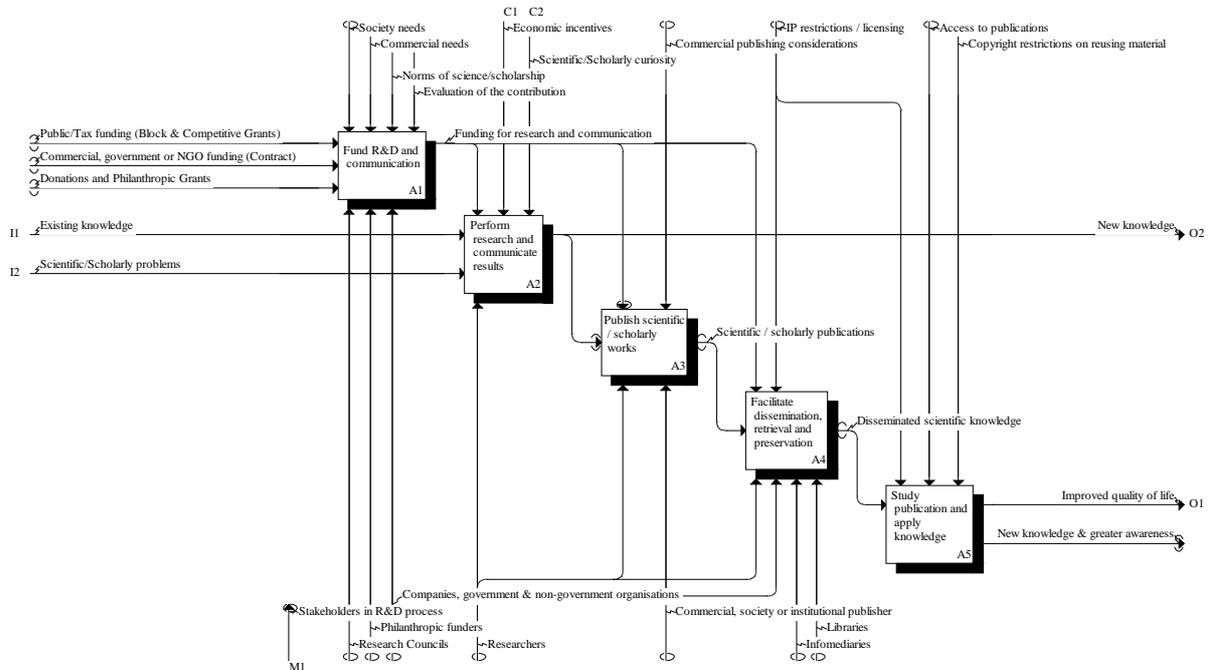
Björk (2007) developed a formal model of the scholarly communication life-cycle to act as a roadmap for policy discussion and research concerning the process. Based on the IDEF0 process modelling method, often used in business process re-engineering, it provided the first detailed map of the scholarly publishing process. Björk's central focus was the single publication (primarily the journal article), how it is written, edited, printed, distributed, archived, retrieved and read, and how eventually its reading may affect practice. Björk's model included the activities of researchers who perform the research and write the publications, publishers who manage and carry out the actual publication process, academics who participate in the process as editors and reviewers, libraries who help in archiving and providing access to the publications, bibliographic services who facilitate the identification and retrieval of publications, readers who search for, retrieve and read publications, and practitioners who implement the research results directly or indirectly.

Extending the model outlined by Björk (2007), the scholarly communication process model developed for the JISC study included five core scholarly communication process activities, namely:

- (i) Fund research and research communication;
- (ii) Perform research and communicate the results;
- (iii) Publish scientific and scholarly works;
- (iv) Facilitate dissemination, retrieval and preservation; and
- (v) Study publications and apply the knowledge (Figure 1).

Each of these is further subdivided into a detailed description of the activities, inputs, outputs, controls and supporting mechanisms involved. This formal process modelling was used to identify activities and provide the foundation for activity costing.²

Figure 1: The scholarly communication process



Link: <http://www.cfses.com/EI-ASPM/SCLCM-V7/>

Source: JISC EI-ASPM Project Scholarly Communication Process Model.

Phase II: Quantifying the costs and benefits

The second phase of the JISC study sought to *quantify* the costs and benefits identified, identify and where possible quantify the cost and benefit implications for each of the main players in the scholarly communication system and, as far as possible, compare the costs and benefits of the three models. There are three elements to our approach to quantifying costs and benefits.

- First, we explore the costs of individual process activities and then sum them to estimate system-wide costs. From this we can see cost differences and direct cost savings.
- Second, we present cases and scenarios to explore the potential cost savings resulting from alternative publishing models: looking, for example, at impacts on search and discovery, library handling costs, etc. From this we can explore indirect cost differences and savings.

² Details of the entire model in 'browseable' form can be found on the Web at <http://www.cfses.com/EI-ASPM/SCLCM-V7/>.

- Third, we approach the issue from the top down and model the impact of changes in accessibility and efficiency on returns to R&D using a Solow-Swan model, into which we introduce *accessibility* and *efficiency* as negative or friction variables to reflect the fact that there are limits and barriers to access and to the efficiency of production and usefulness of knowledge (Houghton and Sheehan 2006; 2009).

A full description of the modelling approach and details of its operationalisation can be found in the JISC Project Report (Houghton *et al.* and Oppenheim *et al.* 2009) (<http://www.cfses.com/EI-ASPM/>).

Data sources and limitations

There are two elements to the activity cost modelling, namely (i) local national variables, and (ii) more generic activity costings. While there are important structural differences between national research and scholarly communication systems, research is a global activity and many research-related and scholarly publishing activities are common across countries. Consequently, for preliminary estimations, it is possible to use international sources on research and publishing activities where no local sources exist or where international sources are preferred for the sake of commensurability. This section describes the major sources used and possible limitations, taking each of the five main activity elements identified in the scholarly communication process model in turn (See Annex I and Annex II for details). All data are standardised on 2007 prices and levels of activity.

(i) Fund research and research communication

Major sources on research funding in the Netherlands include the annual reports of the major funding agencies and departments (*e.g.* NWO, KNAW, etc.), national and international reporting of R&D expenditures and the number of personnel engaged in research (*e.g.* CBS, NOWT, OCW, OECD, EuroStat, etc.), and reports of the activities of universities and research institutes in the Netherlands (*e.g.* VSNU, etc.). Drawing on these sources provides sufficient data for preliminary estimation.

(ii) Perform research and communicate the results

Major sources on the performance of research in the Netherlands include a mix of local and international sources. Local sources include academic pay scales and the ratio of salaries to overheads typical in universities and research institutes, and publication counts by institution for journal articles and from NWO funded research for articles and other forms of output.

Salaries are based on those reported by the universities, with estimated overheads based on a combination of a University of Amsterdam model for calculating full cost recovery for contract research and simply dividing R&D expenditure by full-time equivalent (FTE) researchers in those categories reported. The number of FTE researchers in Netherlands in 2007 was 44,116 sourced from EuroStat, and we estimate that there were around 11,740 researchers in higher education who were published. The total cost of researcher activities is estimated to be around EUR 215,000 per person per year, or EUR 128 per hour (*i.e.* full economic cost including

overheads). This figure includes the personnel costs of research technicians and support staff as overheads.³

Locally sourced publication counts are supplemented by counts sourced from the Web of Knowledge and SCOPUS databases for the calendar year 2007, scaled to account for content not included in those sources (Björk *et al.* 2008). For non-article content, counts for the universities are supplemented by estimates based on output proportions reported in the UK Research Assessment Exercise (RAE). These sources suggest a core peer-reviewed content of around 25,400 articles produced in the universities during 2007 and around 29,000 nationally.

For much of the researcher activity data we must rely on international sources on the activities of researchers in universities and elsewhere. The principal sources include the King and Tenopir tracking studies, which have been undertaken over many years in the US and more recently in a number of other countries (not including the Netherlands). Major sources include Tenopir and King (2000), Tenopir and King (2002), Tenopir and King (2007), Tenopir, King, Edwards and Wu (2009), King, Tenopir and Clarke (2006), Rowlands and Nicholas (2005), Halliday and Oppenheim (1999), Houghton, Steele and Sheehan (2006), CEPA (2008), Björk, Roos and Lauri (2008), etc. These sources are supplemented by reports of research activity times in universities in the Netherlands. Drawing on these sources provides sufficient data for preliminary estimation.

(iii) Publish scientific and scholarly works

Scholarly publishing is a global activity and the activities of journal and academic book publishers are similar around the world. Moreover, the aim herein is to cost the activities relating to the publication of scientific and scholarly works researched and written in the Netherlands, and Netherlands-based research is published by international as well as local publishers. Consequently, publishing activities and costs can be sourced from a wide range of existing literature and industry consultations undertaken for the previous studies.

For the basic market data relating to STM publishing we rely on EPS/Outsell, while publishing output volumes are sourced from the Web of Knowledge and SCOPUS databases, Ulrich's, The Publishers Association, Björk *et al.* (2008), etc. Detailed activity costs relating to journal publishing are sourced primarily from Tenopir and King (2000) and their subsequent tracking studies, the ALPSP, CEPA (2008), Waltham (2005; 2006), etc. Activity costs relating to scholarly book publishing are less well reported in the literature, although data can be sourced from Clark (2001; 2008), Watkinson (2001), Greco and Wharton (2008), etc. We have also obtained confidential cost data from book publishers for the previous studies. Details of author-pays fees are sourced from a sample of open access journal publishers.

These sources provide sufficient data for preliminary estimation. Nevertheless, more information on local publishing costs in the Netherlands would be helpful in informing us as to the need to adjust for local costs structures (*e.g.* due to publication in local languages and implied shorter print runs and fewer subscribers, publication in multiple languages adding

³ To the extent that researchers work longer than their official standard hours these costs may be somewhat high and might, perhaps, be thought of as the value of the activity rather than the cost (per hour).

translation and additional production costs, possibly higher international distribution costs, etc.). To the extent that such factors add to the costs of publishing the scientific and scholarly content produced by researchers in the Netherlands, the publisher cost estimates herein should be taken as something closer to lower bound estimates.

(iv) Facilitate dissemination, retrieval and preservation

The activities of dissemination, retrieval and preservation, most notably those of research and special libraries, exhibit greater variation between countries. Data from the Dutch University and National Libraries Consortium (UKB) provide a solid foundation, but we lack information about other research and special libraries outside the university sector. In the absence of detailed local information about activity costs, research library activity costings can be no more than first approximations based on international activity studies (*e.g.* Schonfeld *et al.* 2004; King *et al.* 2004; etc.), with activity times translated to local costs using average Dutch university library staff salaries. Moreover, as electronic journals become the norm and e-book collections are emerging library handling activities are changing rapidly, making data from 2003-2004 no more than an approximate guide to library activities.

Cost and operational data relating to repositories are highly varied, but there are sufficient data for preliminary estimation from international studies (*e.g.* Swan 2008, The Driver Report 2008, Bailey 2006, Universities UK 2007, Houghton *et al.* 2006 and ROAR, etc.) as well as local sources. It is notable that the case studies in the LIFE Project report very similar per article and per object repository life-cycle costs to those derived independently for the JISC study.

(v) Study publications and apply the knowledge

With limited information about the activities of researchers, research and special libraries, and research users outside higher education and specialist public sector research institutions, the analysis of costs relating to studying publications and applying knowledge is limited to the use of research by other public sector researchers. This limits the extent to which the possible costs, cost savings and benefits of alternative scholarly publishing models can be examined on a detailed case-by-case basis and has led to our reliance on a macro-modelling of the potential impacts of enhanced access on social returns to R&D using a modified Solow-Swan model. This limitation and consequent approach has been common across the previous studies.

Summary of preliminary results

Drawing on this wide range of data sources, activity surveys and tracking studies we estimate costs for activities throughout the scholarly communication process at the national level and for the 13 research universities in the Netherlands. To enable ready comparison this summary follows the structure of the JISC Project Report's Executive Summary (Houghton *et al.* and Oppenheim *et al.* 2009).

Scholarly communication system costs

The reading of scholarly publications by Netherlands-based researchers and academic staff is a major activity, perhaps costing around EUR 3.6 billion annually, and reading by those actively

publishing (*i.e.* approximating reading in order to write) cost around EUR 1 billion during 2007 (Table 1).⁴ We estimate that writing the core peer-reviewed scholarly publications may have cost around EUR 920 million, and preparing and reviewing research grant applications for the NWO and KNAW alone may have cost around EUR 60 million.

The peer review of scholarly journal articles and books conducted by Netherlands researchers on behalf of publishers (*i.e.* external peer review activities) probably cost around EUR 115 million during 2007, and the external journal editorial and editorial board activities of researchers around EUR 27 million. We estimate that publisher costs relating to Netherlands-authored publications probably amounted to around EUR 210 million (excluding the external costs noted above). Summing these costs suggests that core scholarly publishing system activities may have cost around EUR 2.4 billion in the Netherlands during 2007⁵ (See Annex III for detailed activity costings).

Table 1: Estimated annual national scholarly communication activity costs (EUR, circa 2007)

<i>NL National</i>	<i>Estimate</i>
Reading (Published Staff)	1,032,700,000
Writing (WoK based estimate, scaled)	918,900,000
Peer Review (Scaled to publication counts)	115,900,000
Editorial activities (Scaled to published staff)	24,400,000
Editorial board activities (Scaled to published staff)	2,700,000
Preparing Grant Applications (NWO & KNAW)	53,800,000
Reviewing Grant Applications (NWO & KNAW)	4,200,000
Publisher Costs (Scaled to publication counts)	210,800,000
Total National System	2,363,500,000

Source: NL model: Authors' analysis.

Table 2 summarises these same scholarly communication activity costs for the 13 universities. It shows that reading by academic staff probably cost around EUR 1.7 billion during 2007, and reading by those actively publishing around EUR 805 million. We estimate that writing the core peer-reviewed scholarly publications in higher education cost around EUR 856 million, and preparing and reviewing research grant applications for the NWO and KNAW (estimated) alone may have cost around EUR 46 million.

The peer review of scholarly journal articles and books conducted on behalf of publishers by academic staff in the Netherlands (*i.e.* external peer review activities) probably cost around EUR 105 million during 2007, and their external journal editorial and editorial board activities around EUR 20 million. We estimate that university output-related publisher costs probably amounted to around EUR 195 million (excluding the external costs noted above). Summing

⁴ All costs are expressed in 2007 Euros and, where necessary, have been converted to Euros using OECD published annual average exchange rates and adjusted to 2007 using the Netherlands consumer price index. Publisher costs include commercial margins.

⁵ These activity costings include the cost of publishing Netherlands-based research, but do not include the cost of toll and subscription access to non-Netherlands scholarly content.

these costs suggests that scholarly publishing system activities may have cost Netherlands universities almost EUR 2 billion during 2007 (See Annex III for detailed activity costings).

Table 2: Estimated annual higher education scholarly communication activity costs (EUR, circa 2007)

<i>NL Universities</i>	<i>Estimate</i>
Reading (Published Staff)	805,000,000
Writing (WoK based estimate, scaled)	856,400,000
Peer Review (Scaled to publication counts)	105,200,000
Editorial activities (Scaled to published staff)	18,300,000
Editorial board activities (Scaled to published staff)	2,000,000
Preparing Grant Applications (NWO & KNAW)	43,100,000
Reviewing Grant Applications (NWO & KNAW)	3,400,000
Publisher Costs (Scaled to publication counts)	194,900,000
Total Higher Education System	2,028,400,000

Note: Includes the 13 universities only.

Source: NL model: Authors' analysis.

The cost of alternative models

Our analysis focuses on three alternative models for scholarly publishing, namely: subscription publishing, open access publishing and self-archiving. Table 3 summarises costs relating to each of these models.

Subscription and toll access publishing cost the university libraries EUR 46.5 million for acquisitions during 2006. Negotiation of subscriptions and licensing, access control and other library handling relating to the subscription or toll access model also accounted for a substantial share of university library non-acquisition costs.

Table 3: Estimated annual higher education scholarly communication related costs (EUR, circa 2007)

<i>Netherlands Higher Education</i>	<i>Estimate</i>
Library Acquisition (UKB) (Subscription or toll access publishing)	46,500,000
Library non-Acquisition (UKB)	85,400,000
Author-pays fees for all journal articles (Open access publishing)	55,700,000
Current estimated Repository Costs (Open access self-archiving)	2,700,000

Source: NL model: Authors' analysis.

Open access publishing all the Netherlands universities journal article output in 2007 would have cost around EUR 56 million at EUR 2,200 per article published. Given that it is said that no more than half of open access journals actually charge author fees, perhaps EUR 28 million would have been required for author-side payments. However, if the Netherlands supported open access publishing in proportion to output, the remaining EUR 28 million would have been paid in other forms of institutional support.

Open access self-archiving costs are based on estimated repository costs, which are necessarily no more than approximate. Nevertheless, we estimate that the open access repositories in operation in the Netherlands as of December 2008 may have involved annual costs of around EUR 3 million, and that a system of institutional repositories in higher education (*i.e.* including the 86 universities, research institutes and HBOs), in which every institution had one publications-oriented repository and all publications were self-archived once, would cost around EUR 10 million per annum (at 2007 prices and levels of publication output).

Costing activities, objects and functions

The matrix approach to costing lying behind these activity costs enables their presentation in various forms, including as costs for actors, objects and functions. For example, combining activity costs to estimate object costs we find that journal articles cost an estimated average of around EUR 19,600 to produce in the Netherlands circa 2007, of which around EUR 12,200 related to the direct cost of writing (excluding input research activities, such as reading), EUR 4,300 related to publisher costs and EUR 3,200 to external peer review costs (per article published) (Table 4 and Figure 2).

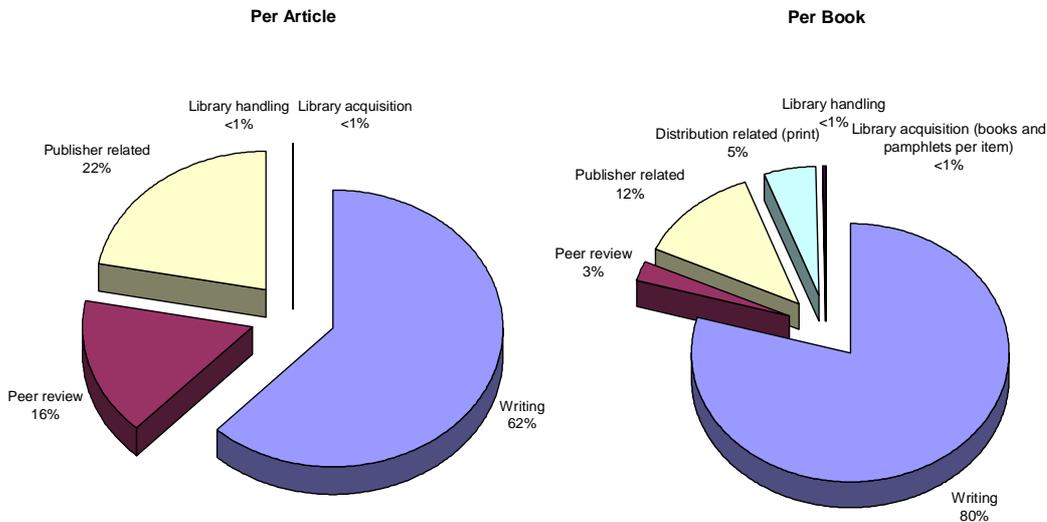
Table 4: Estimated per item object costs (EUR, circa 2007)

	<i>Estimate</i>
Cost of journal articles (per article)	
Writing	12,200
Peer review (per published)	3,200
Publisher related	4,300
Library acquisition	1.19
Library handling	0.85
<i>Per article production</i>	<i>19,600</i>
Publisher share of production costs	22%
Cost of academic books (per title)	
Writing	146,200
Peer review (per published)	4,800
Publisher related	23,000
Distribution related (print)	9,900
Library acquisition (books and pamphlets per item)	60
Library handling	200
<i>Per monograph production</i>	<i>184,100</i>
Publisher and distributor share of production costs	18%

Note: Writing costs include those items that are not published while all other costs are per item published. Acquisition costs are excluded from the totals to avoid double counting.
Source: NL model: Authors' analysis.

Similarly, we estimate that academic books (*i.e.* authored and edited books) cost an average of around EUR 184,100 to produce in the Netherlands circa 2007, of which around EUR 146,200 related to the direct cost of writing (excluding input research activities, such as reading), EUR 23,000 related to publisher costs and an estimated EUR 9,900 to distribution costs, and EUR 4,800 to external peer review costs (per title published) (Table 4 and Figure 2).

Figure 2: Estimated per item object cost shares (per cent)



Note: Writing costs include those items that are not published while all other costs are per item published.
 Source: NL Model: Authors' analysis.

Activity costs can also be combined into the cost of specific functions, such as peer review and the functions of quality control and certification.⁶ Our activity cost estimates include both internal publisher peer review handling and management related costs and external, largely non-cash, peer reviewer costs. Per article published, these amounted to an estimated EUR 503 and EUR 3,174, respectively, or a total function cost of EUR 3,677 circa 2007. For books, these costs are estimated at EUR 2,535 per title for publisher editorial activities and EUR 4,761 for external peer review, or a total function cost of EUR 7,296.

Publisher costs per journal article

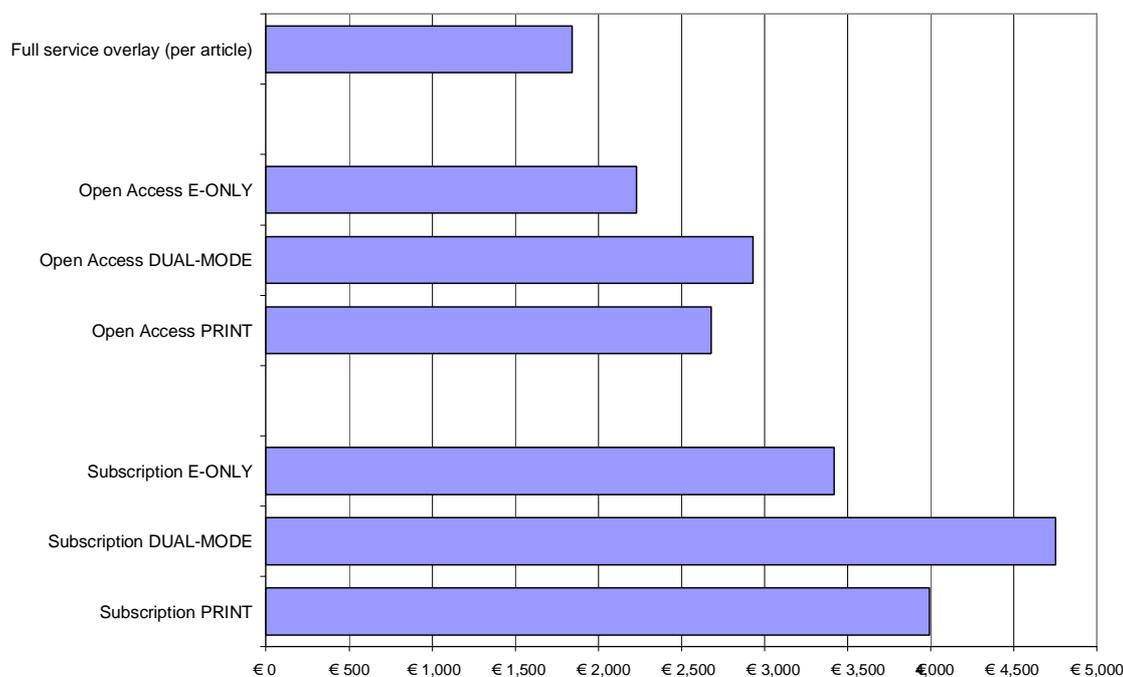
One key challenge is to separate the cost impacts of publishing models from those of publishing format, so we can explore the cost differences between subscription and open access publishing models independent of differences between print and electronic formats. Our approach is to estimate costs for print, dual-mode (*i.e.* parallel print and electronic) and electronic-only formats for subscription and open access business models, and then to compare subscription and open access models as if they were all electronic or 'e-only'. All of these costings include commercial publisher margins.

For *subscription publishing*, we estimate an average publisher cost of around EUR 4,750 per article for dual-mode production, EUR 3,990 per article for print only production and EUR

⁶ A number of publisher activities relating to the proofing, checking and editing of manuscripts might also be included in the function of quality control, but have been excluded from this example for the sake of simplicity.

3,420 per article for e-only production (excluding the costs associated with external peer review and Value-Added Tax) (Figure 3).⁷

Figure 3: Estimated average publisher costs per article by format and model (EUR, circa 2007)



Note: These costs exclude the external costs of peer review and VAT. Overlay services include operating peer review management, editing, proofing and hosting, with commercial margins. Estimates for print and dual-mode open access publishing exclude copy print and delivery related costs, assuming that the content is produced print ready and print is an add-on.

Source: NL model: Authors' analysis.

For *open access publishing*, we estimate average per article costs at EUR 2,230 for e-only production. Excluding the costs of copy printing and delivery, we estimate the cost of dual-mode open access publishing at around EUR 2,930 per article and print only open access publishing at EUR 2,680 per article.⁸ Indicatively, if printing and delivery costs were the same as subscription publishing, they might add around EUR 395 per article.

We include the implied publisher costs of *overlay services to open access self-archiving* (i.e. elements of publisher activity that could provide value adding overlay services to open access repositories), with the same commercial management, investment and profit margins applied. This suggests that operating peer review management, editing, production and proofing as an

⁷ These publisher costs are derived from those reported in the UK JISC EI-ASPM study, and are converted to Euros at 2007 annual average exchange rates.

⁸ It is impossible to estimate the cost of printing and delivery in open access publishing as it depends on the number of copies involved, and in the absence of subscriber counts that number cannot be known. Therefore, estimates for print and dual-mode open access publishing exclude actual copy print and delivery related costs, assuming that the content is produced print ready and print is an add-on.

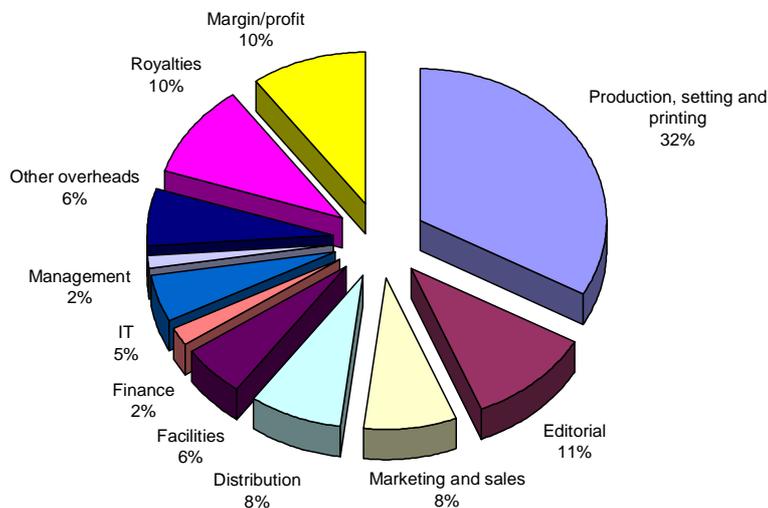
overlay service would cost around EUR 1,650 per article excluding hosting, or EUR 1,845 including hosting.

Publisher costs per book title

Costs relating to academic book publishing are less widely discussed in the literature, although there a number of sources on book publishing costs, publisher management and pricing issues that provide a foundation (e.g. Clark 2001, 2008; Watkinson 2001; Greco and Wharton 2008; etc.). It is clear from these sources that book publishing costs vary widely, even within scholarly monograph publishing.

Based on proportions derived from industry consultation and those reported in the literature (Figure 4), we estimate average publisher Net Sales Revenue at EUR 14,500 to EUR 25,500 in 2007 prices (excluding external peer review costs). Average costs can be summed by format and publishing model, with the cost of toll access book publishing in print form at an estimated average of EUR 23,000 per title. In electronic or e-only format, we estimate toll access publishing costs at an average of around EUR 16,560 per title, and open access publishing around EUR 10,800 per title. These average costs are no more than approximate, but differences between the modes and models are indicative.

Figure 4: Approximate academic book publisher cost shares (per cent)



Note: Cost shares of estimated Net Sales Revenue per title, print.
Sources: Industry consultation and Clark (2001). NL model: Authors' analysis.

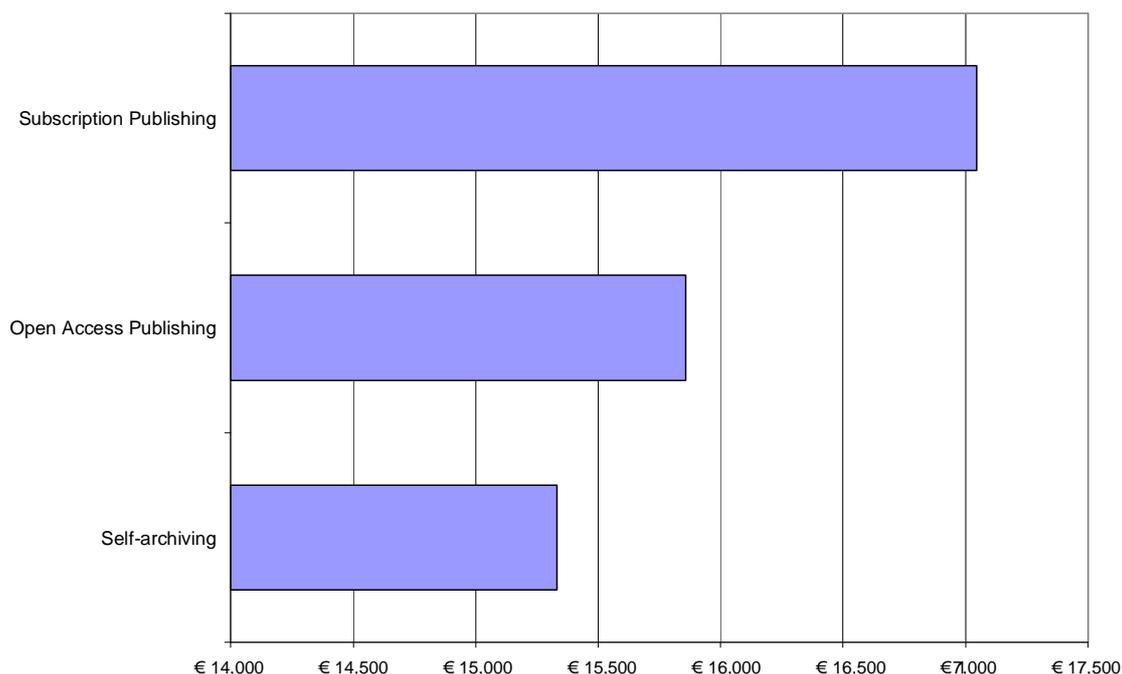
Those difference are accentuated when distributor discounts are taken into account. Academic book publisher discounts to distributors can be substantial, often ranging in the region of 30% to 40%. These discounts should not simply be included in publisher costs, but rather separately

identified as distribution or channel costs. For example, if a book sold 500 copies at EUR 66 per copy, a 30% distributor’s discount would be worth EUR 19.75 per item or an average EUR 9,875 per title. Adjusting publisher costs to include distributor discounts brings our estimated average costs per title to EUR 32,915 for print, EUR 21,530 for toll access e-books and an unchanged EUR 10,800 for open access e-books – substantially increasing the difference between publishing models.

The impact of alternative scholarly publishing models

Summing the costs of production, publishing and dissemination *per article* in electronic-only format suggests that average subscription publishing system costs would amount to around EUR 17,046 per article (excluding Value-Added Tax), average open access publishing costs would amount to EUR 15,857 per article and average open access self-archiving costs EUR 15,331 per article (including overlay review and production services with commercial margins). At these costs, open access publishing would be around EUR 1,190 per article cheaper than subscription publishing, and open access self-archiving with overlay services around EUR 1,715 per article cheaper (Figure 5).

Figure 5: Scholarly communication system costs per article (EUR, circa 2007)



Note: Includes the direct costs of writing, peer review, publishing and disseminating in e-only format, and excludes VAT. Self-archiving includes publisher production and review costs, including commercial margins (*i.e.* overlay services).

Source: NL model: Authors’ analysis.

For the universities, these journal article publisher cost differences would have amounted to savings of around EUR 30 million per annum circa 2007 from a shift from subscription access

to open access publishing, and EUR 43 million from a shift to open access self-archiving with overlay services. While alternative publishing models for scholarly books are much less developed and costings more speculative as a result, similar savings would appear to be available from shifting to open access book publishing.

In addition to direct cost differences there are potential system cost savings. In a highly simplified form, the following figures summarise the estimated impacts for the Netherlands nationally and for the universities in the Netherlands of unilateral national and worldwide adoption of alternative open access journal/article publishing models, including: (i) 'Green OA' self-archiving in parallel with subscription publishing; (ii) 'Gold OA' or author-pays journal publishing; and (iii) the 'deconstructed' or 'overlay journals' model of self-archiving with overlay services. Reported increased returns to R&D expenditure are for public sector and higher education R&D spending, and are expressed as annual increases in current values (Box 1).⁹

Box 1: Estimating the impacts of enhanced access on returns to R&D

To explore the impacts of enhanced access on social returns to R&D we modify a basic Solow-Swan model, by introducing 'accessibility' and 'efficiency' as negative or friction variables, and then calculate the impact on returns to R&D of reducing the friction by increasing accessibility and efficiency.

We find that with a 20% return to publicly funded R&D, for the major categories of research expenditure in the Netherlands in 2006, a 5% increase in accessibility and efficiency would have been worth:

- EUR 78 million per annum in increased returns to public sector R&D (*i.e.* government and higher education);
- EUR 53 million per annum in increased returns to Higher Education R&D (HERD); and
- EUR 26 million per annum in increased returns to Government R&D (GovERD).¹⁰

These are recurring annual gains from the effect of one year's R&D expenditure, so if the change that brings the increases in accessibility and efficiency is permanent they can be converted to growth rate effects.

Note: Estimates of the returns to R&D are based on aggregates, such as national or public sector expenditure, for which they can be reasonably accurate. Their application specific fields of research and smaller aggregations, perhaps even smaller countries, will be subject to greater uncertainty and should be treated with caution.

⁹ Increased returns are recurring gains from one year's R&D expenditure. Such returns can be expressed in Net Present Value, lagged and recurring over the useful life of the knowledge. For the sake of simplicity and transparency in these charts we have simply taken the original value of annual returns as indicative. In the cost-benefit comparisons presented below, however, returns are reported in Net Present Value and lagged.

¹⁰ The rationale behind the use of a 20% return to R&D and a 5% increase in accessibility and efficiency is discussed in detail in the JISC EI-ASPM Report (Houghton *et al.* and Oppenheim *et al.* 2009, pp193-208). See <http://www.cfses.com/EI-ASPM/>

As many of the potential cost savings cannot be fully realised unless there is worldwide adoption of open access alternatives, in the unilateral national open access scenarios funder, research, library handling and subscription cost savings are scaled to the Netherlands' article output (*i.e.* are in proportion to the share of worldwide journal literature that would be open access as a result of the unilateral adoption of alternative open access models by the Netherlands). In the 'Green OA' model self-archiving operates in parallel with subscription publishing, so there are no publisher, library handling or subscription cost savings. Separating modelled increases in returns to R&D resulting from enhanced access from the cost impacts, the following figures also present the net cost impacts of the alternative publishing models. Where net cost is negative it represents a saving, and where positive it represents a cost (*i.e.* effectively, the investment required to obtain the increased returns and realise the benefits).

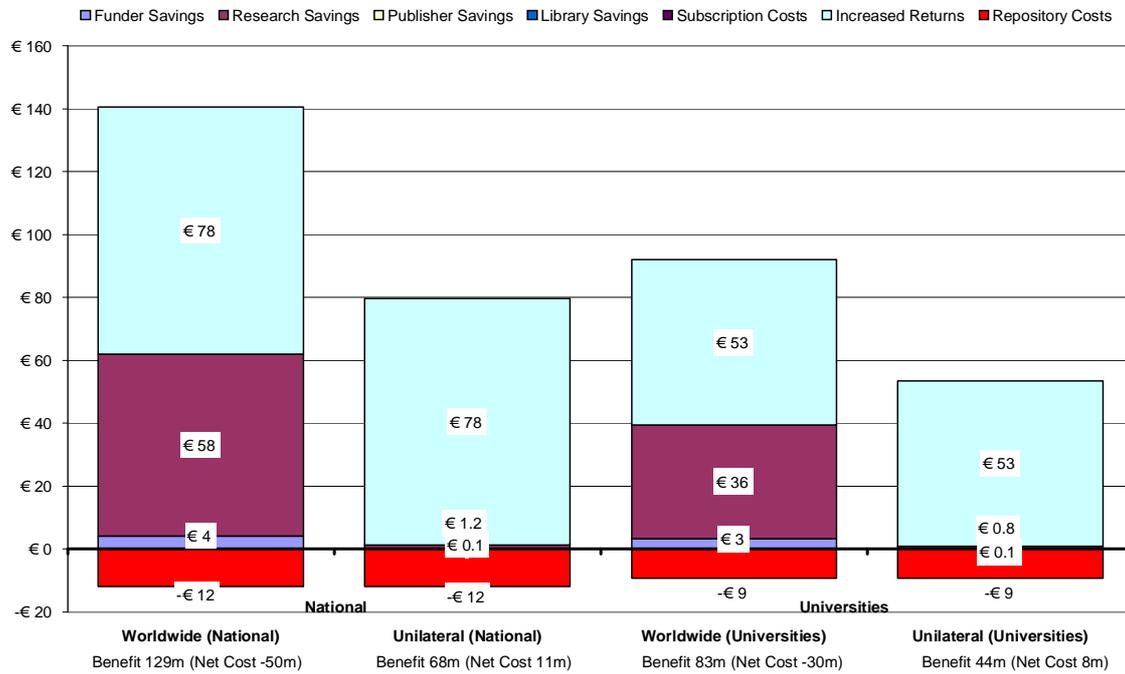
We estimate that:

- '*Gold OA*' open access publishing for journal articles might bring net system savings of around EUR 133 million per annum nationally in the Netherlands in a worldwide open access system, or EUR 37 million if the Netherlands adopted open access unilaterally (at 2007 prices and levels of publishing activity), of which around EUR 107 million and EUR 32 million, respectively, would accrue in the universities.
- *Open access self-archiving without subscription cancellations* (*i.e.* '*Green OA*') would save around EUR 50 million per annum nationally in a worldwide Green OA system, of which around EUR 30 million would accrue in the universities.
- The *open access self-archiving with overlay services* model explored is necessarily more speculative, but a repositories and overlay services model may well produce similar cost savings to open access publishing.

These savings can be set against the cost of open access journal/article publishing alternatives, which if all journal articles produced encountered author fees of EUR 2,200 per article published would have been around EUR 63 million nationally in 2007, of which EUR 56 million would have been faced by the universities. Similarly, estimated repository costs would have been around EUR 12 million nationally and EUR 9 million for the universities. Thus, in an open access world, the cost savings alone are likely to be sufficient to pay for open access journal publishing or self-archiving alternatives, independent of any possible increase in returns to R&D that might arise from enhanced access.

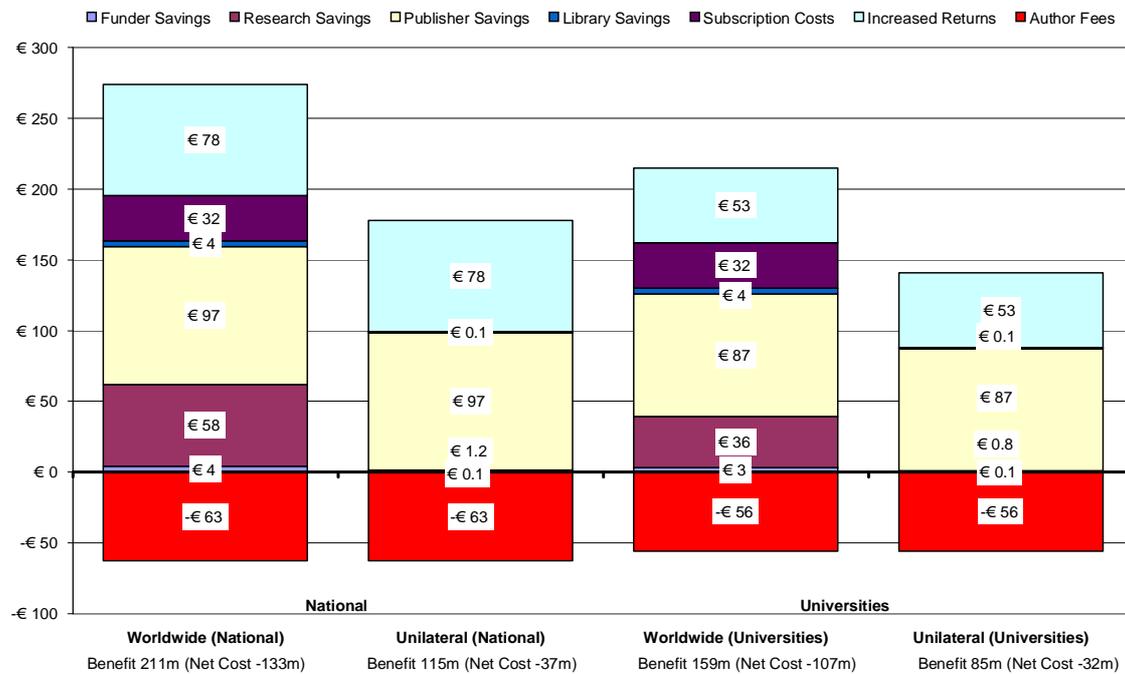
Figure 6 summarises the potential cost impacts of 'Green OA' self-archiving in parallel with subscription publishing circa 2007. Indicatively, it suggests that in an all open access world, 'Green OA' to all journal articles produced in the Netherlands during 2007 might have generated an approximate net benefit of around EUR 129 million (per annum), including a net cost saving of around EUR 50 million. Whereas, the unilateral national adoption of 'Green OA' in the Netherlands may have generated a little more than half the net benefit while incurring a net cost of around EUR 11 million (*i.e.* an additional cost, effectively the investment required to realise the benefit).

Figure 6: Estimated impact of “Green OA” self-archiving (EUR millions per annum, circa 2007)



Source: NL model: Authors' analysis.

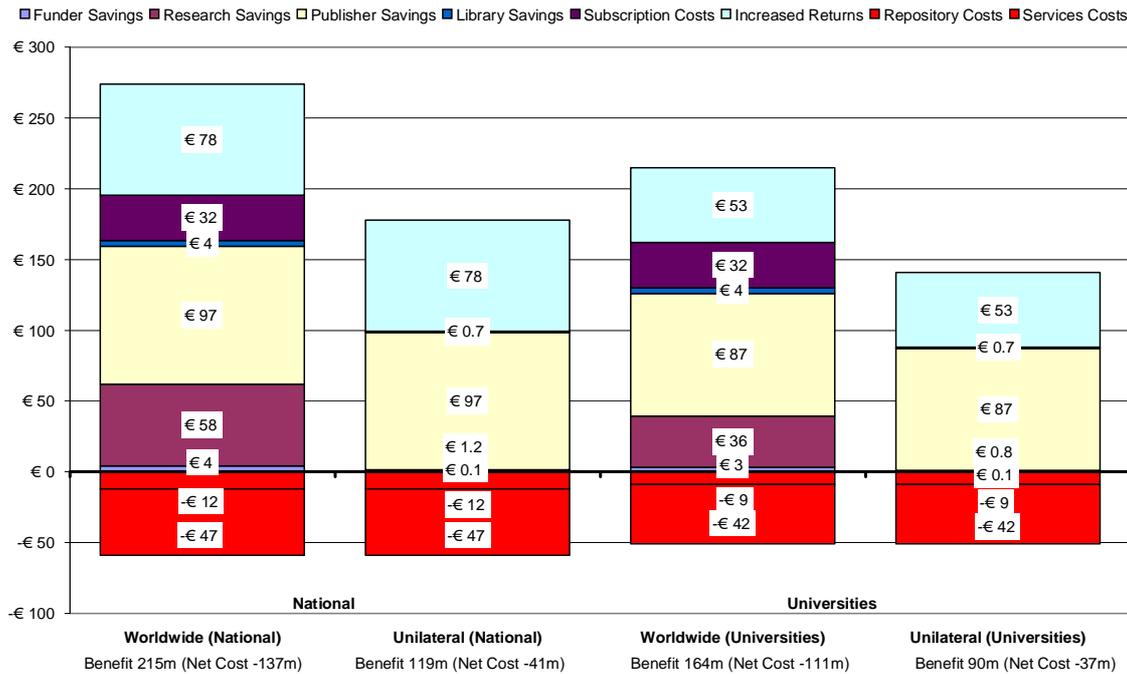
Figure 7: Estimated impact of “Gold OA” publishing (EUR millions per annum, circa 2007)



Source: NL model: Authors' analysis.

Figure 7 summarises the potential cost impacts of ‘Gold OA’ publishing through the author-pays model, and Figure 8 the cost impacts of self-archiving with overlay production and review services (*i.e.* the deconstructed or overlay journals model). Each includes indicative net benefit and net cost implications.

Figure 8: Estimated impact of OA self-archiving with overlay production and peer review services (EUR millions per annum, circa 2007)



Source: NL model: Authors' analysis.

Comparing costs and benefits

Modelling the impacts of an increase in *accessibility* and *efficiency* resulting from more open access on returns to R&D over a 20 year period and then comparing costs and benefits, we find that the benefits of open access publishing models are likely to substantially outweigh the costs.

First, we explore the cost-benefit implications of simply adding open access publishing and self-archiving to current activities, all other things remaining the same (*i.e.* *ceteris paribus* scenarios).¹¹ Then we explore the implications of open access publishing and self-archiving as alternatives to current activities, by adding the estimated system savings to estimated increases in returns to R&D (*i.e.* net cost scenarios).

These cost-benefit comparisons suggest that the additional returns to R&D resulting from enhanced accessibility and efficiency alone would be sufficient to cover the costs of parallel

¹¹ Of course, the scenario adding open access publishing to current activities is ‘unrealistic’, as parallel publishing all articles in open access and subscription journals simultaneously would not be possible given the copyright demands of subscription publishing.

open access self-archiving without subscription cancellations (*i.e.* ‘Green OA’). When estimated savings are added to generate net costs there is a substantial increase in the benefit/cost ratios, and for both open access publishing and self-archiving alternatives (*i.e.* ‘Gold OA’ and ‘Green OA’) the benefits exceed the costs, even in transition. Indicative modelling of post-transition ‘steady-state’ alternative systems (Box 2) suggests that, once established, alternative open access publishing and/or self-archiving systems would produce substantially greater net benefits.

Box 2: A brief description of the returns to R&D model

Main characteristics: A spreadsheet model to estimate the impacts of increases in ‘accessibility’ and ‘efficiency’ on returns to R&D over 20 years in a 20 by 20 matrix, with three data inputs: (i) R&D expenditure, (ii) annual costs associated with the publishing model, and (iii) annual savings resulting from the publishing model (in the net cost scenarios only).

Assumptions and parameters: All the parameters can be changed in order to explore various scenarios and test sensitivities. Key parameters include: (i) the rate of social return to R&D, (ii) the rate of depreciation of the underlying stock of knowledge, (iii) the discount rate applied to costs and benefits to estimate net present value, (iv) the rate of growth of R&D expenditure, (v) the rate of growth of costs associated with the alternative publishing scenario being explored, (vi) the average lag between publication or self-archiving and returns to R&D in years, and (vii) the average lag between R&D expenditure and publication in years (See Annex II for details).

Transition versus ‘steady-state’ alternative: Because of the lag between research expenditure and the realisation of economic and social returns to that research, the impact on returns to R&D is lagged (by 10 years in the base case scenario) and the value of those returns discounted accordingly. This reflects that fact that a shift to OA publishing or self-archiving would be prospective and not retrospective, and the economic value of impacts of enhanced accessibility and efficiency would not be reflected in returns to R&D until those returns are realised.

An alternative approach would be to model a hypothetical alternative ‘steady-state’ system for alternative publishing models in which the benefits of historical increases in *accessibility* and *efficiency* enter the model in year one. This would reflect the situation in an alternative system, after the transition had worked through and was no longer affecting returns to R&D.

The model used herein focuses on the transition and explores alternative models through a series of scenarios over a 20 year transitional period. However, the possible impacts in a hypothetical ‘steady-state’ alternative system are explored indicatively by introducing the estimated annual increase in returns into year one. This effectively removes the lag, but is no more than indicative because it does not include the recurring gains from historical expenditures occurring before year one.

Source: Houghton, J.W., Rasmussen, B., Sheehan, P.J., Oppenheim, C., Morris, A., Creaser, C., Greenwood, H., Summers, M. and Gourlay, A. (2009) *Economic Implications of Alternative Scholarly Publishing Models: Exploring the Costs and Benefits*, London & Bristol: The Joint Information Systems Committee (JISC), p211.

Table 5: Summary of benefit/cost comparisons by scenario and model (EUR millions over 20 years and benefit/cost ratio)

Scenario	Costs	Benefits		Benefit/Cost Ratio
		Savings	Returns	
Ceteris Paribus Scenarios				
Transitional Model:				
OA Publishing in HE (unrealistic)	566	..	240	0.4
OA Publishing Nationally (unrealistic)	636	..	358	0.6
OA Repositories in HE (Green OA)	95	..	240	2.5
OA Repositories Nationally (Green OA)	124	..	358	2.9
Simulated Steady State Model:				
OA Publishing in HE (unrealistic)	566	..	2,506	4.4
OA Publishing Nationally (unrealistic)	636	..	3,737	5.9
OA Repositories in HE (Green OA)	95	..	2,506	26.3
OA Repositories Nationally (Green OA)	124	..	3,737	30.2
Net Cost Scenarios				
Scenario (Netherlands Unilateral OA)				
Transitional Model:				
OA Publishing in HE	566	896	240	2.0
OA Self-archiving in HE (Green OA)	95	8	240	2.6
OA Self-archiving in HE (Overlay Services)	517	896	240	2.2
OA Publishing Nationally	636	1,010	358	2.1
OA Self-archiving Nationally (Green OA)	124	13	358	3.0
OA Self-archiving Nationally (Overlay Services)	598	1,010	358	2.3
Simulated Steady State Model:				
OA Publishing in HE	566	896	2,506	6.0
OA Self-archiving in HE (Green OA)	95	8	2,506	26.4
OA Self-archiving in HE (Overlay Services)	517	896	2,506	6.6
OA Publishing Nationally	636	1,010	3,737	7.5
OA Self-archiving Nationally (Green OA)	124	13	3,737	30.3
OA Self-archiving Nationally (Overlay Services)	598	1,010	3,737	7.9
Scenario (Worldwide OA)				
Transitional Model:				
OA Publishing in HE	566	1,648	240	3.3
OA Self-archiving in HE (Green OA)	95	401	240	6.7
OA Self-archiving in HE (Overlay Services)	517	1,648	240	3.7
OA Publishing Nationally	636	1,987	358	3.7
OA Self-archiving Nationally (Green OA)	124	631	358	8.0
OA Self-archiving Nationally (Overlay Services)	598	1,987	358	3.9
Simulated Steady State Model:				
OA Publishing in HE	566	1,648	2,506	7.3
OA Self-archiving in HE (Green OA)	95	401	2,506	30.5
OA Self-archiving in HE (Overlay Services)	517	1,648	2,506	8.0
OA Publishing Nationally	636	1,987	3,737	9.0
OA Self-archiving Nationally (Green OA)	124	631	3,737	35.3
OA Self-archiving Nationally (Overlay Services)	598	1,987	3,737	9.6

Note: Compares open access alternatives against subscription or toll access, with costs, savings and benefits expressed in Net Present Value over 20 years (EUR millions). Increased returns to R&D relate to higher education R&D expenditure (HERD) and national public expenditure on R&D (PUBRD).

Source: NL model: Authors' analysis.

For example, during a transitional period we estimate that, in an open access world:

- The combined cost savings and benefits from increased returns to R&D resulting from open access publishing all journal articles produced in Netherlands universities would be around 3 times the costs;
- The combined cost savings and benefits from open access self-archiving in parallel with subscription publishing (*i.e.* ‘Green OA’) would be around 7 times the costs; and
- The combined cost savings and benefits from open access self-archiving with overlay production and review services (*i.e.* ‘overlay journals’) around 4 times the costs.

Indicative modelling of post-transition ‘steady-state’ alternative systems returns benefits of around 7 to 8 times costs for open access publishing and overlay services models and around 30 times the costs for the open access self-archiving (Table 5).

This preliminary analysis of the potential benefits of more open access to research findings suggests that different publishing models can make a material difference to the benefits realised, as well as the costs faced. It seems likely that more open access would have substantial net benefits in the longer term and, while net benefits may be lower during a transitional period they are likely to be positive for both open access publishing and self-archiving alternatives (*i.e.* ‘Gold OA’) and for parallel subscription publishing and self-archiving (*i.e.* ‘Green OA’).

International comparisons

In exploring the potential impacts of alternative publishing models in the UK, Netherlands and Denmark differences in the modelling *per se* have been kept to a minimum, although some minor adjustment of the basic model to fit different national circumstances has been necessary. Nevertheless, there are a number of factors that can affect the benefit/cost ratio estimates for different countries and, thereby, the overall findings. As modelled, these include such things as: the number and size of universities and research institutions; the implied number of institutional and other repositories, each with substantial fixed costs and relatively low variable costs; the ratios of publicly funded and higher education research spending to gross national expenditure on R&D; historical and projected rates of growth of R&D spending by sector and overall; relative national and sectoral publication productivity; historical and projected growth in publication output; the mix of publication types; etc. There are also inherent data limitations that vary somewhat between the countries.

Despite these influences, the different national studies produce very similar results and exhibit broadly similar patterns within the results. The cost-benefits of the open access or ‘author-pays’ publishing model are very similar across the three countries. In terms of estimated cost-benefits over a transitional period of 20 years, open access publishing all articles produced in universities in 2007 would have produced benefits of 2 to 3 times the costs in all cases, but showed benefits of 5 to 6 times costs in the simulated alternative ‘steady state’ model for unilateral national open access, and benefits of around 7 times the costs in an open access world.

The most obvious difference between these results relates to the ‘Green OA’ self-archiving and repositories model, which does not look quite as good in the Netherlands as in the UK and nothing like as good as it does in Denmark. This is due to the implied number of repositories, each with operational overheads. As modelled, the number of institutional repositories required in each country relates to the number of institutions and their operational overheads are shared across the number of articles produced and self-archived. For example, under the modelled assumptions for 2007, the Netherlands’ 86 higher education institutions’ repositories might have housed around 26,000 articles (302 each), the UK’s 168 higher education institutions’ repositories might have housed around 100,000 articles (595 each), and Denmark’s 8 universities’ repositories might have housed around 14,000 articles (1,750 each). These differences materially affect the implied per article cost of self-archiving.

Notwithstanding this difference, the modelling suggests that open access alternatives are likely to be more cost-effective mechanisms for scholarly publishing in a wide range of countries (large and small), with ‘Gold OA’ open access or author-pays publishing, the deconstructed or overlay journals model of self-archiving with overlay production and review services, and ‘Green OA’ self-archiving in parallel with subscription publishing progressively more cost-effective.

Conclusions and implications

The analysis summarised in this report compares three scholarly publishing models as if they were alternatives. In reality, of course, there are a number of variations and hybrids (*e.g.* delayed open access, open choice/author choice, etc.) and the models co-exist in various mixes in different fields of research. Nevertheless, these three models do have some key defining characteristics, and these characteristics have cost implications for producers, intermediaries and the users and consumers of content. They also have implications for the efficiency of research, the accessibility of research findings and their impacts, and, thereby, for returns to investment in R&D.

The potential cost implications for stakeholders throughout the scholarly communication system are summarised in Figures 6, 7 and 8 (above), which outline the cost implications of the three alternative models for funders, researchers and research institutions, publishers, research and special libraries. The estimated cost-benefit of the alternative models over 20 years are summarised in Table 5 (above).

Implications for funders

The operational costs of funding agencies are unlikely to change very much as a result of alternative publishing models, but there is likely to be an impact on the implied effective level of research funding – primarily through the diversion of research funding into author-side fees.

Noting that only around half of all open access journals actually charge author fees but that support for open access publishing would nevertheless be coming from the producer-side, we estimate that had all Netherlands-authored journal articles been published in an entirely

producer-pays open access publishing model in 2007, at EUR 2,200 per article published it would have cost around EUR 63 million nationally, of which around EUR 56 million would have been from the universities.

Balancing the negative impacts of such a diversion of research funding on the level of research activity against the positive impacts of enhanced accessibility and efficiency on returns to that R&D still conducted and system cost savings, we find that the benefits of enhanced accessibility and efficiency and potential system cost savings would be likely to outweigh the costs of diverting research funds to author-side open access publishing fees. However, the increased returns would be lagged and diffuse and the potential system savings would be realised primarily by research institutions and research users. Consequently, a policy decision to fund open access alternatives through the producer-side is required.

Implications for researchers

In addition to possible costs and cost savings, impacts on funding flows within research activities would be likely to revolve around possible differences in the use of researcher time and funding (*e.g.* in applying for and obtaining permissions versus self-archiving to a subject or institutional repository, etc.). Time and cost savings are likely to arise in such areas as: reduced search, discovery and access time through enhanced discoverability, greater accessibility and less use of authentication and access control and of proprietary silo access systems; and less time spent on seeking and obtaining permissions. In addition to these savings, there are opportunities for new forms of analysis when the findings and record of research are openly available, due to both their accessibility and usability (*e.g.* permission to use for any purpose subject only to attribution). Independent scholars working outside mainstream institutions, as well as those from poorer institutions and poorer countries, could also benefit from more open access to scholarly publications.

Open access publishing may require author-side payments, and researchers in fields that are relatively poorly funded, those working without specific project funding, and independent scholars may find it difficult to pay unless there are specific funds made available to support publishing fees. Self-archiving also takes some additional time, but for the researcher the potential benefits from enhanced accessibility, broader readership and, potentially, increased citation are likely to make the effort worthwhile. Moreover, the act of self-archiving could be centrally organised and performed by specialist staff with more experience of metadata requirements and at a lower time/cost (*e.g.* through research libraries).

Implications for the universities and research institutions

From the perspective of universities and research institutions, research library acquisition and handling cost savings should also be factored in. Because research intensive institutions are both major producers and users of scholarly publications, research and library cost savings would tend to offset additional producer-side costs. Nevertheless, research intensive institutions might pay relatively more in a producer-pays system, and it would be preferable to cover the direct costs of producer-side open access publishing fees from competitive and block grant funding.

This might be scaled to outputs in the previous year, and would be likely to cost of the order of EUR 60 million per annum to publish journal article output in open access journals.

Similar support mechanisms could be offered for the operation of institutional repositories and, perhaps, open access book publishing. Enabling and supporting self-archiving through the operation of institutional repositories offers a number of potential benefits for universities and research institutions, not only through providing greater support to research, but also in providing a platform for hosting and showcasing the institutions research and maintaining a more complete record of it, which can assist the institution in research management and reporting functions. There are also potential benefits in hosting teaching and learning materials alongside research materials in integrated institutional repositories. Consequently, research institutions may see the operation of institutional repositories as an integral part of their operations, and given relatively modest costs, it is unlikely that anything more than ‘facilitational’ central funding support would be required.

Implications for publishers and the publishing industry

Savings relating to publishing are captured in the publisher cost differences between the publishing models. Clearly, reduced costs imply reduced revenue flows from research users to publishers, although these reductions may be offset by revenue gains from selling value-adding services to a larger number of readers and/or authors and from alternative revenue streams (*e.g.* advertising).

For governments, there are taxation differences between alternative publishing models. Obviously, with no access charges levied in open access models there would be no value-added tax (VAT) collected on subscriptions. However, VAT would be collected on the (domestic) provision of publisher services, including author-pays fees and fees for overlay services, depending on the domicile of content producers vis-à-vis publishers, and the VAT registration status of institutions. Consequently, while one might expect lower publisher production costs to imply somewhat lower taxation revenue in open access publishing and self-archiving models, the net impact is unlikely to be significant and will depend on the methods of payment and level of international publishing (*e.g.* whether or not authors publish with domestic or overseas publishers).

A reduction of revenue to the publishing industry, should such a reduction arise, would imply a reduction of activity and employment in the industry. Such adjustments are difficult for those concerned, but an economy is a dynamic system and, over the business cycle, is likely to achieve something close to ‘full employment’. As a result, the capital and labour no longer employed in publishing would be employed in an alternative activity. Given the relative size of the publishing industry and the rate at which alternative publishing models are being adopted, it is unlikely that the Netherlands economy would have difficulty adjusting to such a change.

The publishing industry in the Netherlands is a significant exporter, contributing as all exporters do to the balance of payments. However, scholarly publishing is a global activity with payments for scholarly content and services flowing both in and out. While it is impossible to predict how alternative publishing models would affect these payment flows, there is no obvious reason to expect the net effect to be large. For example, possible losses from reduced subscription

payments inflows would be offset by reduced subscriptions payments outflows and increased author-pays fees and overlay services payments inflows to open access publishers.

Implications for research libraries

Savings relating to facilitating dissemination, retrieval and preservation are largely captured in the research library acquisition and handling cost differences between the publishing models. There are also library-related savings in such areas as operating and supporting access control and authentication systems, permissions and copyright fees, etc.

It is difficult to say exactly how open access publications will be treated by research libraries and what role libraries would play in dissemination and preservation in these alternative publishing models. Nevertheless, we suggest that research libraries will continue to play a key role in providing access to open access journals and self-archived content and have costed library handling activities accordingly.

With little evidence to date that open access self-archiving in parallel with subscription publishing (*i.e.* Green OA) leads to subscription cancellations, acquisition cost savings have not been included in that model. However, should they arise in the future, there would be potential for significant additional savings – as is indicated by the open access self-archiving with overlay services model.

As elsewhere, the potential cost savings are seen as efficiency gains. Such gains can be realised in two ways: (*i*) by producing the same output with fewer input resources, or (*ii*) by producing more output with the same resources. European countries, including the Netherlands, have set and are committed to ambitious R&D spending targets. In such an environment, there is little suggestion that there would be substitution at the margin. Savings realised would release resources to more research and research support activities, rather than being clawed back in funding cuts and result in job losses. Indeed, the savings suggested indicate the level of resources that could become available to libraries – as well as researchers, publishers and users of the scholarly content – to address the challenges of the digital age.

Implications for government and central agencies

Given the potential benefits, government and agency initiatives might focus on reducing the barriers to innovation in scholarly publishing models. This might involve:

- Ensuring that research reporting and evaluation is not a barrier to innovation (*e.g.* by developing and using metrics that support innovation in scholarly publishing, rather than relying on traditional evaluation metrics that reinforce and reward traditional publishing models and behaviours);
- Ensuring that there is funding for author or producer side fees (*e.g.* encouraging all research funders to make explicit provision for publication charges, and encouraging higher education and research institutions to establish funds to support publishing fees);
- Encouraging and funding the further development of institutional and/or subject repositories to enable author self-archiving; and

- Supporting advocacy initiatives to inform and educate funders, researchers and research managers about the potential impacts of alternative publishing models.

There is likely to be uncertainty during the coming years as to the direction and speed of a transition towards more open access to research findings through open access publishing and/or self-archiving, if there is such a transition, and there will be difficulties in shifting budgetary allocations around the system in such a context. Moreover, some of the savings and benefits resulting from alternative publishing models cannot be realised until some time after the costs have been met. Consequently, it seems inevitable that central allocations will be required at the funder, institutional and, perhaps, national levels.

However, estimated annual author-pays costs of around EUR 65 million for the Netherlands nationally and perhaps EUR 12 million nationally for a basic system of publications-oriented institutional repositories are relatively modest in comparison to the Netherlands' gross expenditure on R&D of around EUR 9.7 billion per annum and higher education R&D expenditure of EUR 2.6 billion per annum. All the more so when system-wide cost savings as well as potential increases in the social returns to R&D resulting from more open access to research findings are likely to outweigh those costs. Nevertheless, however modest, these costs would have to be met, as would the costs associated with facilitating the structural, behavioural and cultural changes that would be necessary throughout the scholarly communication system to support the emergence of alternative models.

Annex I Main data sources from the Netherlands

Nr	Data	Source	Link
1	Bijlage; Statistisch tabellen, behorend bij de figuren in het rapport "Wetenschaps- en TechnologieIndicatoren 2008"	NOWT	http://www.nowt.nl/docs/NOWT-WTI_2008_statistische_tabellen.pdf
2	Wetenschaps- en Technologie-Indicatoren 2008, tabel 4.6 en bijlage C.	NOWT	http://www.nowt.nl/docs/NOWT-WTI_2008.pdf
3	Wetenschaps- en Technologie-Indicatoren 2008, tabel 4.24a en bijlage C.	NOWT	http://www.nowt.nl/docs/NOWT-WTI_2008.pdf
4	Website WOPI per 31-12-2007 def 20080708, tabel 12	VSNU	http://www.vsnu.nl/web/show/id=110152/langid=43
5	Website WOPI per 31-12-2007 def 20080708, tabel 8	VSNU	http://www.vsnu.nl/web/show/id=110152/langid=43
6	Website WOPI per 31-12-2007 def 20080708, tabel 6	VSNU	http://www.vsnu.nl/web/show/id=110152/langid=43
7	CAO 2008	VSNU	http://www.vsnu.nl/web/show/id=72629/langid=43
8	CAO 2006	VSNU	http://www.vsnu.nl/web/show/id=72629/langid=43
9	Website WOPI per 31-12-2006, tabel 8	VSNU	http://www.vsnu.nl/web/show/id=111960/langid=43
10	Website WOPI per 31-12-2005, tabel 8	VSNU	http://www.vsnu.nl/web/show/id=111960/langid=43
11	Informatie over informatie Nummer 31 -september 2008	OCW	
12	Steen, J. van (2008). Sciece System Assesment. Feiten en Cijfers 1: De Nederlandse Universiteiten. Den Haag: Rathenau Instituut. 24p	Rathenau Institute	http://www.rathenau.nl
13	Onderzoeksinzet per HOOP-gebied (fte's)	VSNU	http://www.vsnu.nl/web/show/id=112382/langid=43
14	Tijdsbesteding universitair wetenschappelijk personeel	EIM	http://www.eim.nl
15	UKB Benchmark 2007	UKB	http://www.ukb.nl/activiteiten/benchmarking.html
16	UKB Jaarverslag 2006	UKB	http://www.ukb.nl/organisatie/algemenestukken/jv20062007.pdf
17	NWO Annual Report 2007	NWO	http://www.nwo.nl/nwohome.nsf/pages/NWOA_7G7QHT_Eng
18	CBS statline	CBS	http://statline.cbs.nl
19	De omvang van matching; Onderzoek naar de effecten van matching van 2 ^e en 3 ^e geldstroomfinanciering op de beleidsruimte van Nederlandse, publieke kennisinstellingen	Ernst & Youngaccountants	http://www.awt.nl/uploads/files///Achtergrondstudie/as30.pdf
20	Narcis/Darenet	Narcis/Darenet	http://www.narcis.info
21	The European Repository Landscape; M. van de Graaf & K. van Eijndhoven	AUP	http://dare.uva.nl/document/93725
22	Answers NL repositories number records total and snapshot 2007; M. van de Graaf & K. van Eijndhoven	PCM	-
23	Informatiebulletin NARCIS nr. 12, 6 februari 2009	KNAW	http://www.narcis.info
24	Research repositories in Europe: the 2008 DRIVER inventory study; M. van de Graaf & K. van Eijndhoven	PCM	-
25	Libraries: Annual report Universiteitsbibliotheek Erasmus Universiteit Rotterdam (EUR)	EUR	http://www.eur.nl/fileadmin/ASSETS/ub/Jaarverslagen/Jaarverslag_2007.pdf

Annex II Model parameters

Data for preliminary estimations are drawn from a range of local and international sources. The following tables describe the main parameters used and their sources. A simplified version of the model is available online, in which it is possible to experiment with a range of parameters (See http://www.cfses.com/EI-ASPM/NL_EI-ASPM_Model.exe). It runs as an application in MS-Excel.

Cost estimation parameters

Parameter	Basis	Value
FUND RESEARCH		
R&D expenditure	EuroStat & OECD	GERD 9.7 bn, HERD 2.6 bn
Grant applications, grants and reviews	NWO and estimates for KNAW based on NWO share of grants	4,419 applications, 1,563 grants, 6,587 reviews
External peer review of grant applications	Tenopir and King (2000) time to review a journal article	3 to 6 hours each, average 4.5 hours
Peer reviews per grant application	NWO Annual Report (reviews received over applications)	1.5 per application
Peer review costs, per hour, based on academic salaries and overheads	NOWT and VSNU reports, University of Amsterdam cost model and EuroStat	Average EUR 128 per hour
PERFORM RESEARCH		
Researchers (FTE) (Excludes technicians & support)	EuroStat & OECD	44,116 (11,740 publication active researchers in universities)
Articles (peer reviewed)	Web of Knowledge and SCOPUS scaled to account for share of peer reviewed journals not listed (Björk <i>et al.</i> 2008)	Approx. 28,500 of which 25,400 in universities
Time to write a journal article	Tenopir and King (2000), King (2004)	90 to 100 hours, average 95
Time to peer review an article	Tenopir and King (2000), King (2004)	3 to 6 hours, average 4.5 hours
Number of peer reviewers per article	Tenopir and King (2000)	2 to 3 reviewers, average 2.5
Rejection and resubmission (article)	Authors' estimate based on a consensus from the literature	50% rejected of which 60% are sent for external review and 40% rejected without review, and of which 75% are resubmitted once
Number of peer reviewers per monograph	Industry consultation	2 to 3 reviewers, average 2
Rejection and resubmission (monograph)	Authors' estimate based on a consensus from the literature	20% rejected of which 50% are resubmitted once
Time spent on editorial activities	Industry consultation and authors' estimate	10 to 30 days per annum, average 20
Time spent on editorial board activities	Industry consultation and authors' estimate	½ to 1 day per year, average ¾
Percentage of authors who are editors and/or on editorial boards	Rowlands and Nicholas (2005)	8% and 24%, respectively

Parameter	Basis	Value
Number of readings per researcher per year	Tenopir and King (2000), subsequent tracking studies and Tenopir <i>et al.</i> (2008)	Industry/higher education: <ul style="list-style-type: none"> Articles 130/270 rising to 280 Books 53/48 Reports 65/46 Trade literature 51/74 Other items 22/14
Time spent reading an article	Tenopir and King (2007) and Tenopir <i>et al.</i> (2008)	34 minutes falling to 31, but slightly higher for research, estimate 31
Time spent searching for and accessing an article	Tenopir and King (2007), CEPA (2008) and Tenopir <i>et al.</i> (2008)	8 to 17 minutes, average 12.5 but falling, estimate 12.5
Article requests per reading	Tenopir and King (2000), CEPA (2008)	1.3 to 1.4
Time spent by author obtaining permissions per article	Halliday and Oppenheim (1999)	1 to 4 hours, average 2
Percentage of articles photocopied or printed	CEPA (2008) and Tenopir <i>et al.</i> (2008)	20% print, 69% electronic
Cost of printing and copying per page	Authors' estimate	10 cents per page
Time spent printing or copying an article	Authors' estimate	1 to 5 minutes, average 3
PUBLISH JOURNALS		
Pages per article	Tenopir and King (2000) and tracking studies, CEPA (2008), King <i>et al.</i> (2008)	11.7 to 14.3, estimate 12.4
Articles per issue	Tenopir and King (2000), CEPA (2008)	10 to 20, estimate 10
Issue per year	Tenopir and King (2000) and tracking studies, CEPA (2008)	8 to 16, estimate 12
Articles per title per year (location of average article)	Tenopir and King (2000) and tracking studies, Björk <i>et al.</i> (2008)	50 to 150, estimate 120
Non-article content pages	King (2007), King <i>et al.</i> (2008)	10% to 20%, estimate 14%
Article rejection rate	Consensus from literature	40% to 60%, estimate 50% (20% rejected without review)
Subscriptions per title	Tenopir and King (2000), CEPA (2008)	300 to 3,000, estimate 1,200
Management and investment margin	CEPA (2008)	20% to 25%, estimate 20%
Surplus / profit margin	CEPA (2008) adjusted	10% to 30%, estimate 20%
E-only delivery and fulfilment (relative to print)	CEPA (2008), Waltham (2005), etc. adjusted	25%
E-only content processing (relative to print)	CEPA (2008), Waltham (2005), etc. adjusted	25%
OA rights management (relative to toll)	Authors' estimate	20%
OA user support (relative to toll)	Authors' estimate	20%
'Author-pays' marketing and support costs (relative to toll)	Authors' estimate	33%

Parameter	Basis	Value
OA hosting (relative to toll)	Authors' estimate	50%
OA management and Investment (relative to toll)	Authors' estimate	75%
OA surplus/profit (relative to toll)	Authors' estimate	75%
PUBLISH MONOGRAPHS		
Pages per title	Watkinson (2001) and industry consultation	250 to 300, estimate 275
Print run per title	Watkinson (2001) and industry consultation	400 to 1,000, estimate 700
Sales per title	Watkinson (2001) and industry consultation	350 to 500, estimate 500
Average prices	Watkinson (2001), industry consultation and LISU	EUR 60 to EUR 75, estimate EUR 66
Publisher discounts (print)	Industry consultation	20% to 40%, estimate 30%
Peer reviewers per manuscript	Industry consultation	2 perhaps 3, estimate 2.25
E-only production, setting and printing (relative to print)	CEPA (2008), Waltham (2005), etc. adjusted	25%
E-only IT facilities (relative to print)	Authors' estimate	200%
Toll access e-only facilities (relative to print)	Authors' estimate	50%
OA e-only facilities (relative to toll and print)	Authors' estimate	33%
OA rights management (relative to toll)	Authors' estimate	20%
OA marketing and support costs (relative to toll)	Authors' estimate	33%
OA management and overhead costs (relative to toll print)	Authors' estimate	75%
DISSEMINATION		
University library expenditure, acquisitions and stocks	UKB	Acquisitions 47m, other costs 85m
Librarian salaries	Annual reports	EUR 55,000 pa, total EUR 79/hour
Author fees	Sample of OA journals	EUR 2,200 per article published
Repository counts	http://archives.eprints.org/	Current & estimated system

Source: Authors' analysis.

Scenario parameters

Parameter	Basis	Value
FUND RESEARCH		
Funding, evaluation and reporting as a share of operational costs	Authors' estimate	50%
Potential savings in these costs from enhanced access	Authors' estimate	5% to 10%, estimate 5%
Returns to publicly funded R&D	Literature review (conservative consensus from the literature)	20% to 60%, estimate 20%
Improved allocations increase returns to R&D	Authors' estimate	1% to 5%, estimate 2.5%
Increase in allocations to R&D	Authors' estimate	1% to 5%, estimate 2.5%
PERFORM RESEARCH		
Search, discovery and access time saving through more open access	Authors' estimate	5% to 10%, estimate 5%
Permissions time saving through more open access	Authors' estimate	40% to 60%, estimate 50%
Peer review time saving through more open access	Authors' estimate	5% to 20%, estimate 10%
Writing and preparation time saving through more open access	Authors' estimate	5% to 10%, estimate 5%
PUBLISH		
Share of worldwide scholarly publishing output (articles)	Web of Knowledge, SCOPUS and Björk <i>et al.</i> (2008)	2.1%
Competition reduces publisher costs and margins	Authors' estimate	5% to 10%, estimate 5%
DISSEMINATE		
Time for self-archiving per item	Harnad, Swan (2008), etc. adjusted	10 minutes
Self-archiving performance	Done by researcher at average cost per hour	EUR 21

Source: Authors' analysis.

Modelling parameters

Parameter	Basis	Value
CHANGE IN ACCESSIBILITY		
Percentage change in accessibility (access)	(i) 50% of the 20% of the stock of knowledge that is journals (ii) 50% of the 40% of the stock of knowledge that is publications	10% to 20%
Percentage change in accessibility (OA citation)	(i) 25% of the 20% of the stock of knowledge that is journals (ii) 25% of the 40% of the stock of knowledge that is publications	5% to 10%
<i>Combined estimate of the percentage change in accessibility to be modelled</i>	<i>Conservative consensus of the above</i>	<i>5% to 10%, estimate 5%</i>
CHANGE IN EFFICIENCY		
Percentage change in efficiency (wasteful expenditure: duplicative research and blind alleys)	Authors' estimate, for illustrative purposes	1% to 5%, estimate 2%
Percentage change in efficiency (new opportunities: collaborative opportunities)	Authors' estimate, for illustrative purposes	1% to 5%, estimate 2%
Percentage change in efficiency (speeding up the process)	Authors' estimate, for illustrative purposes	1% to 5%, estimate 2%
<i>Combined estimate of the percentage change in efficiency to be modelled</i>		<i>5%</i>
R&D ASSUMPTIONS		
Social returns to R&D	Conservative consensus from literature (Arundel and Geuna 2004)	20% to 60%, estimate 20%
Rate of growth in R&D spending	EuroStat	2.6% per annum (current prices)
Lag between R&D spending and impacts	Mansfield (1991, 1998)	3 years to publication plus 7 years to impact, 10 years
Discount rate (risk premium)	Conservative consensus from literature	10% per annum
Rate of cost increases	Conservative estimate from CPI and scaled to R&D growth	2.6% per annum

Source: Authors' analysis.

Annex III Additional data tables

The following tables report detailed cost estimates for various scholarly communication related activities in annual costs at 2007 prices and levels of activity.

Perform research and communicate the results

Table A1: Estimated annual costs: research related activities (EUR, circa 2007)

<i>Activity / Item</i>	<i>Estimate</i>
READING	
<i>Reading per year (National)</i>	3,647,000,000
Papers (journal)	779,300,000
Books (monographs + edited books)	2,051,600,000
Other (Conference papers, Reports, etc.)	816,100,000
Cost of reading by authors (National)	1,032,700,000
<i>Reading per year (Universities)</i>	1,729,400,000
Papers (journal)	467,900,000
Books (monographs + edited books)	931,500,000
Other (Conference papers, Reports, etc.)	329,900,000
Cost of reading by authors (Universities)	805,000,000
WRITING	
<i>Writing per year (National)</i>	918,900,000
Papers (journal & conference)	374,300,000
Books (monographs + edited books)	489,900,000
Chapters	54,800,000
<i>Writing per year (Universities)</i>	856,400,000
Papers (journal & conference)	324,100,000
Books (monographs + edited books)	481,600,000
Chapters	50,700,000
SEARCH & DISCOVERY	
Search and Discovery (National researchers)	762,400,000
Search and Discovery (University researchers)	192,900,000
PRINTING & COPYING (Universities)	
Print and copying	7,800,000
Total including time spent	34,300,000
PERMISSIONS	
Cost to authors (National researchers)	13,300,000
Cost to authors (University researchers)	12,100,000

Source: NL model: Authors' analysis.

Table A2: Estimated annual costs: publisher related activities (EUR, circa 2007)

<i>Activity / Item</i>	<i>Estimate</i>
PEER REVIEW	
Peer review per year (National)	115,900,000
Papers (journal & conference)	92,900,000
Books (monographs + edited books)	15,900,000
Chapters	7,100,000
Peer review per year (Universities)	105,200,000
Papers (journal & conference)	82,900,000
Books (monographs + edited books)	15,700,000
Chapters	6,600,000
JOURNAL EDITORIAL	
Editorial activities (National)	27,100,000
Editor activities	24,400,000
Editorial board activities	2,700,000
Editorial activities (Universities)	20,300,000
Editor activities	18,300,000
Editorial board activities	2,000,000

Source: NL model: Authors' analysis.

Table A3: Estimated annual costs: research grants related activities (EUR, circa 2007)

<i>Activity / Item</i>	<i>Estimate</i>
RESEARCH GRANTS	
Grant applications (National)	65,800,000
Preparation of grant applications (National)	53,800,000
Review of grant applications (National)	4,200,000
Reporting grant project (National)	6,100,000
Administering grant projects (National)	1,700,000
Grant applications (Universities)	52,760,000
Preparation of grant applications (Universities)	43,100,000
Review of grant applications (Universities)	3,400,000
Reporting grant project (Universities)	4,900,000
Administering grant projects (Universities)	1,360,000

Note: Includes grants relating to NWO and (estimated) KNAW only. Local differences in reviewing and reporting practices are such that these estimates can be no more than approximate.

Source: NL model: Authors' analysis.

Publish scientific and scholarly works

Table A4: Estimated average publisher costs per article by format and model (EUR, circa 2007)

	<i>Estimate</i>
Subscription Journal Publishing	
Per article costs PRINT	3,991
Per article costs DUAL-MODE	4,750
Per article costs E-ONLY	3,419
OA Journal Publishing	
Per article costs PRINT	2,678
Per article costs DUAL-MODE	2,930
Per article costs E-ONLY	2,230
OA Self-archiving (Publisher overlay services)	
Peer review management as an overlay service	665
Editing and proofing as an overlay service	984
Hosting as an overlay service	193
<i>'Full service' overlay (per article)</i>	<i>1,843</i>

Note: These costs exclude the external costs of peer review and VAT. Overlay services include operating peer review management, editing, proofing and hosting, with commercial margins. Estimates for print and dual-mode OA publishing exclude print or subscriber related costs, assuming that the content is produced print ready and print is an add-on.

Source: NL model: Authors' analysis.

Table A5: Estimated publisher costs of Netherlands research output (EUR, circa 2007)

<i>Source & type of publication</i>	<i>Estimate</i>
Universities (Published Outputs)	194,900,000
Journal articles	108,300,000
Conference papers	1,000,000
Books	75,900,000
Chapters	8,000,000
Other	1,700,000
National Research (Published Outputs)	210,800,000
Journal articles	121,700,000
Conference papers	1,600,000
Books	77,200,000
Chapters	8,600,000
Other*	1,700,000
Book distribution	
Total Universities authored and edited	32,530,000
Total National authored and edited	33,060,000

Notes: Book publisher costs are based on research monographs costs, despite the fact that a small percentage of the books produced will be textbooks which have very different costs. Hence, these costs are no more than indicative.

Source: NL model: Authors' analysis.

Table A6: OA versus toll access for journals: cost estimates by mode and model (EUR, circa 2007)

	<i>Estimate</i>
Costs per article	
Current mix of formats and models	4,280
All print subscription	3,990
All e-only subscription	3,420
All e-only OA publishing	2,230
<i>All e-only OA self-archiving and overlay services</i>	1,650
E-only impacts	570
OA publishing impacts	1,190
OA self-archiving and overlay impacts	1,770
OA publishing impact from current position	2,050
Costs of articles published (Universities)	
Current mix of formats and models	108,300,000
All print subscription	101,100,000
All e-only subscription	86,600,000
All e-only OA publishing	56,500,000
<i>All e-only OA self-archiving and overlay services</i>	41,800,000
E-only impacts	14,500,000
OA publishing impacts	30,100,000
OA publishing impact from current position	51,800,000
Costs of articles published (National)	
Current mix of formats and models	121,700,000
All print subscription	113,600,000
All e-only subscription	97,300,000
All e-only OA publishing	63,500,000
<i>All e-only OA self-archiving and overlay services</i>	46,900,000
E-only impacts	16,300,000
OA publishing impacts	33,800,000
OA publishing impact from current position	58,200,000

Note: These estimates were derived entirely from the bottom up, but they triangulate well with simple top down checks.

Source: NL model: Authors' analysis.

Table A7: OA versus toll access for books: cost estimates by mode and model (EUR, circa 2007)

	<i>Estimate</i>
Costs per title	
Current mix (assuming all print toll)	23,040
All print toll access	23,040
All e-only toll access	16,560
All e-only OA	10,800
E-only impacts	6,480
OA impacts	5,760
OA impact from current position	12,240
Costs of titles published (Universities)	
Current mix of formats and models (assumes all print toll access)	75,900,000
All print toll access	75,900,000
All e-only toll access	54,500,000
All e-only OA	35,600,000
E-only impacts	21,300,000
OA impacts	19,000,000
OA impact from current position	40,300,000
Costs of titles published (National)	
Current mix of formats and models (assumes all print toll access)	77,100,000
All print toll access	77,100,000
All e-only toll access	55,400,000
All e-only OA	36,100,000
E-only impacts	21,700,000
OA impacts	19,300,000
OA impact from current position	41,000,000

Note: Includes authored and edited books, but excludes book chapters. These costings are based on research monographs, but outputs will include textbooks which have very different costs. Hence, they are no more than indicative.

Source: NL model: Authors' analysis.

Facilitate dissemination, retrieval and preservation

Such estimates can be no more than approximate (See section on Data Sources and Limitations).

Table A8: Estimated journal related UKB library activity costs per title (EUR, 2007)

<i>Activity</i>	<i>Open Access (e-only)</i>	<i>Electronic</i>	<i>Print</i>
Collection development	..	6.09	10.60
Negotiation & licensing	..	3.05	0.33
Subscription processing	..	8.38	23.84
Receipt & Check in	..	0.30	35.76
Routing	..	..	1.32
Cataloguing	7.62	7.62	29.14
Linking	1.14	1.14	1.32
Physical processing	..	0.15	33.38
Stacks maintenance	..	..	19.54
Circulation	3.05	3.05	35.76
Reference	19.80	19.80	35.76
User instruction	5.33	5.33	3.97
Preservation	0.15	0.15	2.65
Other	6.85	6.85	13.24
Total	44	62	247

Note: Approximate activity times reported by Schonfeld *et al.* (2004) and King *et al.* (2004) converted to 2007 Euros based on university library staff costs, with electronic staff costs 15% higher than print to reflect different skill levels (as per the studies mentioned). Such estimates can be no more than approximate.

Source: NL model: Authors' analysis.

Table A9: Estimated journal related UKB library activity costs (EUR, 2007)

<i>Activity</i>	<i>Electronic</i>	<i>Print</i>
Collection development	1,070,000	510,000
Negotiation & licensing	540,000	20,000
Subscription processing	1,480,000	1,160,000
Receipt & Check-in	50,000	1,730,000
Routing	..	60,000
Cataloguing	1,340,000	1,410,000
Linking	200,000	60,000
Physical processing	30,000	1,620,000
Stacks maintenance	..	950,000
Circulation	540,000	1,730,000
Reference	3,490,000	1,730,000
User instruction	940,000	190,000
Preservation	30,000	130,000
Other	1,210,000	640,000
Total	10,920,000	11,950,000

Note: Approximate activity times reported by Schonfeld *et al.* (2004) and King *et al.* (2004) converted to 2007 Euros based on university library staff costs with electronic staff costs 15% higher than print to reflect different skill levels, and scaled to library acquisitions. Such estimates can be no more than approximate.

Source: NL model: Authors' analysis.

Table A10: Estimated OA self-archiving costs (EUR, circa 2007)

	<i>Estimate</i>
Cost per year per repository	100,000
Operational costs of current repos per year (National)	2,500,000
Operational costs of current repos per year (Universities)	1,900,000
Cost of depositing per article	21
Cost of posting counted publications (National)	865,200
Cost of posting counted publications per year (Universities)	773,700
Cost of posting journal articles (National)	608,400
Cost of posting journal articles (Universities)	541,600
National system of OA repositories:	
Total cost of OARs per year (National)	12,181,000
Total cost of OARs per year if all HEIs had one	9,373,700

Note: National system costs include the cost of a single deposit of all published outputs.
Source: NL model: Authors' analysis.

System costs and cost savings

Table A11: Estimated costs by publishing model per item (EUR, circa 2007)

	<i>Journal: Per article</i>			<i>Book: Per title</i>		
	<i>Toll Access</i>	<i>OA Publishing</i>	<i>OA Self-archiving</i>	<i>Toll Access</i>	<i>OA Publishing</i>	<i>OA Self-archiving</i>
<i>FUND</i>	..	..	..	..	..	..
<i>PERFORM</i>						
Write	12,184	12,184	12,184	146,205	146,205	146,205
Review	1,443	1,443	1,443	3,463	3,463	3,463
<i>PUBLISH</i>						
Publish e-only	3,419	2,230	1,649	16,561	10,797	9,806
Distribute	..	..	..	4,968	..	..
<i>DISSEMINATE</i>						
Handle e-only	0.52	0.37	0.37	62	44	44
IR operation			34			34
Deposit			21			21
<i>USE</i>	..	..	..	..	..	..
Total	17,046	15,857	15,331	171,258	160,509	159,573

Note: Includes e-only average estimated costs for each publishing model, and excludes toll access acquisition costs to avoid double counting (i.e. assuming that acquisition costs recoup publisher and distribution costs). VAT is also excluded. The costs of writing and reviewing are per manuscript written and reviewed, whereas other costs are per manuscript published and disseminated. The OA self-archiving with overlay services models are necessarily rather speculative, especially for books.
Source: NL model: Authors' analysis.

Table A12: Estimated savings by publishing model: Journals only (EUR millions, circa 2007)

	<i>National</i>			<i>Higher Ed.</i>		
	<i>Toll</i>	<i>OAP</i>	<i>OASA</i>	<i>Toll</i>	<i>OAP</i>	<i>OASA</i>
FUND	..	4	4	..	3	3
PERFORM	..	58	58	..	36	36
PUBLISH	..	34	50	..	30	45
DISSEMINATE						
Handling	..	4	4	..	4	4
Acquisition
USE
Partial Total	..	100	116	..	74	88

Note: Includes e-only estimated cost savings for each publishing model, and excludes acquisition costs. Additional returns exclude the impacts of accessibility and efficiency on returns to R&D. National handling savings relate to UKB libraries only.

Source: NL model: Authors' analysis.

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