COUNCIL OF THE EUROPEAN UNION

Brussels, 23 July 2012

12846/12
ADD 2

RECH 319
TELECOM 145
COMPET 517

COVER NOTE

from:	Secretary-General of the European Commission, signed by Mr Jordi AYET PUIGARNAU, Director
date of receipt:	17 July 2012
to:	Mr Uwe CORSEPIUS, Secretary-General of the Council of the European Union
No Cion doc.:	SWD(2012) 222 final
Subject:	Commission Staff Working Document Impact Assessment accompanying the document Commission Recommendation on access to and preservation of scientific information in the digital age

Delegations will find attached Commission document SWD(2012) 222 final.

Encl.: SWD(2012) 222 final

EUROPEAN COMMISSION

Brussels, 17.7.2012
SWD(2012) 222 final

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

COMMISSION RECOMMENDATION

ON ACCESS TO AND PRESERVATION OF SCIENTIFIC INFORMATION IN THE DIGITAL AGE

{C(2012) 4890 final}
{SWD(2012) 221 final}

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ON ACCESS TO AND PRESERVATION OF SCIENTIFIC INFORMATION IN THE DIGITAL AGE

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1. BACKGROUND, PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

1.1. Introduction

This **Impact Assessment** accompanies the **Recommendation from the Commission** to the Member States on access to and preservation of scientific information.

One of the ways in which Europe aims to tackle its structurally low growth rate is by creating optimal conditions for innovation. According to the March 2010 Communication from the Commission Europe 2020,[1] knowledge and innovation are essential to future growth. **Innovation can be enhanced via knowledge sharing**, which in turn can be supported by Information and Communication Technologies (ICT).

Indeed, as a result of the institutional and public debate subsequent to the **2007 Commission Communication on scientific information in the digital age**,[2] which was followed by Council Conclusions on Scientific Information,[3] a number of key areas have been identified where effective action by and between Member States could deliver significant gains for Europe's research and innovation system. This would help to create the "**fifth freedom" in Europe** - the free circulation of knowledge across the European Union (EU). By improving and facilitating efficient access to world-class scientific knowledge for large communities of researchers, SMEs and citizens, it would also foster Europe's wider competitiveness and enable a better understanding of society and the environment.

The specific challenges in the area of scientific information and the accompanying actions are spelled out in a **Communication** and in a **Recommendation to the Member States**. The **Communication** will **take stock of recent developments** and **will set out the way in which the Commission will promote and implement open access within its research programmes**. The **Recommendation**, the object of this impact assessment, **will suggest a concrete set of actions to be implemented by Member States**.

The Commission is also planning to table a Communication on a Unified European Research Area to Foster Efficiency, Excellence and Growth. The Communication will *inter alia* address open access with a cross reference to the Recommendation on access to and preservation of scientific information (the Impact Assessment of the Communication was initially submitted on 29 February 2012).

1.2. Background

In order for Europe to become an increasingly competitive knowledge-based economy, it is vital to improve not only the production of knowledge, but also access to and dissemination of the results of scientific research, in particular those resulting from publicly funded and co-funded research.

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1 http://europa.eu/press_room/pdf/complet_en_barroso___007_-_europe_2020_-_en_version.pdf

2 COM(2007) 56 final of 14.04.2007

3 Council conclusions of 22 November 2007 on scientific information in the digital age: access, dissemination and preservation, available at http://ec.europa.eu/information_society/activities/digital_libraries/doc/scientific_information/council_conclusions_nov2007.pdf

In 2010, the Commission adopted the **Europe 2020 Flagship Initiatives Innovation Union**,[4] and the **Digital Agenda for Europe.**[5] Both Communications make reference to open access (OA) as a means to work towards achieving the Europe 2020 objectives. They underline the importance of **promoting better access to the results of publicly funded research**, and introduce open access as **the general principle** for projects funded by EU research framework programmes.

Widening the availability and accessibility of scientific information is an essential part of the Commission's open data policy, which was underlined as a priority in the recent Communication[6] on Open Data adopted by the Commission on 12th December 2011. The document reflected the basic principle that scientific results resulting from EU publicly funded and co-funded research should be used as widely as possible.

A further strategic policy issue is the **development and implementation of a European Research Area (ERA)**. The ERA is composed of all research and development activities, programmes and policies in Europe which involve a transnational perspective.[7] Together, they will enable researchers, research institutions and businesses to increasingly circulate, compete and co-operate across borders. The aim is to give them access to a Europe-wide open space for knowledge and technologies in which transnational synergies and complementarities are fully exploited. In this context, questions of access to and preservation of digital scientific information remain highly relevant.

The 2007 Council Conclusions on Scientific Information[8] also invited the Commission to experiment with open access to scientific results emanating from projects funded by EU research framework programmes. In August 2008, the Commission launched the **Open Access Pilot** in the Seventh Framework programme for Research and Development.[9] The Commission has collected feedback on experiences with the pilot through a survey sent to the co-ordinators of 811 projects. The 194 answers received provide important input for the future of the OA policy and practices in Horizon 2020. A summary of responses to this survey is available in Annex 3.

On 30 November 2011 the Commission adopted its proposal for the Horizon 2020 programme.[10] The programme will, from 2014 onwards, combine European research and innovation funding in one single framework. In the context of Horizon 2020, open access, which refers to the policy and practice of granting immediate and free internet access to scientific results (including peer-reviewed journal articles), will become a basic principle for the dissemination of EU publicly funded research[11]. The specific rules which will apply to the

4 http://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication_en.pdf

5 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0245:FIN:EN:PDF

6 http://ec.europa.eu/information_society/policy/psi/docs/pdfs/opendata2012/open_data_communication/en.pdf

7 http://ec.europa.eu/research/era/index_en.htm

8 See footnote 3 above

9 http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1300&lang=1

10 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0808:FIN:en:PDF

11 http://ec.europa.eu/research/horizon2020/pdf/proposals/proposal_for_a_regulation_of_the_european_parliament_and_of_the_council_laying_down_the_rules_for_the_participation_and_dissemination_in_horizon_2020%20(2014-2020).pdf#view=fit&pagemode=none

dissemination of the results of projects funded under Horizon 2020 will be spelled out in the implementing provisions of this programme.

The initiative to improve the access to and preservation of scientific information is co-lead by DG INFSO & DG RTD.[12]

An Impact Assessment steering group was set up to accompany the preparation of the IA report. The following Directorate-Generals (DGs) and services were invited: SG, SJ, COMP, EAC, ENTR, ENV, MARKT, MARE, JRC, ERCEA, CLIMA, MOVE, ENER, OP. The first meeting of the steering group took place on 7 April 2011, and a subsequent meeting was held on 14 October 2011.

A first version of this impact assessment was submitted to the Impact Assessment board on 9 November 2011. The current text takes up the suggestions made by the Board.

1.3. External expertise and studies

The Commission has monitored and taken into consideration the large number of reports and studies undertaken in this field.[13]&[14]&[15] In addition it has financed several projects and studies that assess different aspects of the access to and the preservation of scientific information, *inter alia*:

- The project **Study of Open Access Publishing**[16] (SOAP) looked into business models that have emerged over the last years, identifying stakeholders, risks, opportunities and essential requirements for a smooth transition to OA publishing[17] (also called Gold OA);

- The on-going project **Publishing and the Ecology of European Research**[18] (PEER) investigates the effects of large-scale, systematic depositing of authors' final peer-reviewed manuscripts (also called Green OA) on reader access, author visibility, and journal viability, as well as on the broader ecology of European research;

- Further information comes from the project **Open Access Infrastructure for Research in Europe**[19] (OpenAIRE), set up in 2009, which is building an e-infrastructure of interoperable repositories accessible via a single portal. It also has set up a network of helpdesks in the Member States, as well as a system to monitor and systematically gather information on the deposit of OA peer reviewed papers.[20]

12 Agenda item 2011/INFSO+/031

13 http://www.rin.ac.uk/our-work/communicating-and-disseminating-research

14 See for example: http://ec.europa.eu/research/science-society/pdf/scientific-publication-study_en.pdf and the footnotes below

15 http://www.publishingresearch.net/projects.htm

16 http://project-soap.eu/

17 An explanation of the different routes toward open access, in particular "green" (self-archiving) or "gold" (paid) OA is provided in Annex 1.

18 http://www.peerproject.eu/

19 www.openaire.eu

20 http://www.openaire.eu/fr/component/openaire/statspublications/default/539

- The report **'Riding the Wave**: How Europe can gain from the rising tide of scientific data'[21] which resulted from the work of the High Level Group on Scientific Data Infrastructures, specifically looked into the multiple challenges of access to and preservation of the large amounts of research data produced by modern science.

- **Two participatory strategic policy workshops**, one with national experts and one with representatives of the many relevant EC-projects on access and preservation issues, took place in late 2010 and early 2011.[22]

Further input has been gathered through networking, exchange of information, participation to conferences or meetings and informal discussions with stakeholders over recent years.

1.4. Public consultations directly linked to the current policy process

In accordance with established Commission standards, the Commission organised a **public hearing** on the access to and preservation of scientific information, which was followed by a **wide-ranging on-line public consultation**. A roadmap on the initiative was prepared and made publicly available.[23]

The **public hearing** was held on 30 May 2011 in Luxembourg and brought together circa 40 representatives from the scientific publishing community, research funding organisations, universities, research libraries, academia and Member States.[24] The hearing allowed interested parties to present and discuss their views on research evaluation systems, preservation of scientific outputs and access to scientific information (including OA).

The **on-line public consultation on scientific information in the digital age** was open from 15 July 2011 until 9 September 2011. All interested parties, including national and regional governments, research funding organisations, universities and research centres, libraries, publishers (both for profit and not for profit), researchers, as well as the public-at-large, were invited to contribute. The consultation yielded **1140 replies** from 42 countries and the Commission also received 19 position papers.[25]

21 "Riding the wave": http://ec.europa.eu/information_society/newsroom/cf/itemlongdetail.cfm?item_id=6204

22 Reports from these workshops can be found here: http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1301&lang=1

23 http://ec.europa.eu/governance/impact/planned_ia/roadmaps_2011_en.htm#INFSO

24 http://ec.europa.eu/information_society/activities/digital_libraries/scientific/public_hearings/index_en.htm

25 The final analysis is available at: http://ec.europa.eu/research/science-society/document_library/pdf_06/survey-on-scientific-information-digital-age_en.pdf

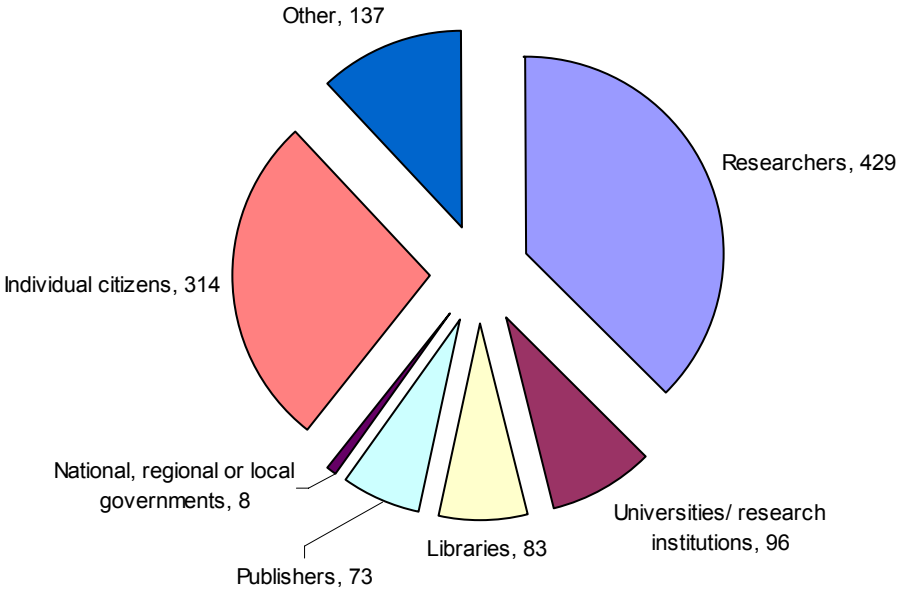

Figure 1: Respondents to the on-line public consultation by group of stakeholder; absolute number of respondents per group of stakeholder.

Box: on-line public consultation on scientific information in the digital age – key results

Respondents identified **a strong need for better access to scientific publications and scientific data in Europe**. **90% of respondents supported the idea that publications resulting from publicly funded research should, as a matter of principle, be in open access (OA) mode and that data from publicly funded research should be available for reuse, free of charge, on the Internet.**

Furthermore, 83% called for policy formulation at EU level.

These findings are also reflected in the open access chapter of the on-line public consultation on the ERA Framework entitled "Areas of untapped potential for the development of the European Research Area (ERA)," which was open from 13.September 2011 to 30 November 2011.[26] 590 responses were received from a variety of stakeholders.

Box: ERA on-line public consultation – main results concerning open access

- A very high number of participants responded to the questions on open access to publications and data; among these respondents, 84% rate this area of intervention as important.
- A high number of respondents agreed that access to scientific publications (75%) and scientific data (81%) in the ERA needs to be improved.

26 Preliminary report available at http://ec.europa.eu/research/era/pdf/era-summary-report-2012_en.pdf

- 88% agreed that open access to scientific publications and open data can enhance knowledge circulation in the ERA.

- The most important barriers to open access and open data include: insufficient awareness of the research community; insufficient member states policies on open access to data; insufficient coordination on member states policies and an insufficient pan European e-infrastructure for depositing; as well as insufficient interoperability.

- Respondents across the different categories acknowledged the key role of the European Commission in coordinating Member State initiatives, monitoring researchers' compliance and promoting open access policies to publications and data.

The results of these public consultations are used throughout this document in relation to the specific issues at stake.

1.5. Opinion of the Impact Assessment Board

Following the Opinions of the Impact Assessment Board on previous versions of this report, this report has undergone considerable changes.

- The problem analysis has been strengthened, by focussing on fewer problem drivers, clearly structuring them according to the three problem areas – access to research publications, access to research data and preservation of both publications and data.

- The framework of objectives, both specific and operational objectives has been entirely rewritten. A chart has been added. The link between the problem analysis and the policy intervention has been highlighted more clearly. Trade-offs are described in the assessment of the impacts, again including charts. The key operational objectives now include some specific and clearly timed targets.

- The policy options have been partly rewritten – in its entirety for the soft law and the approximation of legislation options. The focus is now on a policy framework and its content rather than on instruments of delivery. The comparison between the soft law option and the option of approximation of laws is presented in a new, clearer way. The baseline scenario has been strengthened by adding further aspects of the likely development without further EU policy intervention.

- The link with the ERA Communication (no longer a Framework Directive) and with Horizon 2020, including the way in which the Commission will deal with the research results stemming from its own projects has been clarified. These initiatives have been subject to a separate impact assessment. Also the link to the Commission's Open Data strategy is now clearly described.

- The analysis of the impacts has been entirely rewritten, in particular to address in great detail the concerns brought forward by for-profit scientific publishers. This category includes learned societies. The IA now also pays more attention between the economic and in particular the contractual relations between publishers and the researchers.

- The aspects of costs and benefits for MS have been presented in an entirely new way, including the robustness of the research that the analysis builds on. The economic impacts on research intensive countries are now also spelled out not only in terms of the expected overall savings, but also in terms of the costs in relation to R&D spending.

- Several other elements of substance have been significantly reinforced at the request of the IAB:

  The issue of the relationship between OA and copyright transfers and alternative models for licensing are now discussed in the text;

  The analysis on VAT related issues has been expanded, although the substance of VAT reform is dealt with in a different context.

  The international dimension has been reinforced. This covers international arrangements, as well as the aspect of potential unilateral benefits accruing in third countries.

  The importance of the initiative for SMEs has been further highlighted.

  The need for EU intervention in light of the current experience with the development of policies in MS.

- Results from the stakeholder consultation are integrated into the body of the problem analysis.

2. PROBLEM DEFINITION

2.1. Context and economic impact

In 1676, Isaac Newton famously wrote that "i*f I have seen further it is by standing on ye sholders of Giants."* Today, it is truer than ever that all research builds on previous work and depends on scientists' ability to access and share scientific information. The advent of the Internet and electronic publishing has resulted in unprecedented possibilities for the dissemination and exchange of information. In today's "information economy", knowledge is a source of competitive advantage. For this reason alone, it is politically and economically crucial that there be wide and instant access to scientific information. The wide range of benefits to this would include:

– acceleration of the research and discovery process, leading to increased returns on R&D investment;

– avoidance of the duplication of research efforts, leading to savings in R&D expenditure;

– enhanced opportunities for multi-disciplinary research, as well as inter-institutional and inter-sectorial collaborations;

– broader and faster opportunities for the adoption and commercialisation of research findings, generating increased returns on public investment in R&D and the potential for the emergence of new industries based on scientific information.

A recent study[27] estimated the **overall economic benefit from increased access** to (publicly and privately funded) **scientific information for the EU 27 at €6 billion a year. This implies potential economic benefits from increased access to scientific publications emanating from public funding at €1.8 billion a year.**

The effect of limited access to scientific information on the competitiveness of SMEs was recently documented by a Danish Ministry for Research and Innovation report on access to scientific and technical information for innovative SMEs.[28] It illustrates the difficulties that SMEs in Denmark face in accessing research articles, patent information, scientific and technical standards, technical information, and market intelligence. **The report states that it takes 2.2 years longer to develop or introduce new products without speedy access to up-to-date scientific research**. For new products, a delay of 2.2 years means an average revenue loss of about 36 million DKK for Danish SMEs. The report concludes that there is a need for easier and cheaper access to research articles, patents, laws and regulations, and market information.

The potential benefits of better access to scientific information should be seen in the context of the high investment in R&D across the EU. This reached €245,673 billion in 2010 (2% of GDP)[29], a rise of 43.5 % in ten years.[30] A large part of investment in research in the EU is publicly funded (35%)[31], which gives the public sector an important say in determining how results should be disseminated for the benefit of economic growth and the society at large.[32] It is therefore crucial for public authorities to define ways to improve public access to the results of publicly funded research, in order for the maximum benefit to be drawn from Europe's investment in science.

Estimates[33] put the worldwide Science Technical and Medical (STM) publishing market (which includes journals, books, and secondary information services) at USD 16 billion (ca. EUR 11.6 billion). It is estimated that journal sales account for about 50% of the total STM publishing market, with a market value of USD 8 billion in 2008, up by 6-7% compared to 2007. . The total European STM publishing market was worth some EUR 2.4 -3.2 billion in 2008, giving it a 30%-40% of the total global STM publishing market[34].

Scientific publishing remains a solid and profitable industry, despite the economic crisis, the advent of the Internet, and the development of new business models and market entrants. For

27 http://ec.europa.eu/information_society/policy/psi/docs/pdfs/opendata2012/reports/Vickery.docx

28 http://www.fi.dk/publikationer/2011/adgang-til-forskningsresultater-og-teknisk-information-i-danmark

29 http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/R_%26_D_expenditure

30 http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/R_%26_D_expenditure

31 http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/R_%26_D_expenditure

32 Publicly funded research refers to research undertaken by the government itself, or through grants to academic and other researchers outside the government.

33 www.stm-assoc.org/2009_10_13_MWC_STM_Report.pdf

34 This figure should, however, be interpreted with caution as it does not include non-English language journals in the social sciences, humanities and arts

example, Elsevier, the world's largest publisher of scientific journals with almost 2000 journal titles, performed relatively well during the recession. In 2010, it made GBP 724 million (EUR 841 million) on revenues of GBP 2 billion (EUR 2.3 billion), an operating-profit margin of 36%.[35] Similarly, the results of Springer in 2010 were strong, with revenues reaching EUR 866 million and its EBITDA[36] reaching EUR 294 million, representing a 33.9 % return on sales. The Oxford University Press also presented solid results in March 2011, lead by solid sales growth in its academic arm.[37]

2.2. Problems to be addressed

On-line public consultations on both scientific information and the ERA highlight **limited access to scientific publications and data as a key barrier towards the circulation of knowledge in Europe.** In fact, the scholarly dissemination system is confronted with a series of problems that prevent European researchers from making full use of an integrated system of practices and infrastructures that allow easy, open access to, and re-use of, research results.

The 3 basic problems are: 1) limited access to **research publications/scientific journals**; 2) limited access to **research data** and 3) the **preservation** of scientific information (publications and data) for long-term access and use. These issues, which are often interconnected, are discussed in more detail below. Further background information on the scholarly communication and dissemination system is presented in Annex 1.

2.2.1. Access to research publications

The Internet has radically changed the way in which scientific publications are disseminated and consulted. Almost 90% of all scientific journals are now available online, yet scientific content is usually not freely available to the general public.[38] Appropriate access to scientific content on which to build new research is of crucial importance for the research community. Researchers' access remains linked to their affiliations with universities or other institutions (e.g. research funding organisations, libraries, governments). Therefore, access to this online scientific content relies not just on having Internet access, but on the journal subscriptions that only large institutions and their libraries can afford.

In many cases, this leads to **limited access to scientific journals** for individual researchers, SMEs and citizens at large. A **large majority (83%) of respondents to the on-line public consultation on scientific information**, in particular libraries and researchers, **disagreed, or strongly disagreed, with the statement that there is no access problem** in terms of scientific publications in Europe. This is supported by findings from the EU-funded study, PEER:[39] 34.4% of respondents have very often, or quite often, been unable to get 'quick and easy access to the peer-reviewed journal article' they would like to consult. 42.8% report that

35 Source: The Economist "Academic Publishing: Of Goats And Headaches - One of the best media businesses is also one of the most resented", 26.05.2011

36 Earnings Before Interest, Taxes, Depreciation and Amortization

37 http://fds.oup.com/www.oup.com/pdf/OUP_Annual_Report_2010-11.pdf

38 www.stm-assoc.org/2009_10_13_MWC_STM_Report.pdf

39 www.peerproject.eu

this has 'sometimes' been the case.[40] Only 22% of respondents say that they 'rarely' experience difficulties in accessing peer-reviewed articles. Limited access to scientific journals, and the resulting limitation of the dissemination and circulation of knowledge, restricts understanding of the latest research results, narrows the scope of obtained knowledge, stifles new scientific discoveries, and hinders progress in research and innovation, and, consequently, jobs and growth in Europe. Limited access restricts both the visibility of scientific research results, and their wider use.

Scientific publishing is a significant economic and profitable activity in its own right, publishers are eager to maintain the current status quo. Scientific publishers indicate in support of their case that access to scientific articles has never been better, in particular thanks to so-called "big deals", that is, bundles of journals that cost less than the sum of subscriptions to all the individual journals in the bundle. [41]

Limited access does not only affect European researchers and libraries. As the Danish study cited above[42] demonstrates, SMEs, and in particular high-technology SMEs, **face significant hurdles to access scientific content** which they consider important for the success of their companies.[43] The 2009 "Access by UK small and medium-sized enterprises to professional and academic information" reported that that 55% of SMEs had recently experienced difficulty accessing research articles.[44]

2.2.1.1. Journal subscription prices increase and library budgets are under pressure

A majority (89%) of the respondents to the on-line public consultation on scientific information **identified the high prices of journals/subscriptions** as **the major barrier to access** to scientific articles in Europe. **Limited library budgets (85%)** were also flagged as an important barrier to access to scientific articles in Europe. **Over the last decades, subscription prices of scholarly journals have increased well above inflation (+3.5% pa).**[45]

40 http://www.peerproject.eu/fileadmin/media/reports/Final_revision_-_behavioural_baseline_report_-_20_01_10.pdf, p. 90. and final report: http://www.peerproject.eu/fileadmin/media/reports/PEER_D4_final_report_29SEPT11.pdf, p. 25.

41 See for example the response from Blackwell Publishing Ltd. to the House of Commons Science and Technology Committee Inquiry into Scientific Publications, p. 2, available at http://www.blackwellpublishing.com/docs/House_commons.doc

42 See footnote 28.

43 http://www.publishingresearch.net/documents/SMEAccessResearchReport.pdf; further, if only anecdotal, evidence is contained in the JISC study on 'Benefits to the Private Sector of Open Access to Higher Education and Scholarly Research', available at: http://open-access.org.uk/wp-content/uploads/2011/10/OAIG_Benefits_OA_PrivateSector.pdf

44 http://www.publishingresearch.net/documents/SMEAccessResearchReport.pdf

45 http://www.arl.org/bm~doc/arlstat09.pdf

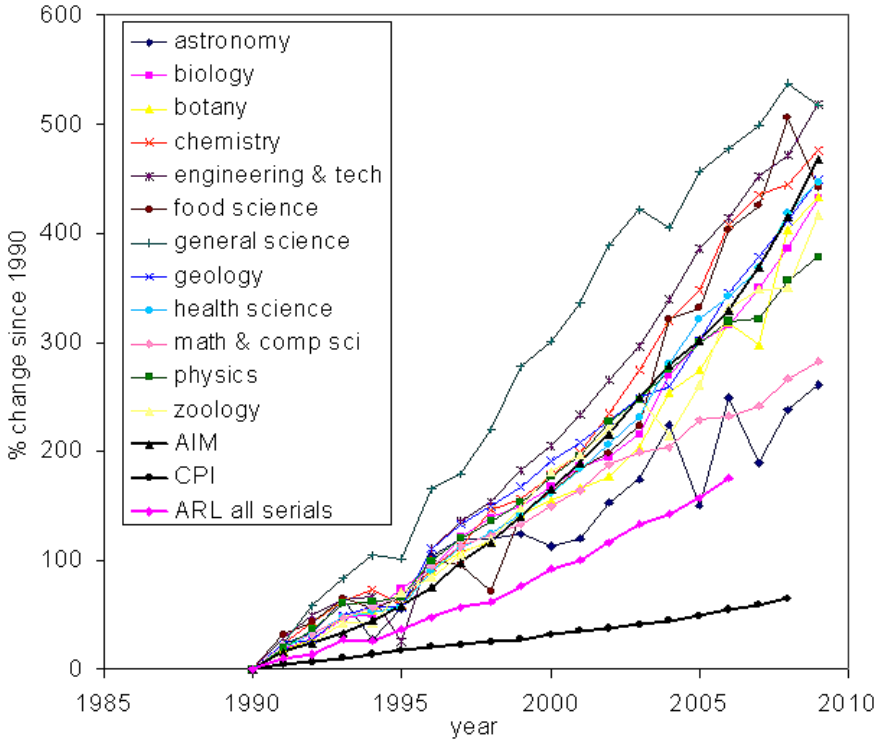

Figure 2: Scholarly (scientific) journals v total serials: % price increase 1990-2009[46]

The steady high annual price increase in the subscription fees of scientific journals is caused by several factors:

– The low level of competition: each individual journal title publishes research findings in a specialised field, has a unique branding and reputation, and a given Impact Factor (a traditional metric indicator for scholarly journal quality, along with citation counts.)[47] Publishers have a significant amount of discretion in setting prices, especially for journals with an excellent reputation;

– The annual growth in the number of scientific articles (+3.5%). This increase is reflected both by a growing number of journals and a higher number of articles per journal, in line with increasing expenditure on research and the number of researchers worldwide;

– Researchers demand and expect access to high quality journals and/or journals with high Impact Factors (meaning that their articles are cited more often than articles published in other journals); these journals cannot be substituted by other journals and therefore demand is price insensitive.

At the same time, libraries' budgets have been under pressure, a pressure which is likely to increase significantly because of the economic crisis. The 2010 US Study of Subscription Prices for Scholarly Society Journals[48] flagged up a list of universities that made significant institutional subscription cancellations in 2009, due to their inability to cope with current

46 http://www.sennoma.net/main/archives/2009/04/scholarly_journals_vs_total_se.php

47 See Annex I.

48 http://allenpress.com/system/files/pdfs/library/ap_journal_pricing_study_2010.pdf

price increases. Similarly, Research Libraries UK (RLUK), which represents thirty major institutions (including Oxford, Cambridge and the London School of Economics), informed two major publishers that, unless they agree to a 15% reduction in prices, it would not renew its "big deal" contracts with them in 2012.

Scientific publishers indicate, on the other hand, that access to scientific articles has never been better, in particular thanks to so-called "big deals", that is bundles of journals that cost less than the sum of subscriptions to all the individual journals in the bundle.[49] However, the big deals do not necessarily reflect the needs of libraries who acquire content that they do not need. Also libraries of less well-endowed academic institutions still find it difficult to cope with the "big deal" prices. On top of it they cannot adjust their expenditure because cancelling individual subscriptions from the bundle will not lead to a reduced overall price under the "big deal" agreement. Their budgets are 'locked' due to the multiannual character of the 'big deal' agreements, making it difficult for new publishers to enter the market. Finally,

The combination of **rising journal subscription prices and pressure on library budgets, risks further limiting access by researchers to scientific journals.** In combination, these factors make it increasingly difficult for institutions to acquire all the journals to which they want to have access. This is also referred to as the "serial crisis".

One factor that contributes to the gap between the prices of electronic journals and library budgets is VAT. Under current EU VAT law, printed scientific publications are subject to a reduced VAT rate, while VAT on the same content delivered in electronic form is charged at the standard rate. 36% of respondents to the on-line public consultation on scientific information mentioned VAT as a factor hindering access to scientific content in Europe. The Communication on the future of VAT[50] stipulates that "[s]imilar goods and services should be subject to the same VAT rate and progress in technology should be taken into account in this respect, so that the challenge of convergence between the on-line and the physical environment is addressed."

2.2.1.2. The development of the open access movement

As a reaction to rising journal prices and the resulting pressure on libraries, there have been calls by the scientific community for a number of years for free, instant, internet access to scientific research results (including peer-reviewed journal articles). One of the main arguments of this 'open access movement' is that publicly funded research should be made available to the general public for free, as taxpayers have already contributed to the costs of its production.

Open access to scientific research results has taken two forms: the so-called ‘Gold Open Access’ and ‘Green Open Access’ models. Under the 'Gold Open Access' model, the costs of publishing are covered by authors rather than by reader subscriptions. In practice, funding bodies or universities pay the publishing costs upfront.

In the 'Green Open Access' model, the journal article – in a final or almost final version – is made available for free on the internet, either on an individual webpage of the author or

49 See for example the response from Blackwell Publishing Ltd. to the House of Commons Science and Technology Committee Inquiry into Scientific Publications, p. 2, available at http://www.blackwellpublishing.com/docs/House_commons.doc

50 COM(2011) 851final of 6.12.2011, p. 11.

within an institutional repository. Usually an embargo period is applied first, to allow the scientific publisher to recoup their costs and make a return on their investment.[51] The length of the embargo period itself depends on a number of factors[52], among them the length of time after which results are considered to be out of date, a time span that varies among disciplines. One can consider this time span to be shorter in the scientific, technological and medical fields and longer in the fields of social sciences and the humanities. Some funders[53], including the EU[54], have applied such a distinction, whereas others set the default rule of a six month embargo period and allow for exceptions[55].

In the on-line public consultation on scientific information, 88% of the respondents supported the idea that publicly funded research should be made available free of charge at some stage. All national and regional government and research funding organisation respondents agreed or agreed strongly. Out of the other stakeholder groups did also agree or agree strongly with the statement: 96% of libraries, 96% of citizens, 95% of universities/research institutes, 94% of individual researchers and 76% of international organisations. Publishers are the only group of stakeholders where a majority (67%) disagree or disagree strongly with the idea that that publications resulting from publicly funded research should, as a matter of principle, be in open access.

Self-archiving (Green OA), or a combination of self-archiving and OA publishing (Gold OA), were identified as the preferred ways of increasing the number and share of scientific publications available in OA mode. The majority (56% of respondents) prefer an embargo period (the period of time during which access to a publication is restricted) of six months.

Recent studies[56] suggest that 20% of the academic and scientific literature published worldwide in 2008 is now be freely available on the Web, 60% as Green OA and 40% as Gold OA.[57]

51 For more details on these models, please see the Annex 1.

52 See p. 68 in Annex I

53 E.g. Deutsche Forschungsgemeinschaft: http://www.dfg.de/download/programme/wissenschaftliche_literaturversorgung_informationssysteme/mittelverwendung/2_12/2_12.pdf; proposed revised OA policy of the Research Councils UK: http://www.openscholarship.org/upload/docs/application/pdf/2012-03/rcuk_proposed_policy_on_access_to_research_outputs.pdf.

54 In the FP7 OA pilot: http://ec.europa.eu/research/science-society/index.cfm?fuseaction=public.topic&id=1300&lang=1

55 E.g. Austrian Science Fund: http://www.fwf.ac.at/en/public_relations/oai/index.html

56 http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0011273

57 ISI index refers to the Thompson Reuters indexed Journals which allows researchers to identify which articles have been cited most frequently, and who has cited them

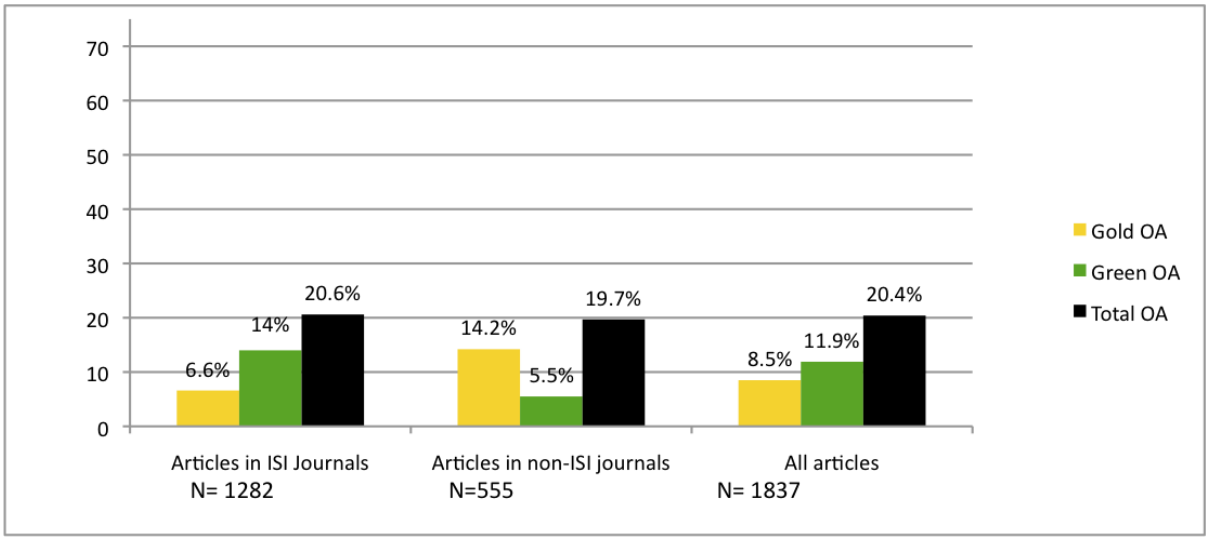

Figure 3: Percentage of scientific articles which are Open Access

Gold Open Access journal publishing saw rapid growth between 2000 and 2009, measured both in terms of total article output and number of OA journals.[58] [59] It is estimated that around 19,500 articles were published as OA in 2000, with the number rising to 191,850 in 2009. Journal numbers show considerable growth, though not as rapid as at the article-level, with an estimated 4,769 journals published as OA in 2009, compared to 740 in 2000.[60]

Publishers like BiomedCentral and Springer have already embarked on large-scale open access publishing models and the Howard Hughes Medical Institute, the Max Planck Society and the Wellcome Trust have announced plans to launch a open access journal in 2012 for biomedical and life sciences research. Elsevier reported to be the largest OA publisher.[61] The huge success of PLoS ONE, an open access journal published by the not-for-profit publisher Public Library of Science (PLoS)[62], has led other major publishers, Science, SAGE Publishing and/or the British Medical Journal to embark on similar OA activities.

58 http://www.plosone.org/article/info:doi/10.1371/journal.pone.0020961

59 http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0011273

60 http://www.plosone.org/article/info:doi/10.1371/journal.pone.0011273

61 In an informal exchange with the authors.

62 12, 000 articles published in 2011 alone.

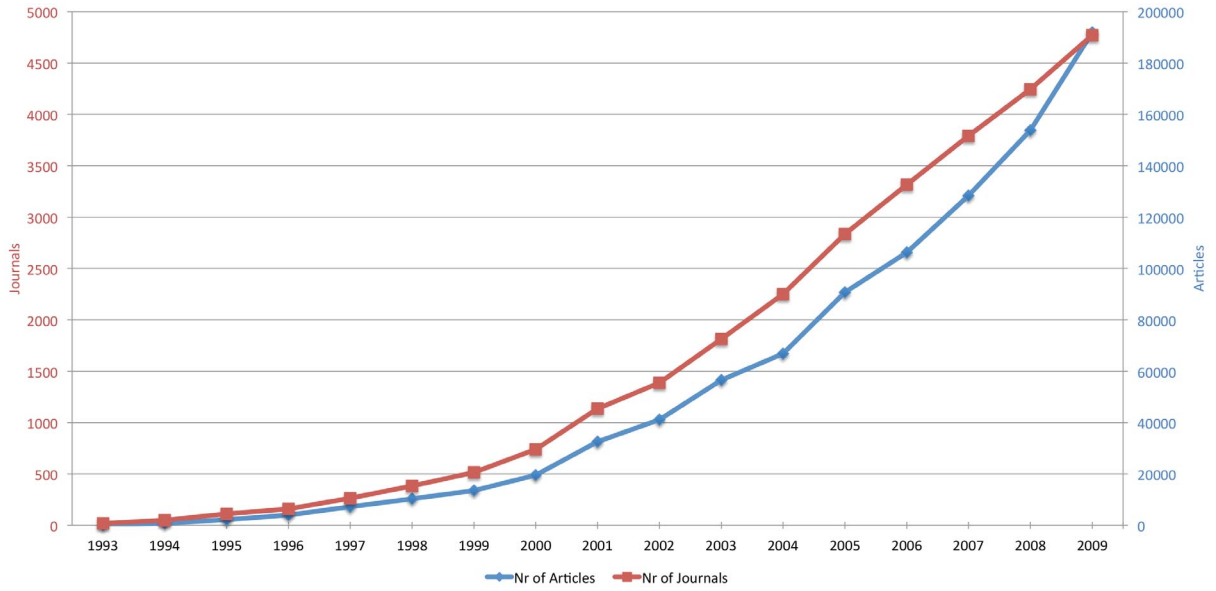

Figure 4: Growth of OA articles and journals[63]

One key finding of the SOAP survey[64] is the large gap between support for open access publishing (around 90%) and actual open access publishing (around 10%). The main reasons were found to be a lack of easily accessible funding for open access publishing, as well as a lack of high reputation open access journals. The latter is a key issue for researchers, whose careers often depend on the number of times their articles are cited. While OA journals are improving their reputation, gaining visibility is a complex challenge. Some, such as the Public Library of Science (PLoS) journals[65] have impressive impact factors.

Recently, the debate around open access got heated, with scientists calling to boycott one of the leading commercial publishers by refusing to submit articles to their journals, or to carry out peer reviews for them.[66]

There are concerns about the effects of open access publishing under both the Green and Gold models.

On the one hand, publishers are afraid that a widespread implementation of "Green OA" mandates with too short embargo periods could lead librarians to cancel subscriptions. According to the industry, this would endanger the existence of individual journals and also potentially publishers themselves, in particular those with a small business portfolio (including the learned societies). Consequently, the overall impact on the existing scholarly dissemination system would be negative.

63 http://www.plosone.org/article/info:doi/10.1371/journal.pone.0011273

64 http://project-soap.eu/

65 www.plos.org

66 See 'Mathematicians Organize Boycott of Publishers', NYT online edition of 13 February, available at http://www.nytimes.com/2012/02/14/science/researchers-boycott-elsevier-journal-publisher.html; this boycott action was a reaction to the introduction of the 'Research Works Act' into the US Congress in 2011, a bill that is considered to be sponsored by major commercial publishers; the developments in the US will be dealt with on page 36.

On the other hand, there are questions about the cost attached to a large-scale transition to "Gold OA", and who would pay for it, bearing in mind that 1.5 million scientific articles are published worldwide every year. Likewise, issue are raised about the transitional phase during which articles would be published under the Gold model as well as on a subscription basis. The concern is that subscription prices would not be reduced in parallel with the rising income for publishers from Gold Open Access publishing fees. Finally, there is the matter about keeping article processing costs under control under any 'Gold OA' system.

Self-archiving is facing a legal obstacle related to the current practice of copyright transfers by authors to publishers. Publishers argue that they need the copyright transfer in order to have an exclusive exploitation right ensuring that they will recoup their investment made into the publication process. Under this scenario, authors can only self-archive a version of their manuscript with the consent of the publisher, putting the publisher in a strong position. It is argued[67] that a system of non-exclusive licences should replace the current practice as it would allow for a more flexible management of IPR rights, in particular allowing for self-archiving along-side publication in a subscription-based journal and the right to re-use the information contained in the article. In any event a policy mandating self-archiving of articles after a defined embargo period will have an impact on either the exercise of the economic aspects of the copyright if transferred by the author or the extent to which an exclusive licence can be granted to the publisher.

2.2.2. Accessibility of research data

Observations and data collected during the research process underpin the results of published research. This raw data has a value in itself. It can be used to verify the results of the experiments, for further research in the same area, and it can also be combined with data from other research to work towards new cross-disciplinary discoveries.

As underlined in the Commission's open data strategy,[68] scientific activities are increasingly undertaken through online global collaborations, using very large research data collections, huge computing resources and high performance visualisation. **E-Science** (research enabled by e-infrastructure/ICT) is essential for meeting the challenges of the 21st century in scientific discovery and learning. The data come from simulations, digital instruments, sensor nets, and observatories. The 2010 report 'Riding the Wave'[69] underlined the crucial role of data for science, and its potential to change the very nature of the scientific process itself.

In the **on-line public consultation**, 86% of the respondents agreed on the development of an EU network of repositories.

The shift in the scientific process brought about by e-science will increase research productivity, and enable new and unexpected solutions to emerge in response to social challenges.

Currently, research data resulting from publicly funded research is not widely available for others to build upon. Moreover, even if it is available online, data is not necessarily

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67 Knowledge Exchange Report 'IPR Policy and Scientific Research", available at: http://www.knowledge-exchange.info/Default.aspx?ID=516

68 http://ec.europa.eu/information_society/policy/psi/docs/pdfs/opendata2012/open_data_communication/en.pdf

69 Final report of the High Level Expert Group on Scientific Data, October 2010.

presented in formats that facilitate its use and re-use. **The vast majority (87%) of respondents to the on-line public consultation on scientific information disagreed, or strongly disagreed, with the statement that 'there is no access problem to research data in Europe.'** In addition, there was strong support (89%) for public access to research data, and for the results of publicly funded research to be, as a matter of principle, available for re-use free of charge on the Internet. The main barriers to access to research data were identified as: the lack of funding to develop and maintain the necessary infrastructure (80%); insufficient credit given to researchers for making research data available (80%); insufficient national/regional strategies/policies (79%); and the lack of incentives for researchers (76.4%).

The EU-funded project PARSE-Insight[70] (Permanent Access to the Records of Science in Europe) found that researchers have difficulty in finding relevant data resources, and in re-using available datasets. Reasons ranged from access being denied to a lack of data manipulation skills or software. Only 25% of researchers state that they share their research data openly. 11% make it available for researchers within their research discipline, while 58% make it available within their specific research group. These figures tend to support the UK Research Data Service (UKRDS) survey,[71] which found that while informal sharing is common amongst researchers, overall they wish to keep control of their data.

This situation hinders the dissemination of knowledge, and results in a loss of efficiency of research investment.

The following key factors limit access to research data:

- Costs

There are many different kinds and categories of data generated at different stages of the research process. Designating which datasets ought to be made publicly available is a complex question. The costs in terms of effort and time needed to prepare data for depositing are viewed as a burden by researchers. Unless depositing is mandated by funders and research institutions, researchers have little incentive to make their data accessible for re-use. Costs are exploding as the generation of data (from scientific instruments or large scale simulations) rises exponentially, raising significant problems for the sustainability of long-term preservation for re-use.

- Lack of explicit career rewards and/or recognition for sharing data

The lack of explicit career rewards and/or recognition for researchers for depositing and sharing research data was highlighted in a UK RIN report as a major disincentive for granting OA to data.[72] Researchers who share their data are motivated by altruism, encouragement from peers, or hope of opening up opportunities for collaboration. However, most researchers wish to retain exclusive use of the data they have created until they have extracted all the

70 www.parse-insight.eu

71 http://www.ariadne.ac.uk/issue60/beagrie-et-al/

72 Report 'To share or not to share: Publication and Quality Assurance of Research Data Outputs' commissioned by the UK Research Information Network, available at: http://eprints.ecs.soton.ac.uk/16742/1/Published_report_-_main_-_final.pdf; see also the findings of the report 'Insight into digital preservation of research output in Europe' prepared by the PARSE Insight project, available at: http://www.parse-insight.eu/downloads/PARSE-Insight_D3-6_InsightReport.pdf.

publication value possible. When combined with the perceived lack of career rewards for data sharing, this constitutes a major constraint on making research data openly available. The insufficient credit given to researchers who make research data available was reported by 80% of the respondents to the on-line public consultation on scientific information, indicating that this is a barrier to enabling wider access to research data in Europe.

- Lack of the necessary and interoperable e-infrastructure

As the volume and diversity of scientific data increase, and as research becomes more multi-disciplinary and researchers struggle to connect and correlate data – especially if it comes from another academic discipline - reliable infrastructures for Digital Object Identifiers (DOIs), Digital Access Index (DAIs), AAA (Authentication, Authorization and Accounting), and metadata interoperability are required. To improve scientific efficiency and productivity, researchers will need a trusted system for finding, accessing, using and re-using data. Although ICT infrastructures (e-infrastructures) for data are now rapidly emerging in Europe and internationally, they are not necessarily interoperable across countries and disciplines, or are unsustainable due to lack of commonly agreed governance, legal frameworks and funding models.

The fact that this is a relatively new field suggests the possibility of pilot initiatives to uncover which rules and infrastructures would address the problem of data access in a cost effective way. Studies such as ODE (Opportunities for Data Exchange)[73] are providing the evidence and context for setting European strategies in this area.

The report 'Riding the wave'[74] argues that the most efficient way to address both the objective of widespread access to research, as well as its preservation for re-use, is to provide a collaborative and federated information infrastructure. According to the report, the essential attributes of this infrastructure would include flexibility, reliability, security and openness. It should have a strong European dimension and be well connected globally. It needs to achieve high standards of performance with contained costs through extensive collaboration of governments, funders, research organisations, companies and individuals. The collaborative and federated model for e-infrastructures has been previously implemented with success in the areas of research networks (GEANT), high performance computing (PRACE) and grid computing (EGI.eu).

The preservation of the software created to process, access, visualize and preserve scientific data should also be ensured. Without this infrastructure and the possibility to adapt it to the changing circumstances of the scientific data, the data itself would not be usable in most cases.

In this area further work would be undertaken regarding the interoperability of repositories, metadata and quality issues and building for example on the works of OpenAIRE or the Alliance for Permanent Access, enabling that the challenges related to preservation are undertaken. Moreover, the development of institutional repositories and implementation of institutional mandates would further expose results from publicly-funded research to the use and re-use by other researchers and potential commercial users.

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73 http://www.alliancepermanentaccess.org/index.php/current-projects/ode/

74 http://cordis.europa.eu/fp7/ict/e-infrastructure/docs/hlg-sdi-report.pdf

- Other obstacles

Other disincentives to sharing research data include lack of time and resources, lack of experience and expertise in data management and provision of good metadata, legal[75] and ethical constraints, lack of an appropriate archive service, and fear of exploitation or inappropriate use of the data.

2.2.3. Preservation of scientific content

The preservation of scientific content is crucial in order to ensure permanent access to digital content over time. However, despite a widespread recognition of the importance of long-term preservation of scientific information the scientific community has limited incentives to engage in this area.

In the on-line public consultation on scientific information, 80% of the respondents indicated that the lack of appropriate financing and organisational models put the long-term preservation of patrimonial digital scientific material at risk: when critical data – whether about climate, new medicines or historic monuments, are needed later on, it might be too late.

2.2.3.1. Preservation of scientific journals

The PARSE-Insight study[76] that looked into the preservation of scientific content in Europe highlighted that the preservation of scientific journals is reasonably well organised. The publishers themselves often take care of preservation issues. Most scientific journals (93 %) are subject to preservation measures or policies implemented by publishers. However, there are also gaps: only 23% of small publishers report having a dedicated preservation strategy. Some publishers (52%) have transferred preservation responsibilities to a third party (for example, JSTOR, Portico, or LOCKSS). Some alternative solutions are being implemented, notably through national library services such as the e-Depot at the Koninklijke Bibliotheek in the Netherlands.

It should be noted that publishers are not always in the best position to preserve scientific material in the public interest, because the concept of "long term" in the world of science is often longer than the life of most publishing companies. Traditionally, the national 'deposit libraries' received one or more copies of all scientific journals for preservation purposes. 69% of respondents to the on-line public consultation on scientific information indicated that the obligation for content producers to make one or more copies of scientific materials available to a designated deposit body is a central issue for the preservation of digital scientific publications.

Legal deposit legislation across the EU is being adapted to the digital age, but scientific publications are not fully covered, which may put the long-term preservation of these publications at risk.

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75 Essentially the sui generis copyright protection offered by the Database Directive (Directive 96/9/EC) and data protection issues (Directives 95/46/EC and 2002/58/EC)

76 http://www.parse-insight.eu/downloads/PARSE-Insight_D3-6_InsightReport.pdf

2.2.3.2. Preservation of scientific data

There are many reasons to support the preservation and sharing of research data: it allows for the re-analysis of existing data, enables greater cross-sector collaboration and opportunities within education and training, and reduces the cost of collection and duplication. Furthermore, in many scientific fields each dataset is unique, costly and irreproducible; **if the data is not preserved it is lost for ever**. In the area of earth sciences,[77] for example, it is impossible to go back in time and resample environmental data, given the variability of the state of the Earth and its environment over time. Earth observations are of unique value in understanding climate change and natural hazards, and in developing an appropriate response to global and regional climate change and related threats.

However, **very few research funding organisations, research infrastructures and universities undertake proper research data preservation activities**. Results from a study that looked into the current state of affairs in Europe show that individual researchers are generally unaware of the need to preserve data for the long term, nor of the best ways to do so. According to the PARSE-Insight study**, only 20% of researchers submit data to a digital archive.** 40% of researchers report that they store between 1 Gigabyte and 1 Terabyte of data, whilst 11% reported that they were unaware of how much information they stored. Some preserved their research data on a PC at work or on the server of the institution they belong to (59%), or, in many cases, on a personal computer at home (51%).

The key question of who should be responsible for long-term preservation and its funding remains unresolved. Moreover, different academic communities have different approaches, and their preservation strategies are at different stages of development. There is a consensus that each particular research field should develop partnerships with data scientists or informatics specialists with domain expertise to ensure effective curation, and preparation for deposit, of articles. However, this does not solve the problem of the funding and overall responsibility for the preservation of scientific content.

2.3. Stakeholder analysis: who is affected and how?

Limited access to research publications and raw data, and the lack of preservation of both publications and data, negatively impact on a number of stakeholders.

2.3.1. Researchers

Their research generates data. They write articles and review those of their peers. They value the importance of making their work widely available and better preserving the research data they make accessible, but are not always aware of the importance of their role. However, access to scientific publications remains a problem for 4 out of 5 researchers,[78] while **access to underlying research data** is a problem for almost 90% of them.[79] Likewise, the lack of appropriate **preservation of scientific publications and data** negatively impacts the work

77 http://www.parse-insight.eu/downloads/PARSE-Insight_D3-6_InsightReport.pdf

78 See section 2.2.1.

79 See section 2.2.2.

and careers of researchers. Open access publishing increases the visibility of researchers' publications and therefore their research impact.[80]

2.3.2. Businesses, including SMEs

SMEs do not usually have in-house research labs/departments. They therefore rely on access to scientific literature in order to be able to innovate. The present lack of open **access to scientific publications** impacts negatively on the capacity of SMEs to innovate. As described above,[81] it may take SMEs 2.2 years longer to develop/launch a product to the market without open access to scientific publications.

2.3.3. Scientific publishers

Publishers are, in general, comfortable with the status quo. The market is characterised by a large amount of traditional journal publishers. Many publish journals on behalf of learned societies who seek revenue from subscriptions to fund activities such as academic conferences. Most commercial publishers today offer some kind of open access publishing option under the Gold OA model, and allow for some sort of self archiving. There is also an increasing number of publishers who exclusively publish open access journals.

2.3.4. Governments (national/ sub-state level)

The cost of acquisition of academic literature by academic libraries is a matter of concern for governments, since they are one of the principal sources of research funding, and the most important funders for higher academic institutions. A move towards open access publishing could lower overall costs for Governments when purchasing scientific content, as well as maximising their social and economic returns in terms of increased visibility for research and wider access to scientific output. The lack of appropriate **preservation policies** leads to a loss of scientific and cultural heritage. Research may need to be funded twice when past results are no longer accessible.

2.3.5. Academic institutions (including their libraries)

Academic libraries struggle with rising subscription prices. The budgets for acquisition of academic literature by academic libraries have been strained over the years by a growth of subscription prices well beyond inflation.[82] Sometimes a rise of subscription prices in the area of science, technical and medical publishing is covered at the expense of publication subscriptions in the field of arts and humanities. The current absence of policies favouring open access publishing negatively impacts on library budgets, and on the amount of content they can purchase. The absence of open access publishing can also negatively impact on the global visibility and reputation of academic institutions, and potentially hinder their ability to attract funding, new faculty members and potential students.

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80 A. Swan, Open Access citation advantage. Studies and results to date, available at: http://eprints.ecs.soton.ac.uk/18516/2/Citation_advantage_paper.pdf

81 See discussion on page 13.

82 See discussion on page 15.

2.3.6. Citizens

Citizens and individual professionals, such as doctors and pharmacists, need easy access to scientific research results, without the need to be affiliated to an academic library. The current absence of easy and open access negatively impacts on their capacity to benefit from up to date knowledge in their daily practice.

2.4. The EU dimension

2.4.1. Treaty Base

The right of the EU to act in this field is set out in the Treaty on European Union (TEU) and in the Treaty on the functioning of the European Union (TFEU). Firstly, the promotion of scientific and technological advance in its own right became a specific objective of the Union for the first time, with Article 3(3) TEU. In addition, Article 179(1), (2) of the TFEU references the ERA as the way to strengthen the scientific and technological bases of the Union, whereby scientific knowledge is mentioned as a key characteristic of the ERA. Finally, Article 182(5) TFEU provides a legal basis for taking the measures necessary for the implementation of the ERA. The European added value lies in maximising the social and economic value of Europe's investments in Research and Development.

2.4.2. Subsidiarity test

In order for Union action to be justified, the subsidiarity and proportionality principles need to be respected.

Action in this area at European level is necessary to avoid further fragmentation across the EU and to take into account the cross-border nature of the scientific dissemination process. In all Member States initiatives exist to facilitate and enable wider access to and preservation of scientific information, but the intensity and focus of effort vary. Multiple initiatives have confronted European researchers, research funding bodies and citizens with overlapping policies and e-infrastructure development progressing at different speed. As shown by the baseline scenario outlined below, there is a serious risk of current fragmentation persisting or getting worse.

The aim of the initiative is to narrow the gaps between policy and practice in Member States, and thereby contribute to the fifth freedom and the development of the ERA. Moreover, it will stimulate the creation of EU-wide products and services based on scientific information (e.g. e-science).

Political, legislative and strategic interaction at European level is required in order to offer Member States and stakeholders a supportive framework to seize the opportunity of wider access to scientific information. This requires the type of co-ordination that can only be facilitated at the European level with input from all stakeholder groups, and which cannot be achieved by Member States alone.

In terms of the proportionality of EU action, the proposal would need to provide Member States with sufficient room to determine the specific conditions for pursuing and implementing policies to improve the access to, and preservation of, scientific information. It should also take into account the varying needs between scientific disciplines, universities and

research funding organisations, as well as the different stage of development of the relevant policies and practices in Member States.

2.5. Baseline scenario

The baseline scenario would propose no policy change and would largely maintain the current policy approach to access to, and preservation of, scientific information in Europe. The access to, and preservation of, scientific output would continue to build on existing legal frameworks at Member State or European level, and policies would continue to largely depend on varying national initiatives.

2.5.1. Fragmentation of national OA policies

As reported in the National Open Access and Preservation Policies in Europe Report,[83] Member States are putting strategies in place regarding access and dissemination. Eight reported implementing a national policy, and five reported action at a regional level. **The approaches vary widely**. This makes it difficult to move in an orderly way to a more open dissemination model for scientific information across the EU that would benefit all stakeholders.

For example, Denmark adopted recommendations as to how to implement the 2007 Council Conclusions on Scientific Information at a national level, and Sweden has a national open access programme. In contrast Germany has chosen to develop strategies at a stakeholder level, Estonia adopted a Research Infrastructure Roadmap and Ireland has put in place a network of institutional repositories and a "national harvester". From the legislative point of view, only eight Member States have adopted laws or legal provisions encouraging or mandating open access – the UK has very recently announced that publicly funded research should be open access[84]. 17 Member States have funding bodies that implement open access policies. The Austria Science Fund has developed an OA policy for all the research programmes they fund, s has the Deutsche Forschungsgemeinschaft (DFG). The number of Member States where universities implement open access has risen to 22, as of 2009. In the Netherlands, all universities have some sort of OA policy.

2.5.2. Divergence regarding developing the e-infrastructure for open access

Considerable differences also exist in the development of e-infrastructures, both from an organisational and technical point of view.

The University of Finland, for example, provides a centralised repository for the benefit of all Finnish Universities. Ireland's approach has been to set up a central register to harvest the content of the different institutional repositories. In order to ensure repository quality, Germany and Spain have developed quality certification services to ensure a minimum quality regarding operation, collection, development for compliant repositories. Other Member States have no such certification measures.

The EU funded project OpenAIRE (based on the former DRIVER project) implements a network of institutional repositories with common European standards, which many

83 http://ec.europa.eu/research/science-society/document_library/pdf_06/open-access-report-2011_en.pdf

84 http://www.bis.gov.uk/assets/biscore/innovation/docs/i/11-1387-innovation-and-research-strategy-for-growth.pdf

institutions are applying.[85] Some Member States, such as Germany, the UK, Finland and France, are aiming to interconnect their repository infrastructure so that a large digital library for scientist and researchers can be established.

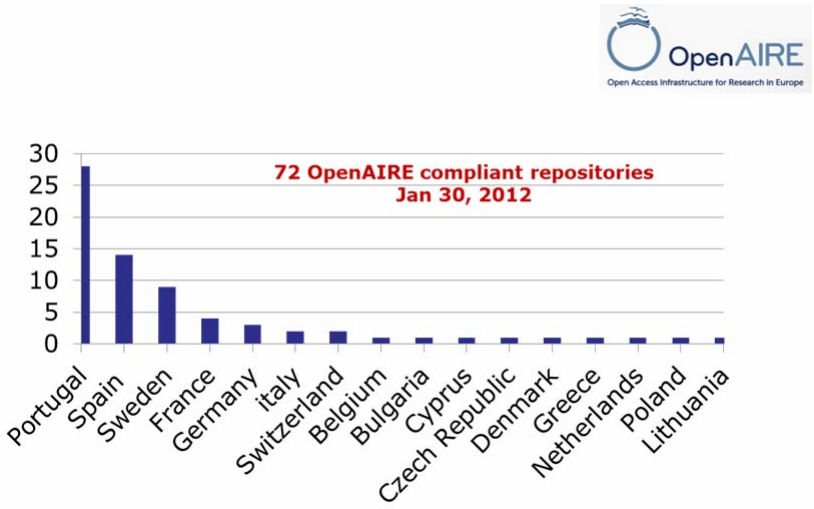


Figure 5: OpenAIRE currently links 72 repositories in 27 Member States.

2.5.3. Fragmentation regarding research data

The picture is also fragmented with regard to access to research data. Currently, not all Member States have explicit policies and/or arrangements for research data, but there are bodies that encourage making research data widely available and accessible. Germany, for example, has set up a research data centre to facilitate research data access. Slovenia has emphasised the need for free access to research data, and the UK research councils are developing a set of principles on the subject.

It seems that research data practices are implemented in the EU only in very specific research domains varying by Member State. At the federal level in Belgium, for example, the focus is on meteorological data, while at regional level it is on marine and coastal research data. Social research data is of interest in Austria, Finland, Slovenia and the UK. The policies for the data deposit process and conditions for access that are being implemented are very different across research disciplines, institutions and Member States.

There is a real risk that infrastructures for access and management of research data develop uncoordinated in Member States, hampering scientific progress. Therefore, action is required at European level to promote interoperability. In contrast to individual Member States, the EU can play the important role of coordinating existing (or future) national policies on data access, preservation and management, through a combination of policy measures and operational activities.

2.5.4. Lack of preservation policies in EU

The approaches of Member States to preserving scientific content also vary considerably. Most have updated, or are updating, their legal deposit legislation to take into account the

85 www.openaire.eu

requirements of the digital age, but the material covered varies. For example, the UK is currently consulting on whether the legal deposit system could be extended to cover born-digital media, such as e-journals. As for the long-term preservation of research data, policies are sketchy and often lack the operational and organisational implementation structures needed.

2.6. Conclusion on the baseline scenario

Member States are working to improve the access to, and preservation of, scientific information, but not necessarily at the same speed. The priorities and focus of Member States differ widely, and national policies could easily remain isolated. In this baseline scenario, it would be up to individual institutions or Member States to share good practice with other research communities and institutions. No benefit would be drawn from the scale of the internal information market.

In this scenario, the potential benefits of wider access to research publications, estimated at 1.8 billion EUR a year for the EU27 (see section 2.1), would not or only be very partially realised.

3. OBJECTIVES

3.1. General policy objectives and more specific/operational objectives

Free, wider and easier access to scientific information generated through public funding would allow the benefits of science to be exploited by researchers, industries and citizens in scientific endeavour, business innovation and whatever unexpected re-use they may think of. **The general objective of EU action in this field is to provide stronger support to innovation and contribute to economic growth by improving the conditions for the access to and re-use of scientific information and enabling the development of the ERA**. This general objective is fully in line with the horizontal EU level strategies, in particular the 2010 Communication from the Commission Europe 2020.

Specific objectives include:

(1) Scientific publications become openly accessible online for free, as far as possible and as soon as possible;

(2) Research data is made openly accessible online, for free;

(3) Scientific information (publications and data) is preserved for future generations;

(4) Access to scientific information (publications and data) across Member States is facilitated.

The implementation of better policies on access to, and preservation of, scientific information, requires the timely establishment of Europe-wide partnerships. In this context, the **operational objectives** of this proposal are:

In relation to the specific objective (1):

Stimulate the implementation of open access policies for scientific publications by 2014 that:

– increase the number of publications resulting from public funding available in open access to 60% by 2016;

– increase the number of open access mandates;

– improve the funding conditions for Gold open access.

In relation to the specific objective (2):

Stimulate the implementation of open access policies for data that:

– require the deposit of research data resulting from public funding in an e-infrastructure;

– support the set-up and the maintenance of digital e-infrastructures

In relation to specific objective (3):

– Support the set-up and the maintenance of digital e-infrastructures for preservation

– Promote effective deposit systems for digitally-born scientific information

In relation to specific objective (4):

– Ensure full interoperability between e-infrastructures across and outside the EU;

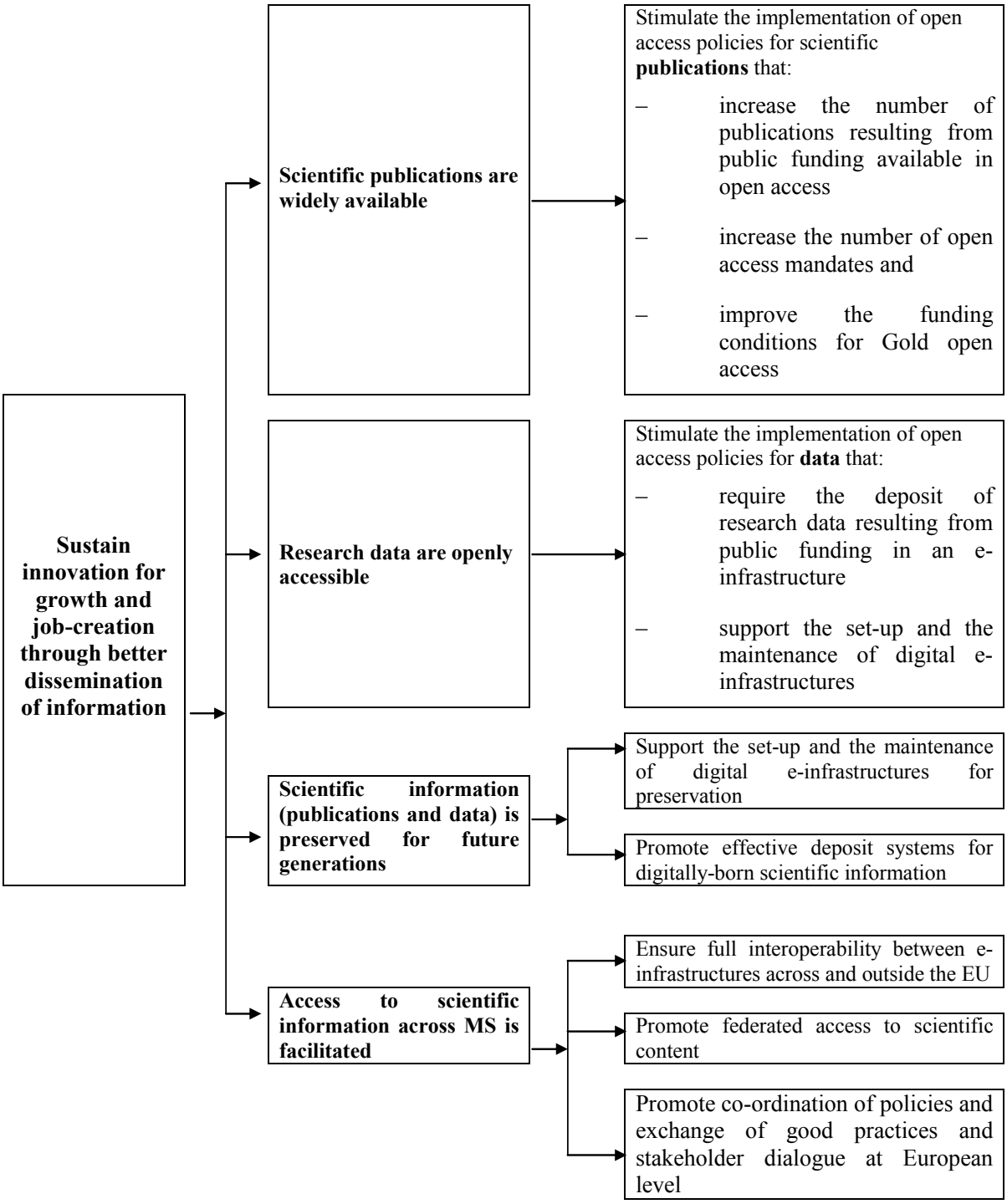
– Promote federated access to scientific content;

– Promote co-ordination of policies and exchange of good practices and stakeholder dialogue at European level.

This proposal will not deal with the issues of differences in VAT rates for print and electronic versions of the same publication. Although this presents a problem,[86] the proposed policy action will not address it. The discussion on reduced VAT rates needs to be addressed in the more comprehensive, ongoing context of VAT reform rather than singling out the case of scientific publications.[87]

86 See discussion on page 17.

87 Communication by the Commission on the future of VAT, COM(2011) 851 final, p. 11.


Sustain innovation for growth and job-creation through better dissemination of information
Scientific publications are widely available
Stimulate the implementation of open access policies for scientific publications that:
– increase the number of publications resulting from public funding available in open access
– increase the number of open access mandates and
– improve the funding conditions for Gold open access
Research data are openly accessible
Stimulate the implementation of open access policies for data that:
– require the deposit of research data resulting from public funding in an e-infrastructure
– support the set-up and the maintenance of digital e-infrastructures
Scientific information (publications and data) is preserved for future generations
Support the set-up and the maintenance of digital e-infrastructures for preservation
Promote effective deposit systems for digitally-born scientific information
Access to scientific information across MS is facilitated
Ensure full interoperability between e-infrastructures across and outside the EU
Promote federated access to scientific content
Promote co-ordination of policies and exchange of good practices and stakeholder dialogue at European level

3.2. Related policies

EU policy in the area of scientific information aims at developing the widest possible accessibility and availability of scientific output for both use and re-use by European researchers and interested parties, in particular innovative industries. Policy objectives in the area of scientific information are consistent with the following horizontal EU objectives:

3.2.1. EU growth strategy Europe 2020 and its flagship initiatives

The initiative contributes to, and is fully aligned with, the EU's growth strategy and, in particular, with two of its flagship initiatives: the Digital Agenda for Europe and the Innovation Union.

One of the objectives mentioned in the 2010 Communication of the Commission on the Flagship Initiative Innovation Union is to promote openness and capitalise on Europe's creative potential. Speeding up research and innovation through better access to scientific information contributes to this aim. Companies innovate in various ways; while some conduct R&D and develop new technologies, others base their innovation on existing technologies. Policies must be designed to support all forms of innovation. The Communication announces that the Commission will promote open access to the results of publicly funded research and in particular make open access to publications the "general principle" for projects funded by the EU research Framework Programmes. Increasing the accessibility of research outputs emanating from publicly funded research is also instrumental in enhancing the overall transparency and accountability of national institutions vis-à-vis their tax payers.

3.2.2. EU policy in the area of open data

The Commission has been at the forefront of open data development through a series of initiatives, in particular the Directive on the re-use of public sector information (Directive 2003/98/EC). The goals of the Commission's open data strategy are to stimulate the public sector across the EU to embrace the principles of open data, increase transparency and administrative efficiency by releasing public data for re-use, and create optimal conditions for innovation and business development based on re-use. On 12 December 2011 the Commission adopted an Open Data strategy.[88] The underlying philosophy of this Communication is that citizens and the society as a whole will benefit from a more open flow of a variety of information. One element of the strategy is a revision of the 2003 Directive. According to the proposal, research and educational establishments remain outside the scope of application of the Directive, in view of the relatively complicated situation as regards third party rights (intellectual property rights not owned by the research institution, but for example by a university professor). In this context the principle that public sector information should be available for free or, at most, at the marginal cost of dissemination, is fully in line with the principle of open access.

3.2.3. Horizon 2020 and the European Research Area (ERA) framework

As described in detail in Section 1 and 2, the area of access to, and preservation of, scientific information is intimately linked to European research and innovation policy. OA policies also

88 COM(2011) 882 final of 12.12.2011

apply to research funded at EU-level. Following on from the Communication on the Flagship Initiative Innovation Union, the proposed Horizon 2020 implementation rules[89] specify that "[w]ith regard to dissemination through research publications, open access shall apply under the terms and conditions laid down in the grant agreement. With regard to dissemination of other results, including research data, the grant agreement may lay down the terms and conditions under which open access to such results must be provided, in particular in ERC frontier research or any other appropriate areas." In addition, in late 2007, the European Research Council (ERC) adopted an OA mandate requiring that all peer-reviewed publications emanating from ERC-funded research projects be deposited on publication into an institutional repository, and made available via open access within six months of publication.[90] The Commission is also supporting open access in the ERA framework. A Communication on "A Reinforced European Research Area Partnership for Excellence and Growth"[91] will set out five key priorities for the completion of the ERA, among them open access.

3.2.4. The Commission's policy regarding open access in the programmes for research and innovation

The Commission will implement an open access policy intended to contribute to improving the access to EU-funded scientific research. As an important research funding body, the Commission is setting an example through the implementation of the forthcoming Horizon 2020 programme. The Commission will require that there be open access to all scientific publications emanating from EU-funded research. The specific details on the implementation of this open access policy will be spelled out in the Rules of Participation of the programme. It will build upon the experience of 7th Framework programme for research and development (FP7 budget) pilot open access exercise launched in 2008 which covered about 20% of the FP7 budget. In this pilot exercise researchers were required to deposit their research publications after an agreed embargo period (6-12 months). In addition the Commission Framework programme also allows for the "Gold Open Access" route. Gold open access fees are considered as eligible cost in EU grants.

3.2.5. The Commission's journal publication scheme

With specific regard to the wealth of scientific information produced by Joint Research Centre (JRC) and with an aim to structure and harmonise the publication of works authored by the staff of the Commission in peer-reviewed journals, the Commission is negotiating the adoption of a one-off framework agreement establishing uniform terms and conditions with several publishers. This publication scheme, EC PLUG, will allow EU-Euratom to retain all its rights with respect to works authored or co-authored by EC staff, and establish an embargo period before they can be reproduced or distributed more widely.

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89 Proposal for a Regulation of the European Parliament and of the Council laying down the rules for the participation and dissemination in 'Horizon 2020 – the Framework Programme for Research and Innovation (2014-2020)', COM(2011) 810 final of 30.11.2011.

90 http://www.openaire.eu/en/component/attachments/download/3

91 COM(2012) xxx (forthcoming)

3.3. The international framework

Major nations in research and development are increasingly implementing OA mandates, investing in open access and supporting research infrastructures. Currently, there are more than 200 OA mandates worldwide.[92] For example in the US 44 OA mandates are being implemented. Most notably, the National Institutes of Health (NIH), the biggest funder of medical research in the world, has a 12-month embargo period OA mandate. PubMedCentral (PMC), which hosts NIH research papers, is the world's largest open access repository, holding over 3 million items The Canadian Institute of Health, the Australian Research Council and the Chinese Academy of Sciences, to name just a few, also implement OA policies. Universities such as Harvard, Yale and MIT are also moving to open access. The arXiv repository, managed by the University of Cornell, provides open access to 731,853 e-prints in Physics, Mathematics, Computer Science, Quantitative Biology, Quantitative Finance and Statistics.[93]

In the US, the mandating policy of the NIH has led to a political debate, giving rise to the introduction of two bills in US Congress, in 2006 and 2009, aiming at either restricting or encouraging the mandating policy of the NIH.[94] The most recent bill, the 'Research Works Act,' was particularly controversial. It was designed to prohibit the open access funding mandates by federal research funding agencies, and triggered vociferous reaction in the scientific community.[95] It was withdrawn in February 2012.[96] Currently, work is being undertaken by the Office of Science and Technology Policy (OSTP), part of the Executive Office of the US President, to advance the debate on open access.[97]

OA policies are also being set up in developing countries and emerging markets, with the objective of increasing the international visibility of their research, and of facilitating scientific exchange.[98]

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92 http://roarmap.eprints.org/

93 http://arxiv.org/

94 These are the 'Fair Copyright in Research Works Act' of 2009 directed at prohibiting any interference by research funding organisations with the transfer of copyright from the author to publishers and the 'Federal Research Public Access Act' introduced in 2006, in 2012 and again in 2012; this bill would generalise the mandating policy of the NIH to all federally-funded research.

95 The act has sparked a boycott movement (see references on page 20) among scientist as it became apparent that the bill has been sponsored by major commercial publishers; on this see the position of the American Association of Publishers: http://publishers.org/researchworksFAQ/

96 http://www.rsc.org/chemistryworld/News/2012/March/research-works-act-dead-open-access-NIH.asp

97 As foreseen by sec. 103 of the America COMPETES Act that asks the OSTP to coordinate public access policies. The result of this work – which included a stakeholder consultation – is not yet finished and no report made public.

98 STM study, http://ec.europa.eu/research/science-society/pdf/scientific-publication-study_en.pdf, p. 64; a noteworthy project is the Scientific Electronic Library Online (SciELO) in Brazil (www.scielo.org).

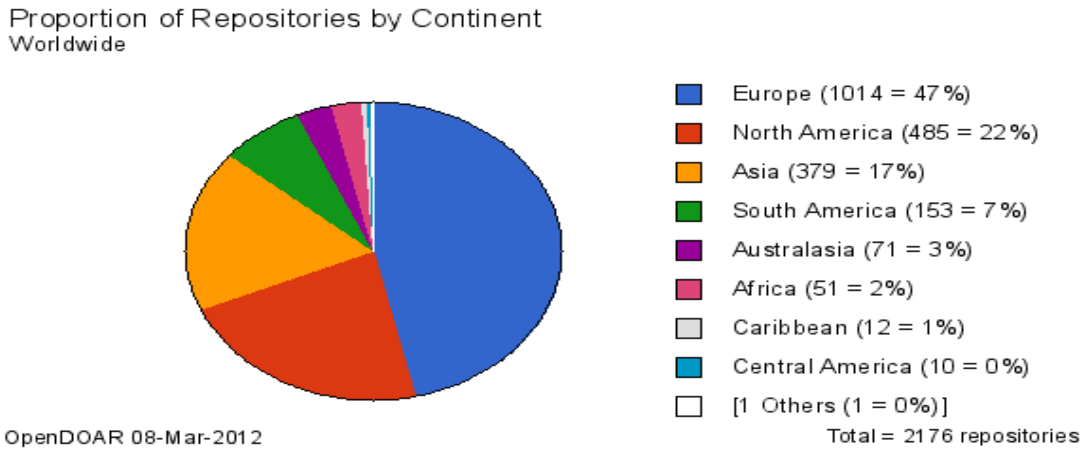

Figure 6: Proportion of Repositories by Continent - Worldwide[99]

At the international level, UNESCO and the OECD are active in promoting better access to scientific information. **UNESCO** has recently updated its Open Access strategy.[100] It centres around three strands:

(1) Provision of upstream policy advice and building partnerships;

(2) Strengthening capacities to adopt OA;

(3) Serve as a clearing-house and inform the global OA debate.

On the last item, UNESCO provides comprehensive country reports on the development of OA policies around the world. The strategy is mainly focused on exchange of best practice.

The **OECD** Declaration on Access to Research Data from Public Funding was adopted by the 30 OECD countries and China, Israel, Russia and South Africa.[101] It sets out 13 principles that should govern access to research data, which ought to be implemented by the signatories.

99 http://www.opendoar.org/onechart.php?cID=&ctID=&rtID=&clID=&lID=&potID=&rSoftWareName=&search=&groupby=c.cContinent&orderby=Tally%20DESC&charttype=pie&width=600&height=300&caption=Proportion%20of%20Repositories%20by%20Continent%20-%20Worldwide

100 Revised strategy on UNESCO's contribution to the promotion of Open Access to scientific information and research of 20 October 2011, available at: http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CI/CI/images/GOAP/OAF2011/213342e.pdf

101 http://www.oecd.org/dataoecd/9/61/38500813.pdf

4. POLICY OPTIONS

This section examines a range of options for addressing the problems highlighted in previous sections. For the purposes of this IA, the options discussed will be the following:

(1) Discontinuing existing EU action

(2) No policy change (Baseline scenario)

(3) Providing a policy framework to MS in the form of soft law

(4) Approximation of MS legislation

4.1. Discontinuing existing EU action

This option would result in the removal of all the soft measures, including any implementing measure, currently contained in the Council Conclusions on Scientific Information.[102] Certain Member States, mostly the more research-intensive ones, would continue to promote open access policies and reap the benefits. A certain degree of exchange of best practice may occur, but this is likely to happen in a haphazard way without any structured exchange. Long-term preservation of scientific information will continue to happen occasionally and in a non-systematic manner. The EU would not address problems and would no longer support the process through its multiple roles, funding or co-funding of infrastructures and projects (FP7 Capacities and CIP) and policy making. All action in the development of research infrastructures aimed at achieving a lasting EU-level infrastructure, as well as all associated actions to support researchers, research funding organisations and scientific communities, would be discontinued. Moreover, the particular role of the Commission and European institutions in relation to different stakeholders would be abandoned.

4.2. No policy change (Baseline scenario)

This option, which would maintain the current approach, has been described in detail in section 2.5. Within this baseline scenario, it is possible to continue the work within the "ERAC Working Group on Knowledge Transfer" in conducting peer learning activities and exchange of good practices, reinforcing the process of policy learning and thereby increasing the effectiveness of measures taken. Elements of evidence-based, comprehensive and consistent policies can be presented by the Commission and discussed with, and by, Member States, but there would be no formal commitment on their part to such an approach as a basis for future policy development. Funding with the CIP, Science and Society/ Responsible Research and Innovation and the Capacities Programme and Future Horizon 2020 could prioritise effective measures to improve access to scientific information in Europe, and elements of evidence based, comprehensive and consistent policies could provide guidance to Member States on how to improve their initiatives.

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102 Council conclusions of 22 November 2007 on scientific information in the digital age: access, dissemination and preservation, available at http://ec.europa.eu/information_society/activities/digital_libraries/doc/scientific_information/council_conclusions_nov2007.pdf

Market and regulatory developments will continue to take place irrespectively of a change in the policy. The number of OA journals and OA content will continue to grow modestly. Traditional publishers will continue to offer hybrid OA alternatives, experiment with different OA business models, and innovate on approaches in order to reduce costs.[103] Many countries and international fora (see section 3.3) consider OA as reliable way to increase access to scientific information, and will continue to pursue this avenue.

The OpenAire infrastructure will be further developed into OpenAirePlus, adding a feature to integrate research data and link publications to data.

However, disparities are likely to become stronger between larger and/or more research-intensive MS and others. Long-term preservation of scientific information will continue to happen occasionally and in a non-systematic manner.

The alignment of the VAT rates for electronic and on-paper publications will be addressed in a separate process. The Communication on the future of the VAT[104] announces a specific revision process on the structure of VAT rates with a proposal expected for the end of 2013.

103 See for example the PLoS peer review approach, http://poynder.blogspot.com/2012/02/oa-interviews-michael-eisen-co-founder.html.

104 COM(2011) 851 final of 6.12.2011.

4.3. Providing a policy framework to MS in the form of soft law

Under this option, a policy framework would be provided to Member States in order to help them develop and implement policies on access to, and preservation of, scientific information (scientific articles and research data). The framework would take a holistic approach in order to substantially improve the access to scientific information in Europe, whether it results from public or private funding.

It would set the general policy objective of widening access to both publications and research data, leaving it to relevant actors in MS to decide which particular open access policy best meets their needs. The policy framework would require the relevant actors in the MS to set up open access mandates requiring all publications and data resulting from publicly-funded research (in whole or in part) to be openly accessible and ensure compliance. Should MS opt to apply the 'Green OA' model, however, certain limitations would apply in terms of the embargo periods to be applied to self-archiving of publications: An embargo period of six months would apply in all fields except the social sciences and humanities where a twelve-month period would apply. The difference in treatment is justified by the longer half-life of research results in social sciences and humanities. Green open access requires the existence of digital e-infrastructures, i.e. online repositories for self-archiving of articles by authors. The policy framework would require the creation, funding and maintenance of such e-infrastructures, as well as the setting of quality standards, if they do not exist already[105]. It should not necessarily require the creation of such e-infrastructures in each MS. MS may want to cooperate on this. In order to ensure compliance with the open access mandates, academic institutions and research funding organisations would be required to reward scientists by taking compliance into account for career evaluations and for the award of research grants.

Scientists will be required to exercise their intellectual property rights in a way compliant with the OA mandates by replacing the current practice of assigning the economic aspects of the copyright to publishers with a system of licences. The length of an exclusive licence to be granted under the Green OA model is clearly linked to the length of the embargo periods as the licence is the legal reflection of agreed embargo period. This aspect of the policy framework leaves the current legislative framework on IPR intact while limiting their contractual freedom to assign their copyright to publishers.

The policy framework is sufficiently flexible to be able to accommodate new technological developments, and allows for the establishment of new modes of cooperation among scientists offered by Web 2.0.[106]

It provides for the adoption of comprehensive policies in the area of preservation, and the development of e-infrastructure in the Member States within their research communities.

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105 Please see the table in the annex that shows the existence of repositories in most MS

106 The peer-review process, for example, could disappear with the functionalities of social networks and other user-feedback mechanisms; see the 'Use and Relevance of Web 2.0 Resources for Researchers' project (ongoing): http://www.merc.ac.uk/?q=RIN_Web2.0_Project; see also the 'Social Media in the Research Workflow' report by CIBER, available at: http://www.ucl.ac.uk/infostudies/research/ciber/social-media-report.pdf.

The policy framework will provide for a monitoring mechanism based on regular reporting obligations. These reporting obligations will include reporting on quantifiable indicators such as the number of open access mandates adopted and the compliance rates with those mandates, as well as the situation of digital e-infrastructures and their technical standards.[107]

The proposed policy framework is based on current experience with efforts to widen access to scientific information in some Member States.[108] It can be adapted to the specific situation in Member States, be it at national or regional level, or at the level of universities/funding bodies.

This framework can also serve as the basis of, and as an agenda for, future cooperation between Member States. It will steer future policy developments at EU level and guide the effective and efficient use of EU funding. Its added value is based in laying the foundations for further work within Member States and, at EU level, in guiding effective cooperation between Member States and providing a good starting point for effective and efficient policies to improve access to, and preservation of, scientific information in Europe.

A Communication and a Recommendation to the Member States adopted by the Commission would describe the intended policy framework. The Recommendation would specify the key features of the policy, although in a non binding manner and providing flexibility for MS for its implementation. Their effect can be improved by targeting funding opportunities better, and by measuring them against their contribution to improving access to, and preservation of, scientific information in Europe. Obligations on regular reporting would allow the Commission to monitor uptake by Member States and to give additional guidance where necessary and appropriate.

4.4. Approximation of MS legislation

Under this option, the Commission would reinforce EU intervention in this field by adopting a Directive. Article 182(5) of the TFEU provides a legal basis for taking the measures necessary for the implementation of the ERA, including the adoption of a Directive.

The proposed policy framework (as explained under 4.3.) would be implemented by a Directive requiring an approximation of laws relating to access to, and preservation of, scientific information.

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107 This will be done in relation to the outcome of process relating to the development of a set of indicators to measure the growth of open access from 2000 onwards within the ERA (a call for tender was launched recently); for further reference see page 63.

108 See the report 'National Open Access and Preservation Policies', 2011, http://ec.europa.eu/research/science-society/document_library/pdf_06/open-access-report-2011_en.pdf; a noteworthy example in terms of policy formulation is the Danish Open Access strategy, available at: http://www.bibliotekogmedier.dk/fileadmin/publikationer/publikationer_engelske/open_access_2010/pdf/Open_Acces_UK.pdf;

5. ASSESSMENT OF THE OPTIONS

For the purposes of this IA, the analysis is limited to a general assessment of the possible options aimed at approximating and reinforcing national access and preservation policies. Policy options have been identified on the basis of both actions (access to scientific publications and research data, and their preservation) and the nature of the measures proposed (whether legally binding or not). The latter is relevant in this context, given that the legal nature of the measures proposed is likely to have a significant impact on the degree to which the objectives of improving access, ensuring preservation and enabling synergies, can be better achieved. The analysis also takes into account the effect on other stakeholders, and issues relating to proportionality, subsidiary and rights.

Options are compared with regard to their effectiveness (the extent to which options achieve the objectives of the proposal) and efficiency (the extent to which objectives can be achieved for a given level of resources/at the lowest cost).

This section presents the qualitative and, where possible in this field, quantitative assessment of the impact of each of the four policy options in the light of the problems and opportunities from section 2, and the policy objectives identified in Section 3. The main areas of potential impact are economic and social. Any policy in this area must ensure that there is a level playing field and that a disproportionate burden is not imposed on stakeholders. More information on the expected effects and potential impacts can be found in the Annexes.

5.1. Discontinuing existing EU action

This option would result in the removal of all the soft obligations currently contained in the Council Conclusions on scientific information in the digital age, including any implementing measures.

5.1.1. Impacts related to access, re-use and preservation of scientific information

European researchers would have to rely solely on the commitment and resources of their Member States, and on the market, to provide solutions for wider access to, and preservation of, the results of publicly funded research. This would create imbalances between Member States and their scientific communities, given the different speeds and different approaches currently in place. Consequently, the conditions for wider access to scientific information in Europe would diminish. This complexity would have detrimental repercussions on the free movement of scientific information and scientists across the EU.

5.1.2. Economic impact

A discontinuation of EU action would lead to increased problems in the circulation of scientific knowledge. This would hamper the innovation capacity of European industry and have consequences for the development of the European scientific knowledge base. A discontinuation of the policy would increase the risk of uncertainty (as Member States would each go their own way). In this scenario, scientific publishers would have fewer incentives to innovate and adapt their current business models, experiment with new paradigms, and seek alternative sources of revenue.

In the long run, this option would lead to wider fragmentation of the internal market and, probably, an unnecessary multiplication of efforts and costs at all levels. The potential benefits of wider access to scientific information identified in section 1 would not materialise.

5.1.3. Impact on stakeholders

5.1.3.1. Impact on researchers

Given the 'serials-crisis' described in section 2, access to information across Europe would be likely to deteriorate. The ability of researchers to access scientific information would depend on the financial strength of the institution they work for, or of the Member States where they live.

5.1.3.2. Impact on academic libraries

Libraries would be faced with prohibitive price increases in their journal subscriptions, leading to a high rate of subscription cancellation. This would have a knock-on effect on journals/ monographs in the humanities, since these are normally the first to be dropped by librarians in order to accommodate STM content within reduced budgets. Given a lack of European intervention, the opportunity for economies of scale for purchasing content, or to address libraries' concerns about undertaking preservation responsibilities, would be limited.

5.1.3.3. Impact on scientific publishers

Under this option, traditional publishers would continue to pursue business as usual and would not be forced to adapt to the current "open access" environment and to begin the transition process towards new business models and areas of added-value. This option would have a negative impact on the emerging set of open access publishers, who have embraced the concept and are successfully pursuing open access publishing.

5.1.4. Financial impact

This option would have a negative impact on governments/public sector budgets and/or impact negatively on the value for money ratio of public investment in scientific information. Journal prices would continue to increase and economies of scale would not be attained.

5.1.5. Social & environmental impacts

Insufficient circulation of scientific knowledge will hamper the innovation capacity of European industry, as well as the capacity of our researchers to address social challenges. This will, in turn, have negative social and environmental consequences. Wide access to research data in relevant areas could also contribute considerably to better policy making.

5.2. No policy change (baseline scenario)

Under this option, no specific incentive would be given by the EU, meaning that co-ordination among Member States and research funding organisations would not be formally supported at a European level. Co-ordination among national initiatives (in order to avoid redundancy and to enhance European synergies) would rely upon informal, transnational or international networks, rather than European ones. Initiatives demonstrating significant

European added value would continue to be funded under the general framework of EU programmes, without being given specific priority.

5.2.1. Impacts related to access, re-use and preservation of scientific information

There is a significant risk that, in the short term, the baseline scenario would discourage some Member States from moving forward with open access, and that it would result in them adopting a "wait and see" approach. As developments at national or regional level are based upon a variety of considerations and criteria, European researchers would have to continue to cope with uncertainty and unpredictability in their working environment. Under this option, current access to, and preservation of, scientific information would remain unchanged, as described previously. European researchers would have to rely solely on the commitment and resources of their Member States, and on the market, to provide solutions for wider access to and preservation of the results of publicly funded research. This would create imbalances between Member States and their scientific communities, given their different speeds and different approaches in this field. Consequently, the conditions fostering wider access to scientific information Europe would diminish.

5.2.2. Economic impact

In this scenario, the current problems in the circulation of scientific knowledge would continue to exist, and probably be exacerbated by the effects of the economic crisis. This would hamper the innovation capacity of European industry and have consequences for the development of the European scientific knowledge base.

An additional risk of the baseline scenario is that of increased fragmentation of the internal market as researchers face increasingly divergent national regimes.

The consequence in terms of loss of consumer welfare and the economy-at-large due to missed opportunities arising from wider access to, and re-use of, publicly funded scientific research publications, can been estimated at up to €1.8 billion.[109]

5.2.3. Impact on stakeholders:

5.2.3.1. Impact on researchers

Given the 'serials-crisis' described in section 2, access to information across Europe would be likely to deteriorate considerably. The ability of researchers to access scientific information would depend on the financial strength of their employer and Member State.

5.2.3.2. Impact on academic libraries

Libraries would find themselves unable to cope with price rises to their journal subscriptions, leading to subscription cancellations. This would have a knock-on effect on journals/ monographs in the humanities, since these are normally the first to be dropped by librarians in order to accommodate STM content within reduced budgets.

109 See reference in footnote 113.

5.2.3.3. Impact on scientific publishers

Under this option traditional publishers would continue to pursue business as usual and would not need to adapt quickly to the current environment, and speed up the transition process. This option would have a negative impact on the emerging set of open access publishers who have embraced the concept and are successfully pursuing open access publishing.

5.2.4. Financial impact

The financial impact of the baseline scenario would be neutral in the short term, but in the medium term it would lead to a suboptimal value for money ratio of public investment in access to scientific information.

5.2.5. Social & environmental impacts

Insufficient circulation of scientific knowledge will hamper the innovation capacity of European industry, as well as the capacity of our researchers to address societal challenges. This will have negative societal and environmental consequences. Wide access to research data in relevant areas can also considerably contribute to better policy making..

5.3. Implementation of a policy framework by a Recommendation to Member States

Improving access to scientific publications has been the focus of the debate on improving access to scientific information. It also has triggered controversy. A considerable number of scientists feel uneasy about the contrast between flat or shrinking library budgets on the one hand, and the impressive profit margins of big players in the scientific publishing industry on the other. Publishers for their part feel that their business model is under pressure depending on the form of open access applied to publications. Access to research data and preservation of both publications of data on the other hand, are largely uncontroversial subjects.

5.3.1. Implementation in relation to scientific publications

5.3.1.1. General impact: Better access to scientific publications and wider economic benefits

The proposed policy framework would lead to better access to scientific information regardless what model – Green or Gold OA – will be applied.

A 2010 study[110] showed that roughly 20% of peer-reviewed **articles** published in 2008 were openly accessible for free. Simulations suggest that, with the implementation of Gold OA, there would be a considerable uptake of OA publishing.[111] This is particularly important for researchers affiliated to less well-endowed institutions.

In addition, another study demonstrates that a self-archiving mandate would likely increase the percentage of papers made OA.[112]

Open access to research results could have a considerable economic impact.

110 http://www.plosone.org/article/info:doi/10.1371/journal.pone.0011273

111 See figure 8 in annex I.

112 See figure 6 in annex I with reference to the study.

Research[113] has been undertaken to estimate the economic benefits derived from open access to research publications. The potential economic impacts can be estimated in detail using a modified Solow-Swan model.[114] Based on conservative assumptions made by the authors, the model suggests that, assuming a 20% return on R&D, a 5% increase in accessibility and efficiency due to open access policies would result in annual gains of EUR 4.8 billion for Gross Domestic Expenditures on R&D, and EUR 1.8 billion for government and higher education expenditures on R&D for the EU27.[115] This suggests that permanent increases in accessibility and efficiency due to open access publishing can be converted to recurrent growth rates. The author's of the report have had to respond to criticisms of their research methodology.[116]

5.3.1.2. Specific impacts on stakeholders

The policy framework sets a number of objectives, but allows freedom in terms of implementation at national level. Currently, two main models of OA provision are being implemented,[117] and any future open access policy in MS is likely to consist of a combination of both of them. MS are particularly likely to mix elements of Green and Gold OA in order to respond to the specificities of different academic disciplines. The policy framework also aims to allow for the development of future alternative OA models.[118]

The impacts of the combination of elements from the Green and the Gold OA models can be described along a continuum – with exclusively Green OA, and exclusively Gold OA at either end:

113 Houghton and Sheehan, The Economic Impact of Enhanced Access to Research Findings, 2006, available at: http://www.cfses.com/documents/wp23.pdf; see Houghton, Open Access – What are the economic benefits? A comparison of the United Kingdom, Netherlands and Denmark 2009, available at http://www.knowledge-exchange.info/Default.aspx?ID=316; Houghton/Sheehan, Economic implications of Alternative Scholarly Publishing Models: Exploring the Costs and Benefits, 2009, available at: http://www.jisc.ac.uk/media/documents/publications/rpteconomicoapublishing.pdf.

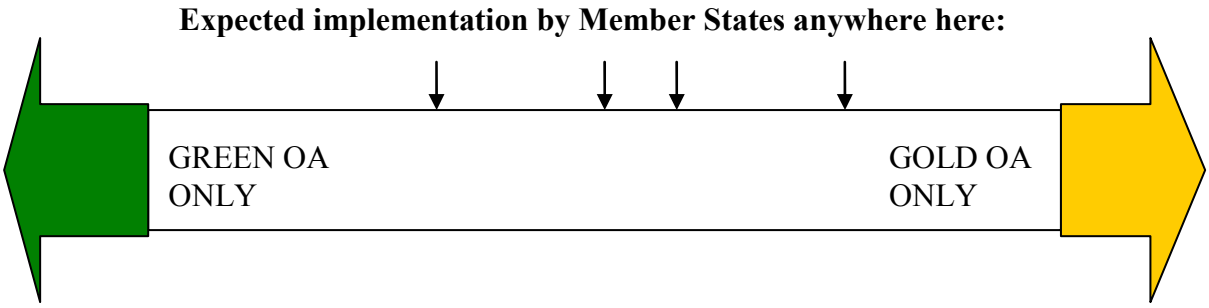
114 see Houghton and Sheehan, 2009; This methodology allows estimating the increase in returns to R&D due to increases in accessibility and efficiency arising from open access policies. This model provides estimates on total annual gains resulting from one year's R&D expenditure. It gives separate estimates for the (overall) Gross Domestic Expenditure and for public expenditure (government and higher education expenditure) only.

115 Please see the table in Annex 1 on p. 72 for details.

116 For a structured response to the criticism in relation to Houghton/Sheehan, Economic implications of Alternative Scholarly Publishing Models, see: Houghton/Oppenheim, Widening Access to research information: A response, 2010, available at: http://www.cfses.com/EI-ASPM/Comments-on-Hall%28Houghton&Oppenheim%29.pdf.

117 See above on the green and gold models.

118 One such additional option are the so-called national licensing schemes, which is some kind of 'big deal' negotiated at the national level by the government or a central research funding organisation.



Ideally the policy framework examines the impacts on stakeholders carefully at each step of the implementation of the policy framework, mainly the publishers.

Any analysis of the potential impacts of the implementation of a mixture of the two models needs to examine the impacts of the two extreme cases:

– Main implementation of the policy framework by applying Gold OA

– Main implementation of the policy framework by applying Green OA.

Main implementation of the policy framework by applying Gold OA

Gold OA is the model in which the costs of publishing are covered by authors (in practice, usually by the funding bodies supporting them) or other sources (e.g. sponsorship), rather than by subscription-paying readers. This type of publishing is also referred to as the 'author pays' model.

International context

In this sense, one could argue that governmental investment in OA in the EU would be inefficient or wasteful, as it would produce unintended positive effects in third countries.

In this respect, it must be underlined that the move towards open access is a global one. Other major economies such as the US, Brazil, Canada, Australia and China[119] are also promoting open access. The National Institutes of Health (NIH) in the US – the biggest funder of medical research worldwide – mandates open access publishing. A study[120] conducted in order to estimate the positive and negative economic impacts of the open access mandating policy of the NIH shows that almost two thirds of the estimated potential incremental benefits of the mandating policy accrues in the US itself, with just a third spilling over to other countries.

It can thus be concluded that, while it should be expected that positive effects would be felt outside the EU, it would be EU states who would be the greatest beneficiaries of the proposed policy framework. The unintended positive effects elsewhere are worth accepting as a trade-off.

119 See on China: http://english.cas.cn/Ne/CASE/201011/t20101104_60928.shtml

120 Houghton/ Sheehan, Economic and Social Returns on Investment in Open Archiving Publicly Funded Research Outputs, 2010, p. 8; available at http://www.arl.org/sparc/bm~doc/vufrpaa.pdf

Other reports point to the adverse effects of not implementing open access policies in the EU. They suggest that Europe risks losing out, should its research publications not be made open access. The "Study on the economic and technical evolution of the scientific publication markets in Europe," carried out for the Commission in 2006 remarks that "[a]s an increasing volume of high-quality research output from outside Europe becomes openly accessible, it raises the question of the visibility and accessibility, and of the subsequent potential impact, of European research, as most articles by European researchers are published in subscription-based journals."[121] This suggests that going OA is indispensible if Europe wants to maintain the high level academic and research prestige that it enjoys today. Without securing visibility for its publications within the global academic community, Europe risks falling behind in innovation, and reducing the competitiveness of its largely R&D-based economic activity.

Impacts on governments and research funding organisations:

Under an author-pays system, publication costs accrue in the country funding the research. Research-intensive countries might therefore be expected to face a disproportionate financial impact in comparison to less-research intensive countries, who would be largely consuming the output of research.

Available studies suggest, however, that moving to a full Gold OA approach would generate substantial savings for all MS, including research-intensive ones. The study 'Open Access – What are the economic benefits?'[122] concluded that even a research-intensive country like the UK could be expected to enjoy annual savings of around € 480 million. The same study estimated the expected savings for similarly research-intensive countries at € 133 million for the Netherlands and around € 80 million for Denmark. Such studies have been highly influential in policy development in the UK.[123]

Total costs for covering publication costs are expected to remain below 1% of total R&D spending. The intended tripling of the number of articles available in open access from a current 20% to 60% of the total of those resulting from publicly funded research together with an expected increase of the proportion of articles available in Gold OA as of the total OA articles (from 40% to 50%) may raise the amount of articles available in Gold OA to 30% of total article output. In terms of the costs attached to it, this would result in a cost in the order of 0.2% of gross R&D spending for a research-intensive country like the UK.[124] For the EU27

121 At p. 66; study available at http://ec.europa.eu/research/science-society/pdf/scientific-publication-study_en.pdf

122 Houghton, Open Access – What are the economic benefits? A comparison of the United Kingdom, Netherlands and Denmark, 2009, available at: http://www.knowledge-exchange.info/Default.aspx?ID=316;

123 See the UK Innovation and Research Strategy for Growth, published in December 2011, available at: http://www.bis.gov.uk/assets/biscore/innovation/docs/i/11-1387-innovation-and-research-strategy-for-growth.pdf

124 Based on the calculation by Robert Kiley from the UK Wellcome Trust in http://blogs.nature.com/news/2012/05/key-questions-in-the-uks-shift-to-open-access-research.html: 120,000 articles published in the UK; the average article processing costs set at € 1,925; the Gross UK R&D spending data taken from the Office for National Statistics (http://www.ons.gov.uk/ons/rel/rdit1/gross-domestic-expenditure-on-research-and-development/2010/stb-gerd-2010.html): € 31.8bn.

this would result in a similar number even when compared to public R&D spending only (0.31%).[125]

Some uncertainty remains as regards how article processing charges, i.e. the costs paid for by research funders, would evolve, and how they could be kept under control. Research funders would need to set fixed-price caps for refundable publishing costs.

There is also a risk that overall public spending on scientific publications may rise if publishers of 'hybrid' journals[126] do not decrease journal subscription prices in proportion to revenue increases from author-pays fees. Research funding organisations need to ask publishers to establish a plan to make reductions (in the following subscription year) to subscription prices, based on the number of open access articles in the journals they publish, as the Oxford University Press and the American Institute of Physics have done.[127]

From a public policy point of view, there is an immaterial benefit resulting from the fact that the scientific publication system continues to operate on the basis of the traditional scientific journal, a tested dissemination channel.

Academic institutions (including their libraries):

A move towards open access journals as the basis for disseminating research outputs is expected to bring economic benefits for academic institutions. The most research-intensive universities, however, may face additional costs under certain circumstances.

The 2010 report by Alma Swan, 'Modelling Scholarly Communication Options: Costs and Benefits For Universities,'[128] examines potential savings in relation to the level of article processing charges (APC). It suggests that there would be savings for all universities when the APC is GBP 700 per article, or lower. Assuming an APC of above GBP 700, but under GBP 1000, there would be benefits for all but the most research-intensive universities. Savings for three out of the four universities examined in the study, range from GBP 0.17 million to GBP 1.4 million per annum, while the most research-intensive university studied would face extra costs of around GBP 1.86 million per annum.

This suggests that, under this scenario, research-intensive academic institutions would need additional institutional or research-specific funding. The determination of the UK government to push for open access despite these findings, as referred to above, should be noted.[129]

Researchers:

Researchers will benefit from wider access to scientific publications in two ways. Firstly, they will have better access to publications as readers.

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125 On the basis of 2008 figures: 469478 articles published (source: http://ec.europa.eu/research/innovation-union/pdf/competitiveness-report/2011/data-and-statistics/key_indicators_summary_table.xls) at an average article processing costs set at € 1,925; total public EU R&D spending of € 87275m (source as above)

126 Journals that have both subscription-based and Gold OA content.

127 OUP reduced its subscription fees depending on the uptake and income from Gold OA, see: http://www.openoasis.org/index.php?option=com_content&view=article&id=265&catid=79&Itemid=316

128 http://ie-repository.jisc.ac.uk/442/2/Modelling_scholarly_communication_report_final1.pdf

129 Please see reference in footnote 110.

Secondly, open access increases the visibility of researchers as authors. OA publications are read by a wider audience than publications in traditional subscription-based journals. This increased visibility can be measured by the citation impacts of papers published in OA. Statistics suggest that the citation impact doubles, when compared to a comparable paper published in a subscription based journal alone.[130]

The Gold OA model presents little burden and low risk. Existing journals would keep their reputations and continue to serve as a means of dissemination, without any major structural changes.

The policy framework recommends the adaptation of career reward mechanisms, and the research grant system, in a way that supports and rewards researchers for OA publishing.

Publishers:

Scientific publishers appear to be relatively comfortable with a move towards 'Gold' Open Access for publications, as it would only require a change in funding patterns and is seen as a sustainable business model.[131]

They have concerns about how to avoid additional burdens in revenue collection. Publishers may not wish to interact with each author individually, preferring to deal with a small number of interlocutors. This concern can be addressed either by centralising the reimbursement of author publication fees in research funding organisations, or by using micropayment services like PayPal or Klarna.

Business/ SMEs:

Businesses would have better access to scientific publications. The benefits of this have been described in a Danish study, which suggested the lack of sufficient access to research results in an average loss of 2.2 years in innovation progress for SMEs.[132] Conversely, better access would lead to a corresponding gain in innovation capacity.

Policy-makers:

Policy-makers would benefit from improved access to scientific research publications to support evidence-based policy-making.

Individual citizens:

Citizens would have better access to scientific publications. With e-journals now being the rule, they could access content directly from their homes.

130 See table 6 in annex I.

131 www.stm-assoc.org/2011_05_30_STM_Mabe_Statement_Public_Hearing_Luxembourg.pdf; see the examples given in the Annex.

132 http://www.fi.dk/publikationer/2011/adgang-til-forskningsresultater-og-teknisk-information-i-danmark

Main implementation of the policy framework by applying Green OA

Green OA refers to the practice of self-archiving, i.e. the practice of authors or their institutions of depositing peer-reviewed articles in either institutional or subject-based online repositories. Peer-reviewed manuscripts can take the form of either a final published article (the publisher's final version of record, including all modifications from the peer review process, copyediting and stylistic edits, and formatting changes – usually a PDF document) or a final peer-reviewed article (including all modifications from the peer review process but not yet formatted by the publisher and thus without citable page numbers – also referred to as post-print version).

Governments and research funding organisations:

Governments and research funding organisations are expected to save money with a move to Green OA. The Houghton report, cited above,[133] estimates potential savings of EUR 30 million p.a. for Denmark, EUR 50 million in the Netherlands, and EUR 125 million in the UK. The difference in savings compared to the Gold OA model can be explained by the fact that there are no subscription-costs, and there are additional savings in library handling costs. Articles would continue to be published first in subscription-based journals with citable page numbers, and to go through the associated peer-review process.

Academic institutions (including their libraries):

Academic institutions are expected to make savings under the Green OA model. The study mentioned above[134] highlights that savings resulting from increased efficiencies in the research and library handling processes would range from GBP 0.1 million to GBP 1.32 million per annum.

Academic institutions are expected to benefit in terms of increased visibility and presence on the Internet for their research,[135] and the resulting increased research impact factor.

Researchers:

Researchers will benefit from wider access to scientific publications in two ways. Firstly, they will have better access to publications as readers.

Secondly, open access increases the visibility of researchers as authors.

Concerns[136] about the lack of prestige for publications in a repository are unfounded. Self-archiving is just one additional channel of dissemination after the article has been published in a traditional journal. Articles are only made available online after the applicable embargo

133 Houghton, Open Access – What are the economic benefits? A comparison of the United Kingdom, Netherlands and Denmark, 2009, available at: http://www.knowledge-exchange.info/Default.aspx?ID=316, at page III.

134 A. Swan, 'Modelling Scholarly Communication Options: Costs and Benefits For Universities', available at: http://ie-repository.jisc.ac.uk/442/2/Modelling_scholarly_communication_report_final1.pdf

135 http://www.openoasis.org/index.php?option=com_content&view=article&id=142&Itemid=264

136 Please see the discussion on page 20

period has expired. This means that the prestige attached to publishing in high-reputation journals will remain.[137]

The policy framework recommends the adaptation of career reward mechanisms and of the system of attribution of research grants in a way to support and reward publishing OA by researchers.

Publishers:

Publishers are concerned that the widespread implementation of mandates requiring delayed open access to final published versions of articles, with short embargo periods and/or not accompanied by sponsorship, could lead libraries to cancel subscriptions. They argue that this would undermine subscription-based peer review journals, and, ultimately, their business model. This concerns both traditional for-profit publishers and learned societies that publish subscription-based journals. Learned societies are as such not-for-profit organisations. Their publication activities are profit-oriented, however, in order to raise revenue for cross-subsidising other activities of the society. Open Access publishers are not concerned by Green OA. They only publish under the Gold OA model.

The impact of Green Open Access on journal subscriptions depends on two factors:

- The **length of the embargo period**: the factor which give the publisher time in which to recoup their investment.
- The **difference between the version of the article** in the repository and the final published version of the article.
- The trade-offs in the implementation of Green OA in terms of both the length of the embargo, and the version that will be archived in the repository, are summarised in this graph:

137 Other disciplines that rely predominantly on self-archiving in repositories like ArXiv apparently do not have a concern about the lack of reputation attached to self-archiving.

Trade-offs:
Length of embargo periods/
Quality of the version in repository

The **shorter** the embargo period/ the closer the version of the article is to the final published article – the **higher** is the	
positive impact in terms of quick access on	**negative** impact in terms of potential loss of revenue on
Researchers	Publishers
Business/SME	
Citizens	

The **longer** the embargo period/ the greater the difference between the version in the repository compared to the final published article – the **lower** is the	
positive impact in terms of quick access on	**negative** impact in terms of potential loss of revenue on
Researchers	Publishers
Business/SME	
Citizens	

A survey of librarians has suggested that libraries may cancel subscriptions if embargo periods are too short.[138] This issue is currently being addressed by the EC-funded PEER project. The publishing industry is conducting research of its own on the impact of Green OA on journal subscriptions.[139] Industry representatives have also reported that there are a considerable number of smaller scientific publishers and learned societies operating at single-digit profit margins that would be hit by even small losses in terms of revenue from Green OA.[140]

However, there is currently not yet enough solid evidence on a correlation between delayed Open Access and subscription cancellations:

- Publishers appear to have adjusted to the twelve-month embargo period required by the US National Institutes of Health (NIH) without a significant loss of subscriptions[141].

138 http://www.publishingresearch.net/documents/Self-archiving_summary2.pdf

139 Elsevier in a meeting with the authors reported that it conducts ongoing Green OA publishing experiments in the Netherlands and in Brazil in the area of biomedical journals in order to see impacts on journal subscriptions. No conclusions could be drawn yet.

140 M. Mabe and B. Kalumenos of the International Association of Scientific, Technical and Medical Publishers speaking with the authors.

141 http://listserv.crl.edu/wa.exe?A2=ind1201&L=LIBLICENSE-L&F=&S=&P=64840

- Publishers appear to have likewise adjusted to the six-month embargo period in place under the OA pilot in the EU's FP7 for all sciences except for social sciences and humanities where the embargo period is twelve months.

- In spite of the uptake of Open Access publishing, including more than 200 Open Access mandates worldwide, the profit and margins of scientific publishers have remained healthy over recent years.[142]

There is a concern that the proposed policy framework creates adverse effects also outside the EU on publishers established in third countries. This is inevitable given the global nature of the publishing industry that does to a large extent attract an international authorship and is therefore indeed subject to different conditions imposed by research funders. The concern disregards however that there is an international trend towards Open Access policies[143] and consequently a move also on the side of publishers to accommodate these policies by offering OA publishing options or by consenting to self-archiving.

Business/ SMEs:

Business would be better off with increased access to scientific publications, in particular, if the articles were available in easily searchable online repositories.

The benefits have been described in a Danish study, which suggested the lack of sufficient access to research results in an average loss of 2.2 years in innovation progress for SMEs.[144] Conversely, better access would lead to a corresponding gain in innovation capacity.

Individual citizens:

Citizens would have better access to scientific publications. Repositories could be easily searched online.

Comparison / trade-offs between Green and Gold OA

Benefits/ costs analysis

A study undertaken for the UK assesses the cost and benefits of open access to research publications.[145] It concludes that both the Green and Gold open access avenues have positive benefit/cost ratios. In the case of Green OA the benefit/ cost ratio ranged from 4.7 to 8.6, for the Gold OA model it ranges from 1.7 to 15.7.[146] The large divergence in the numbers relating to the Gold OA can be explained by two different article processing charges assumed for the analysis. The report actually distinguishes two 'Gold' scenarios.[147]

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142 http://pages.cmns.sfu.ca/heather-morrison/chapter-two-scholarly-communication-in-crisis/

143 See analysis on page 36.

144 http://www.fi.dk/publikationer/2011/adgang-til-forskningsresultater-og-teknisk-information-i-danmark

145 Heading for the open road: costs and benefits of transitions in scholarly communications, 2011, available at: http://www.rin.ac.uk/our-work/communicating-and-disseminating-research/heading-open-road-costs-and-benefits-transitions; please see the Annex I for details.

146 The numbers are to be read as meaning that the benefits outweigh the costs by the factor mentioned.

147 Please see annex I for details.

The study indicates that the best policy option to pursue options is likely to be a mixture of Green and Gold OA.

Since the infrastructure of repositories is already well developed in the country studied (the UK), Green OA would offer a cost-effective means of increasing access. This would hold true also for a large number of MS,[148] and all MS are expected to set up such repositories in any event for preservation purposes. However, it comes with risks to the current scholarly dissemination system, and may not be self-sustainable. Gold OA, on the other hand, involves higher costs, but has the advantage of its underlying sustainability. The study suggests that the best policy option to pursue is likely to be a mixture of Green and Gold OA. It recommends encouraging "the use of the existing green infrastructure (whose costs are largely sunk)" since it appears capable of providing increases in access comparable to or greater than other scenarios, one main reason being that the infrastructure for self-archiving is built. It continues to recommend to be "cautious about pushing for reductions in embargo periods to the point where the sustainability of the underlying publishing model is put at risk"; in parallel, to work to facilitate a transition to 'gold OA' (in specific disciplines first) provided that (i) the average level of APCs remain at or below GBP1,995; (ii) the proportion of articles funded through APCs moves broadly in line with global rates".[149]

Risks attached to the scenarios

In terms of the **risks** attached to the two scenarios, the study distinguishes between risks to the scientific dissemination system, mainly the impacts on the subscription-based journal business model, and risks attached to the transition from the status quo to any of the three open access scenarios:

Scenario	**Risk to scientific dissemination system**	**Transition risk**
Green	**Higher risk.** Greater potential for Green OA to undermine the business model on which it relies, if it leads to significant subscription cancellations.	**Medium risk.** Although many[150] academic institutions already have repositories, a significant shift in culture and practice is required amongst authors. Although this should be achievable, it requires significant impetus from funders and academic institutions.

148 Please see the table in Annex V.

149 Idem at p. 13.

150 See Annex V

Gold	**Lower risk.** Gold is considered a low risk scenario, since it provides an alternative to the subscription-based publishing business model.	**Medium risk.** There is a series of significant challenges in a transition to Gold OA. These include (for funders and academic research institutions) getting money in the right place; and (for publishers) adjusting their business models and cost structures. There are also risks associated with the distribution of costs in the transition, with a greater potential burden on research-intensive institutions.

Table 2: Risks by OA scenario

Source: Heading for the open road: costs and benefits of transitions in scholarly communications[151]

5.3.2. Implementation in relation to open access to research data

The survey done by the PARSE-Insight project[152] shows that only 25% of researchers share their research data openly, only 11% make it available for researchers within their research discipline and 58% make it available within their specific research group. With a sustained effort on the part of Member States and research funding bodies, the number of researchers sharing their data openly could easily triple in a timeframe of 5 years, resulting in benefits for both science and the economy.

Open access to research data has consequences essentially for three (groups of) stakeholders:

Governments/ research funding organisations/ academic institutions

Implementing open access to research data requires the governmental level/ public budget to fund up and providing sustainable funding for e-infrastructures. This will happen through the intervention of intermediaries, such as e.g. university libraries responsible for setting up e-infrastructures at their level, or nation-wide institutions, depending on the size and the structure of each MS.

Scientific publishers

Scientific publishers have declared themselves comfortable with open access to raw research data.[153] In fact, publishers currently develop ways to interlink datasets in existing data repositories with the electronic version of the published article.

151 See footnote 129, at page 42.

152 http://www.parse-insight.eu/downloads/PARSE-Insight_D3-4_SurveyReport_final_hq.pdf

153 See the 'Brussels declaration' of the Association of Scientific, Technical & Medical Publishers (stm), available at http://www.stm-assoc.org/brussels-declaration/

Researchers/ Business/ individual citizens

These are the principal beneficiaries of open access to raw research data. While it might be assumed that researchers are the group likely to be able to make the best use of raw data, the hidden potential of businesses and individual citizens in this area should not be underestimated.

Researchers would be able to test hypotheses on other existing data sets, without the need to collect the same, or similar, data themselves.

Researchers depositing 'their' data may feel that they are being forced to 'give away' data without having extracted all of its publication value. However, they need to understand that they received public money to perform research in terms of one or several specific hypotheses. They cannot, therefore, claim eternal ownership of the data beyond the execution of the research they received the grant for.

In view of the fact that voluntary compliance by researchers is an issue, the policy framework provides them with career incentives and asks research funding organisations to take past compliance with data deposit requirements into account when awarding new research grants.

5.3.3. Implementation in relation to preservation

The impact in relation to preservation produce essentially at two ends:

The governmental level/ public budget has to fund any preservation effort, including the formulation of policy, setting up and providing sustainable funding for e-infrastructures and ensuring the long-term curation of the content. This will happen through the intervention of intermediaries, such as e.g. university libraries responsible for setting up e-infrastructures at their level, or nation-wide institutions, depending on the size and the structure of each MS.

The cost factor is not only relevant for access to scientific information, but also for its **preservation**. Preservation activities are costly, but the investment pays for itself over time. A cost/benefit analysis of the preservation of research data, undertaken by the UK research funding organisation JISC, found that preservation efforts lead to a **fourfold return in terms of cost saving alone**.[154]

At the user end, that is, for researcher's, business and individual citizens, preservation is cost free, and would only have positive effects.

5.3.4. Effects of scale

The policy framework asks governments/ academic institutions to set up e-infrastructures to provide access to, and preservation of, scientific content. It should be emphasized that such e-infrastructures would cover all three of the aspects described above: They would include publications and data, as well as playing a preservation role.

The three aspects are described here separately is for reasons of clarity. Separate infrastructures would not need to be set up.

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154 http://ie-repository.jisc.ac.uk/279/2/JISC_data_sharing_finalreport.pdf

5.3.5. Conclusion

The proposed policy framework is expected to enhance access to scientific information – regardless of the implementing option pursued by MS. Implementing open access to scientific publications does not only have overall benefits in the order of € 1.8bn as a return on investment in terms of R & D spending, but will also save money to governments and research funding organisations, while maintaining a sustainable system of dissemination of scientific publications for the medium and long term. Those savings depend on the concrete mechanism of ensuring open access. Likewise the precise impacts and risks attached to opening up access to publications depend on way in which OA is assured. Impacts attached to the Green OA model are subject to trade-offs.

Given the non-enforceable nature of a Recommendation it can expected that some objectives will be only partially achieved.

5.4. Approximation of MS legislation

Under this option the policy framework described under option 3 would be implemented through an approximation of MS legislation. The potential impacts are therefore largely the same as those described under point 5.3. Under this option, a certain coherence of policies and practices across the EU in terms of access to, and preservation of, scientific information, would be achieved through hard legislation. Some Member States[155] already have, for example, legislative provisions mandating open access to research results. A Directive would unify these provisions and introduce them where they do not exist so far. The binding force of the measure would make it more efficient. However, considerations of subsidiarity and proportionality may mean that only a very shallow level of harmonisation can be achieved.

This option has the disadvantage that legislative provisions are more rigid, and harder to repeal, – in particular when based on a Directive - should the policy produce unwanted effects.

The legislative process takes time, both at European and national level. Based on current experience, a minimum of 3 years has to be counted from the presentation of the legislative draft to the end of the implementation period in Member States. During this process, stakeholders may adopt a wait-and-see mentality and stop moving forward with their current OA and preservation efforts.

5.5. Comparison of the policy options

The table below provides a summary of main likely impacts and risks (with respect to the different economic and social dimensions) arising from the policy options described. The signs represent a scale of possible impacts vis-à-vis the "no change scenario": + positive impact**,** O neutral impact, − negative impact (using option 2 as a baseline).

155 Spain, Lithuania

IMPACTS AND RISKS	Option 1 Discontinuing existing EU action	Option 2 No policy change	Option 3 Policy framework implemented through a Communication and Recommendation to Member States	Option 4 Approximation of MS laws
SPECIFIC ACCESS, RE-USE AND PRESERVATION ISSUES				
Access to and re-use of scientific information	**–** Unfavourable conditions due to discontinuation of existing EU action	**O** No change	**+ +** Increase of favourable conditions for access and re-use through alignment of MS policies with clear targets	**+ +** Increase of favourable conditions for access and re-use through alignment of MS policies with clear targets
Preservation of scientific content	**–** Unfavourable conditions due to discontinuation of existing EU action	**O** No change	**+ +** Increase of favourable conditions through alignment of MS policies	**+ +** Increase of favourable conditions through alignment of MS policies
Transparency	**–** Unfavourable conditions due to discontinuation of existing EU action	**O** No change	**+** Improved transparency (e.g. outputs of publicly funded research)	**+** Improved transparency (e.g. outputs of publicly funded research)
Costs and benefits for re-searchers/citizens	**–** Direct /indirect increase of costs	**O** No change	**++** Trigger wider accessibility and availability of scientific content at lower costs; gain to consumer welfare and economy at large from wider access and re-use of scientific content	**++** Trigger wider accessibility and availability of scientific content at lower costs; gain to consumer welfare and economy at large from wider access and re-use of scientific content

Administrative burden on public bodies	**+ –** Removal of administrative burden of compliance with current EU practices	**O** No change	**+ –** Limited burden, flexible approach, implementation of the policy framework at the stakeholder level; increase in order to improve/put in place a framework	**– –** Increased burden in order to implement a new EU regulatory framework through legislative measures
Legal certainty	**–** Legal uncertainty about practices at national level (e.g. embargo periods, preservation)	**O**	**+** Legal certainty improved by the introduction of EU guidance/recommendations	**+ +** High degree of legal certainty ensured by approximation of MS legislation
Speed of implementation	**– –** Increase of legal uncertainty for access to and re-use possibilities and conditions for the availability of scientific information	No change	**+ +** Policy framework is ready for implementation as of adoption; implementation in MS possible by 2014	**– –** Postponement of positive effects of the policy framework due to the length of the legislative process and the transposition period
ECONOMIC ISSUES				
Scientific publishers and competition	**–** Legal uncertainty and regulatory unpredictability due to MS's flexibility to define rules governing access and re-use; no impact on competition	**O** No change	**+** EU guidance/recommendations e.g. on OA and licensing conditions would provide incentives for new entrants to consider entering/developing the market; Stimulation of competition among publishers (adaptation of business models, reduction of margin etc.)	**– –** An approximation of laws risks to represent a more rigid regulatory framework that would stifle competition in a dynamic and versatile industry already in a transition phase
Investment and	**–**	**O**	**+**	**+**

Innovation	Legal uncertainty and regulatory unpredictability; negative impact on incentives for innovation and investment	No change	Soft law measures stimulate the promotion of innovation and attract investment	A legal framework sets an environment for innovation and investment
Internal Market	**– –** Increased fragmentation of internal market due to divergent national regimen	**O** No change	**+** Soft law measures stimulate a natural convergence on the internal market	**+** A legal framework imposes on the market a greater harmonisation of rules and approaches between MS; resistance can be opposed
SOCIAL ISSUES				
Citizen empowerment/ public accountability	**– –** Increase of legal uncertainty and regulatory unpredictability	**O** No change	**+** Openness and governmental transparency	**+** Openness and governmental transparency
Employment and labour market	**O** No change	**O** No change	**+** Stimulation in line with EU's growth strategy Europe 2020 yet effects not noticeable in the short term	**+** Stimulation in line with EU's growth strategy Europe 2020 yet effects not noticeable in the short term
ENVIRONMENTAL ISSUES				
Environmental Impacts	**–** Reduced access to environmental scientific information leads to less well informed policy decisions	**O** No change	**+** Improved access to environmental scientific information leads to better informed policy decisions	**+** Improved access to environmental scientific information leads to better informed policy decisions

5.6. Evaluation of the administrative burden

The preferred policy option allows Member States to develop open access policies along different routes.

The burden will vary depending on the route chosen by each Member State. It will vary among Member States and by research activity, according to how research funding is organised at present. The question of whether there is an extra administrative burden also depends on whether the proposed policy has already been implemented, as is the case in many Member States, and in many institutions.

As for "green OA", the US experience suggests that the additional administrative burden would be reasonably small. The Department of Health and Human Services reports that "[a]nnual operating costs for [implementing the National Institute of Health - NIH - policy], including ingest of articles, refinement of the submission system and search tools, staffing of a help desk and a central coordinating office for NIH, are approximately $3.5–$4.0 million per year. This represents a small fraction [about one one-hundredth of 1%] of NIH's budget authority of more than $30 billion per year."[156] Evidence from the NIH policy also suggests that the estimated time taken for researchers to deposit their manuscripts in institutional repositories is only ten minutes.[157]

Introducing appropriate administrative structures for "gold OA" within research organisation often requires training and allocating new staff, which represent inevitable implementation/compliance costs.

There may be initial implementation problems for authors and funders as the new policy is introduced. European research institutes/universities would need to allocate additional resources to ensure greater compliance. This may, however, be more of an issue of a shift in the work of research institutes/universities, and less a question of additional staff.

5.7. Conclusion

The comparison between options indicates that **Option 3** (Implementation of a policy framework through soft law) offers the best balance between enabling wider and quicker access to scientific information, and taking into account how science and scholarly publishing have evolved over the past centuries. To mitigate the inherent non-binding character of a recommendation, which per se cannot guarantee that action will be taken by all Member States, a recommendation should foresee a close monitoring role for the Commission. It would not favour any particular open access model. The objective would be to define and move towards convergence, while allowing a certain degree of flexibility for MS to take their national specificities into account within a European framework, as well as for all stakeholders to endorse improvements. In this context, a recommendation would be both a proportionate and effective instrument.

156 http://www.hhs.gov/asl/testify/2010/07/t20100729c.html

157 http://www.hhs.gov/asl/testify/2010/07/t20100729c.html

6. MONITORING AND EVALUATION

A monitoring and evaluation system would be put in place to monitor the implementation of the Recommendation and assess the extent to which the objectives are met.

6.1. Continuous monitoring

The Commission would ensure the overall co-ordination of this action.

The core indicators of progress towards meeting the identified objectives would be undertaken under the context of the ERA framework with periodic reports from Member States on the implementation of the Recommendation. This would not require many more resources than those used presently to monitor the Council Conclusions on scientific information in the digital age.

The establishment of an expert group in the context of policy work leading towards the ERA is also envisaged. It would meet on a regular basis to address specific issues in the area of access to, and preservation of, scientific information.

In addition, the Commission has recently launched a call for tender for the development of a set of indicators to measure the growth of open access from 2000 onwards within the ERA and beyond[158]. The following indicators, which may be refined depending on the outcome of the tender, give examples of how to allow to measure progress in access to and preservation of, scientific information in Europe: number and mandatory content of national OA policies; number and mandatory content of research institutions/universities with an OA mandate; number of repositories developed in Europe; nature and volume of content in repositories; length and nature of embargo periods; compliance rates of OA mandates by researchers; level of access (number of downloads of articles); number of research institutions/universities supporting OA journals (willingness to pay publication fees); number and mandatory content of research institutions/universities with OA policies to data (datasets policy or statement on access to and maintenance of research data); and number of research institutions/universities requiring data management plans (requirement to consider data creation, management or sharing in the grant application) etc.

6.2. Evaluation

Two years after the adoption of the proposed Recommendation, an evaluation would be carried out by a panel of experts reporting to the MS and the Commission in order to assess:

- The uptake and implementation of specific recommendations;
- To what extent the Recommendation has contributed towards its objective of improving access to and preservation of scientific information;
- The need to review or adapt the framework in place.

On that basis the Commission will analyse the need to take further action.

158 http://ted.europa.eu/udl?uri=TED:NOTICE:291163-2011:TEXT:EN:HTML&tabId=1#id11521708-II

Annex 1: Main aspects of the scientific information system

(1) Why is dissemination of results important for research and innovation?

In the information economy, knowledge is the primary raw material and source of value, and is therefore a source of competitive advantage. For this reason, it is politically and economically crucial that there is wide and speedy access to scientific information.

There are a wide range of benefits to be gained from improving access to scientific information and ensuring its sustainable long-term preservation. These include: the acceleration of the research and discovery process, and its quality assessment, leading to increased returns on R&D investment; the avoidance of duplicative research efforts and enhanced opportunities for multi-disciplinary research, as well as inter-institutional and inter-sectorial collaborations. The sharing and exchange of knowledge, both within the scientific community and from research to industry, enables participation by all parts of society. It is particularly beneficial to small and medium-sized enterprises and contributes towards the building of the Innovation Union.

(2) How is scholarly publishing organised?

For historical reasons, there is a reliance on scientific journals as the main channel for the dissemination of scientific knowledge. Scientific journals perform the following functions, which remain the standard in today's scientific world: registration, certification (ensuring quality control through the so-called peer review procedure), dissemination and navigation (providing filters and signposts to relevant work amid all published material). Most researchers seek peer recognition of the results of their research through publication in a renowned journal. In addition, publishing in a high-impact factor scientific journal, rather than any other, may have implications for the career prospects of researchers in terms of tenure, research funding opportunities, and/or consultancy roles. The elements mentioned above are often referred to as the "publish or perish" paradigm.

Researchers participate in the publication process at various levels: Traditionally they have volunteered to peer-review articles written by fellow researchers on the basis that they will be reviewed themselves. More recently publishers ask researchers to submit their manuscripts already edited in the prescribed format of the journal in view of reducing the costs of the editing work at the publishers end. In general, researchers receive no royalties for publication of research articles in journals, but only for textbook contributions.

Scientific journals are normally sold to libraries, which represent the large bulk of the revenue of the journals market, whilst individual subscriptions (both personal and membership-based) have been falling for many years. Traditionally, library sales took the form of subscriptions to individual journals. While this is still an important part (currently around half) of the market, journals are increasingly sold as bundles of titles, either directly to libraries or to library consortia. These are the so-called "bundle deals" ("big deals"), in which libraries subscribe to packages of electronic journal titles from publishers at lower cost than the combined subscription price, although "big deals" may include journals that libraries would otherwise not want to subscribe to. This model involves institutional and other subscribers paying for access to bundles of online journals through consortia or site licensing arrangements. Consequently, libraries are reacting by forming consortia to strengthen their bargaining power vis-à-vis publishers and to share resources.

National licensing schemes are one form of "big deal" whereby a national funding organisation negotiates one single-access license for its territory. Traditionally, such licensing schemes have been drawn up in cooperation with academic institutions. However, such schemes may also cover other actors, such as businesses or even every citizen.

In addition, journals also offer a pay-per-view option, whereby one can access a single article for EUR 25-50.

(3) What is the Impact Factor and how is it connected to scholarly publishing?

A researcher is usually ranked according to the number of published articles of which (s)he is the author or a co-author, along with the number of times those articles have been cited in other articles. The results are weighted according to the visibility of the journal in which the article or citation appears (the "Impact Factor"). This mechanism has become increasingly significant in recent years, as it is seen as a simple metric of output and efficiency by research funders. But it has been criticized too, for publishers themselves are usually providers of such services and as more comprehensive, sophisticated metrics are being studied, proposed and developed. The pressure to publish in journals has expanded into disciplines where it has historically not been prevalent, for example to the social sciences, humanities and arts where books and monographs are traditionally more important to researchers' reputations.

(4) What is the economic dimension of scholarly publishing?

Available estimates[159] value the worldwide Science Technical and Medical (STM) publishing market (which includes journals, books, and secondary information services) at USD 16 billion (ca. EUR 11.6 billion). It is estimated that journal sales account for about 50% of the total STM publishing market, with a market value of USD 8 billion in 2008, up by 6-7% compared to 2007. This figure should, however, be interpreted with caution as it does not include non-English language journals in the social sciences, humanities and arts. The total European STM publishing market has an estimated share of 30% of the total international STM publishing market, that is, EUR 4.8 billion in 2008. Using the average of the journals market estimates, this suggests a European STM scholarly journal market value of EUR 2.4 billion in 2008.

There are in the order of 2000 journal publishers, which can be divided into two groups: for-profits (FP) and not-for-profits (NFP), the latter including learned societies and university presses. FP publishers have been the main impetus behind the growth of publishing activity. The main English-language trade and professional associations for journal publishers include 657 publishers which collectively produce around 11,550 journals, that is, about 50% of total journal output by title. Of these, 477 publishers (73%) and 2334 journals (20%) are not-for-profit. There were about 25,400 active scholarly peer-reviewed journals in early 2009, collectively publishing about 1.5 million articles a year. The number of articles published each year and the number of journals grows by 3% and 3.5% per year, respectively.

The scientific publishing industry is characterised by a set of 4 large publishers with a portfolio of up to 2000 journal titles. However, 95% of the some 2000 publishers worldwide publish only one or two journals.[160] In general, scientific publishing remains a solid and

159 www.stm-assoc.org/2009_10_13_MWC_STM_Report.pdf

160 M. Ware/ M. Mabe, The stm report – an overview of scientific and scholarly journal publishing, September 2009, available at: www.stm-assoc.org/2009_10_13_MWC_STM_Report.pdf.

profitable business, despite the economic crisis, the advent of the Internet and the development of new business models and entrants to the market. This is particularly true for the larger publishers. For example, Elsevier, the world's largest publisher of scientific journals, with almost 2000, performed relatively well during the recession. In 2010, it made GBP 724 million (EUR 841 million) on revenues of GBP 2 billion (EUR 2.3 billion) an operating-profit margin of 36%.[161] Similarly, the results of Springer in 2010 were strong, with revenues reaching EUR 866 million and its EBITDA[162] reaching EUR 294 million, representing a 33.9 % return on sales. Brill, a leading publisher in the Arts and Humanities field, reported an operating-profit margin of 18%.[163] The Oxford University Press also presented strong results in March 2011, lead by the solid sales growth of its academic arm.[164]

Journal prices vary widely depending on whether the publisher is FP or NFP, as well as on citation numbers (see Table 3). As a general rule, journals published by FP publishers cost more than journals published by NFP publishers (three times more, on average).

	Cost per page		*Cost per Cite*	
	For-profit	*Not For-profit*	*For-profit*	*Not For-profit*
Ecology	1.01	0.19	0.73	0.05
Economics	0.83	0.17	2.33	0.15
Atmosph. Sci	0.95	0.15	0.88	0.07
Mathematics	0.70	0.27	1.32	0.28
Neuroscience	0.89	0.10	0.23	0.04
Physics	0.63	0.19	0.38	0.05

Table 3: Journal prices by discipline (Source: "The Costs and Benefits of Site Licences to Academic Journals", Proceedings of the National Academy of Sciences, Jan. 04, by C.T. Bergstrom and T.C. Bergstrom)

161 Source: The Economist "Academic Publishing: Of Goats And Headaches - One of the best media businesses is also one of the most resented", 26.05.2011

162 Earnings Before Interest, Taxes, Depreciation and Amortization

163 http://www.brill.nl/files/brill.nl/press_release_brill_annual_results_2011-final-eng.pdf

164 http://fds.oup.com/www.oup.com/pdf/OUP_Annual_Report_2010-11.pdf

(5) What is open access (OA) and where does it come from?

Open access, which refers to the practice of granting instant, free internet access to scientific research (including peer-reviewed journal articles), has two main driving forces: the opportunities brought to the scholarly dissemination system by the advent of the Internet, and the need to resolve the so-called 'serials crisis'.

The explosion of interest and activity in OA journals has occurred largely due to the widespread availability of internet access. It became possible to publish a scholarly article and make it instantly accessible anywhere in the world, separating the fixed cost of production from the minimal marginal cost of online distribution. These new possibilities emerged at a time when the traditional, print-based scholarly journals system was in crisis. While the supply of journals seems to have been satisfactory in the decades before the electronic transition, the 1975-1995 period has been dubbed the 'serials crisis.' It saw a dramatic increase of over 300% above inflation in the price of journals sold by FP publishers, and this before the big technological change of the electronic transition. The price trend was similar for learned societies, though more moderate for university presses (still in the order of 200% above inflation).[165] This 'crisis' has been widely studied.[166] The aim of the OA movement is to maximise research uptake, usage and impact, by making research articles accessible to all potential users, rather than just those whose institutions can afford the subscription. OA to journal articles can be achieved in different ways, with two basic models: a) self-archiving (or Green OA) and b) OA publishing (or Gold OA).

(6) What is Green OA and how is it organised?

Green OA refers mainly to the practice of self-archiving, i.e. the practice of authors or their institutions of depositing peer-reviewed articles in either institutional or subject-based online repositories. Peer-reviewed manuscripts can take the form of either a final published article (the publisher's final version of record, including all modifications from the peer review process, copyediting and stylistic edits, and formatting changes – usually a PDF document) or a final peer-reviewed article (including all modifications from the peer review process but not yet formatted by the publisher and thus without citable page numbers – also referred to as post-print version). In some cases, draft versions of the paper that have not yet undergone the peer-review process are (also referred to as the preprint version) deposited. This practice has the major disadvantage: Readers essentially seek to have access to the final published article as it is both peer-reviewed and has got citable page numbers.[167] Many publishers maintain that public research funding grants do not cover more than the author's manuscript and that the value they add to the subsequent versions, essentially the final published version, are not covered by this. This is why publishers have no difficulty with self-archiving of the author's pre-print manuscript.[168]

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165 http://ec.europa.eu/research/science-society/pdf/scientific-publication-study_en.pdf

166 Cummings et al. (1992)

167 See PEER Behavioural Research: Authors and Users vis-à-vis Journals and Repositories – Final Report, available at: http://www.peerproject.eu/fileadmin/media/reports/PEER_D4_final_report_29SEPT11.pdf, at pages 16 et seq.; this does not exclude that researchers use a pre-version of the final article when writing a paper to see the papers relevance or use a pre-version while the final version is in the publication process.

168 Some accept the publication of an accepted or peer-reviewed version on the author's webpage (not in a repository as this would make structured searches for the version easily possible) in order to attract readers to the final published version.

A database of publisher self-archiving policies is maintained by the SHERPA/RoMEO project.[169] Of the 997 publishers included in the database:

- 57 % allow archiving of the author's accepted (peer-reviewed) manuscripts;
- 8 % allow archiving of the author's original manuscripts (not peer-reviewed);
- 35 % do not formally support archiving.

Some 64% of publishers, therefore, permit self-archiving in some form. Publishers are, however, keen to impose embargo periods. The **length of the embargo period** is the critical time for the publisher to recoup the investment made into the publishing process in terms of organising the peer-review, the layout and editing work and the costs attached to dissemination of the journals (paper print and distribution, costs attached to hosting the e-versions of the journals, sales management). Publishers explain that the length of the embargo period depends on a multiplicity of factors, among them: The scientific discipline, the rejection rate of articles of the specific journal (i.e. the rate of the number of rejected articles compared to published articles; it is the major cost driver as it multiplies peer-review costs), frequency of the editions, possible revenue from advertisement (not uncommon in high circulation journals such as Science or Nature) and its circulation rate.[170]

A recent study concluded that 11.9 % of OA scientific articles were published under Green OA.[171]

Research funders have started requesting that the researchers they fund or co-fund deposit copies of their accepted manuscripts into online repositories. However, given the very low compliance rate by researchers to these requests (e.g. NIH compliance rate below 5 % prior to 2008), many have changed this policy and now formally require, or mandate, deposits in designated repositories, with, in general, a six-twelve month embargo period before the content is made freely available. The SHERPA Juliet website[172] lists research funders' open access policies, including all the UK Research Councils, the Wellcome Trust, the Howard Hughes Medical Institute, the European Research Council and the DFG. Many other institutions have similar mandates. At present, the number of OA mandates worldwide is 222.[173]

169 http://www.sherpa.ac.uk/romeo/statistics.php?la=en&fIDnum=|&mode=simple; it is important to highlight that the database records the publisher's default policy and does not take into account specific arrangements by the publisher for individual journals.

170 Orally to the authors at a visit to Elsevier publishing.

171 http://www.plosone.org/article/info:doi/10.1371/journal.pone.0011273

172 http://www.sherpa.ac.uk/juliet/

173 http://roarmap.eprints.org/

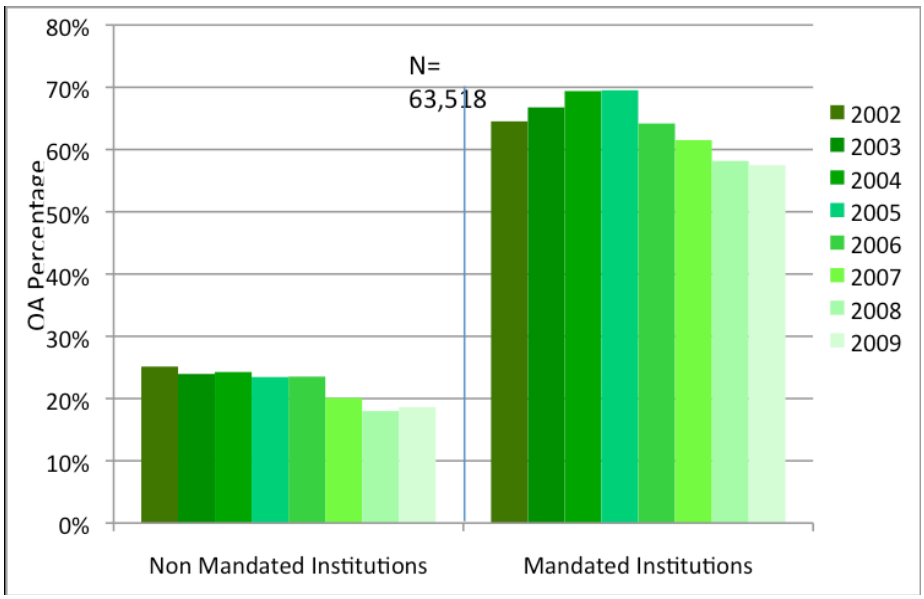

Figure 7: Effects of Green OA funder mandates on open access to publications

Open Access (OA) self-archiving percentages for institutions with self-archiving mandates compared to non-mandated;

Source: S. Harnad, What Is To Be Done. About Public Access to Peer-Reviewed Scholarly Publications Resulting From Federally Funded Research?[174]

Some journal publishers have sought to negotiate individually with universities, research institutes or funders in response to their mandates, in order to require specific agreements. These usually involve increasing embargo periods for authors depositing post-prints of their articles into repositories, or even requesting embargo periods that go beyond what is already requiews by the publishers' own policies.[175] In May 2011, the national programme OpenAccess.se recommended that Swedish universities with open access mandates refrain from making individual agreements with Elsevier.[176]

The new mandatory policies implemented by institutions have had mixed results in terms of compliance rates by authors/researchers. Some research funders (NIH, Wellcome Trust, Minho University) have reported increases of up to 65% in compliance rates (in the case of the NIH) by their researchers. However, other sources show implementation rates by researchers remaining well below these figures (e.g. 15 %). This demonstrates that, while researchers may claim to be willing to deposit copies of their papers if required, they are either uninterested or unaware of the potential benefits of implementing such a policy[177].

The EU-funded project PEER[178] recently reported on the perceptions, motivations and behaviours of authors and readers with regard to repositories. One of the key findings of the research was that the number of researchers who reported placing a version of their journal

174 Available at: http://eprints.ecs.soton.ac.uk/23080/10/COMPETES3-harnad.pdf

175 http://www.sparceurope.org/news/public-response-on-behalf-of-sparc-sparc-europe-and-coar-regarding-publishers-self-deposit-policies

176 http://www.kb.se/Docs/about/projects/openaccess/2011/StällningstagaElsevier%20ENG%20_fin__cs%20recs.pdf

177 Kim J (2007). Motivating and Impeding Factors Affecting Faculty Contribution to In Repositories. J. Digital Inf., 8(2).

178 http://www.peerproject.eu/

article(s) in an OA repository within an 18 month period was negligible. The research also highlighted that, at present, the project respondents consider funder and institutional mandates to be relatively weak motivators for repository deposit, due to their weak enforcement. Early research, however, suggests that if institutions were to enforce OA mandates, researchers would feel compelled to comply with them.[179]

Recently, the League of European Research Universities (LERU) issued a "Roadmap towards open access".[180] This initiative is likely to foster the co-operation of research institutions in developing more effective and user-friendly OA policies. The roadmap also acknowledges the fact that more than mere mandates will be necessary in order to boost compliance rates.

A variant of self-archiving is the practice of **delayed access**. This describes an article which is made available for free on the publisher's website, after an embargo period set by, or agreed with, the publisher. The difference from self-archiving is that the article is not put into a separate institutional or subject-based repository; rather it is sourced from the publisher's database.

(7) What is Gold OA and how is it organized?

Gold OA is the model in which the costs of publishing are covered by authors (in practice, usually by the funding bodies supporting them) or other sources (e.g. sponsorship), rather than by subscription-paying readers. This type of publishing is also referred to as the 'author pays' model. Two types of journals exist: journals publishing only open access articles and hybrid journals offering both open access and subscription articles. No embargo periods are applied to open access articles. The hybrid model has been adopted by many for-profit publishers and large scholarly societies. Hybrid journals can be criticised for having the potential to increase revenues for the publisher, while at the same time subjecting libraries to continuing price inflation.

Article publishing fees for full and optional OA journals now mostly fall in the rather wide range of EUR 700-2100. New players in the market charge fees that are lower than the standard industry average cost per article. Others such as BioMedCentral and PLoS – key leaders of this OA route – have had to adjust and raise their original fees to remain financially viable. PLoS raised its original fee of EUR 1000 to EUR 1500-2200 (depending on journal), while BMC has raised its fee from its original fees to between €1250-€1450 for the majority of its journals.

Recent studies suggest that, measured both by the number of journals as well as by the increases in total article output, Gold OA journal publishing has grown rapidly, particularly between the years 2000 and 2009. It is estimated that there were around 19,500 open access articles published in 2000, growing to 191,850 in 2009. The journal count for the year 2000 is estimated to have been 740, and 4,769 for 2009; numbers show considerable growth, although the pace is slower at article-level. These findings support the notion that OA journals have increased both in number and average annual output over time, as illustrated below.

179 http://cogprints.org/4385/1/jisc2.pdf

180 http://www.leru.org/files/publications/LERU_AP8_Open_Access.pdf

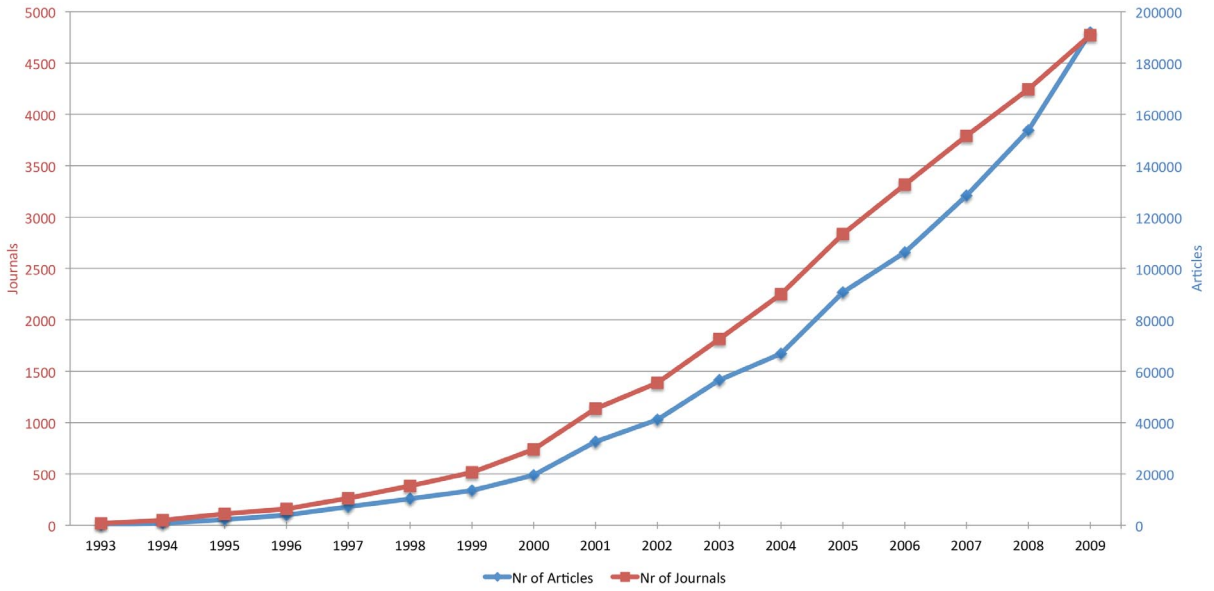

Figure 8: Growth of OA articles and journals[181]

Some research institutions have established specific mechanisms within in their organisations to support reasonable publication charges for articles written by their research staff and published in Gold OA journals. In 2010 the Wellcome Trust funded the publication of 440 articles, costing the organisation EUR 700,000. This averages out at EUR 1,590 per paper.

The Compact for Open-Access Publishing Equity (COPE)[182] is a commitment undertaken by 13 universities (including Harvard, Dartmouth and CERN) Signatory universities commit to the developing mechanisms for supporting reasonable publication charges for articles written by its faculty and published in OA journals, and for which other institutions would not be expected to provide funds.

181 http://www.plosone.org/article/info:doi/10.1371/journal.pone.0011273

182 http://www.oacompact.org/compact

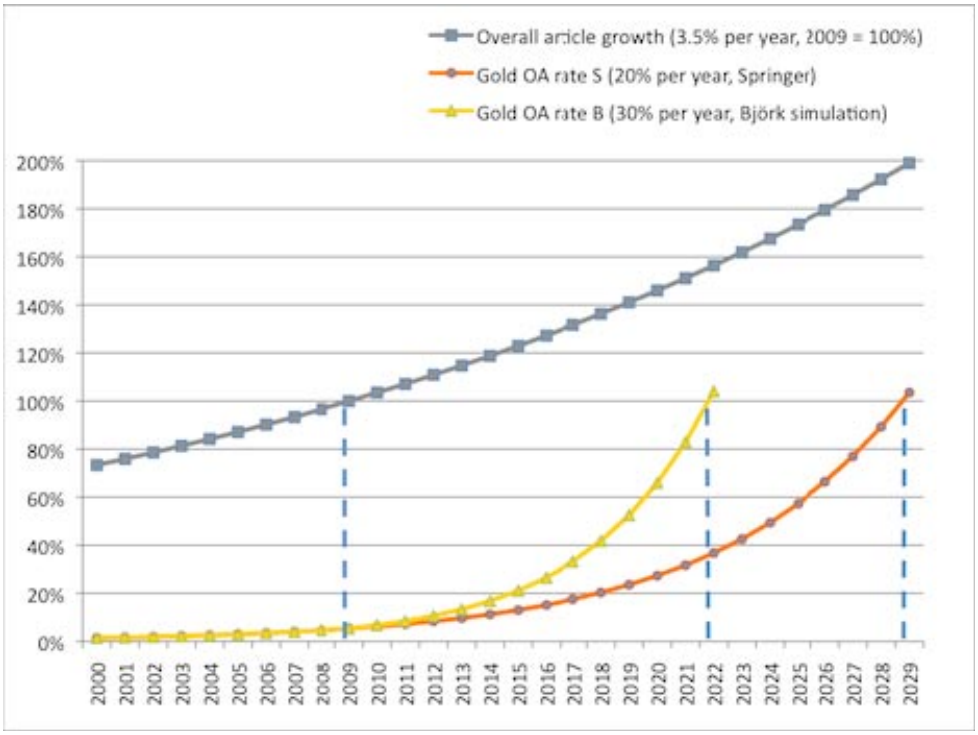

Figure 9: Expected uptake in Gold OA
Source: Poynder, Open Access by numbers, p. 14[183]

(8) What are the estimated benefits of OA?

Research[184] has been undertaken to assess the **economic benefits** derived from open access to research results. The potential economic impacts of wider access to research publications can be estimated in detail using a modified Solow-Swan model[185]. This methodology allows the estimation of increases in returns to R&D due to increases in accessibility and efficiency arising from OA policies. This model provides estimates on total annual gains resulting from one year's R&D expenditure. It gives separate estimates for the (overall) Gross Domestic Expenditure and for public expenditure (government and higher education expenditure) alone. The model suggests that assuming a 20% return on R&D a 5% increase in accessibility and efficiency due to open access policies would result in annual gains of EUR 4.8 billion for Gross Domestic Expenditures on R&D and EUR 1.8 billion for government and higher education expenditures on R&D for the EU27. This suggests that permanent increases in accessibility and efficiency due to OA publishing can be converted to recurrent growth rates.

183 Available at: http://www.richardpoynder.co.uk/Open_Access_By_Numbers.pdf.

184 Houghton and Sheehan, The Economic Impact of Enhanced Access to Research Findings, 2006, available at: http://www.cfses.com/documents/wp23.pdf; see Houghton, Open Access – What are the economic benefits? A comparison of the United Kingdom, Netherlands and Denmark 2009, available at http://www.knowledge-exchange.info/Default.aspx?ID=316; Houghton/Sheehan, Economic implications of Alternative Scholarly Publishing Models: Exploring the Costs and Benefits, 2009, available at http://www.jisc.ac.uk/media/documents/publications/rpteconomicoapublishing.pdf

185 see Houghton and Sheehan, 2009

EU27

GERD	Rate of return to R&D				
EUR 236,553 million	20%	30%	40%	50%	60%
Per cent change in accessibility and efficiency	Recurring annual gain from increased accessibility & efficiency (million)				
1%	951	1,426	1,902	2,377	2,853
2%	1,911	2,867	3,823	4,778	5,734
5%	**4,849**	7,274	9,699	12,123	14,548
10%	9,935	14,903	19,870	24,838	29,806

Table 4: EU27 – Increase in returns to R&D due to increases in accessibility and efficiency arising from open access[186]

In addition to the economic benefits accruing for society as a whole, disseminating research results through OA benefits individual researchers. There is an on-going debate about whether OA increases research impact over and above the impact already gained through the subscription-access system, by increasing the visibility, discovery and accessibility of research articles. The possible components of the OA advantage can be identified as general (citable articles become available to new audiences who would find them citable), earliness (the earlier an article is put before a potential audience, the more this affects subsequent citation patterns), selection bias (authors make their best articles more readily available OA on than their poorer articles), and quality advantage (better articles gain more from the general OA advantage because they are, by definition, more citable than poorer articles).

Another study undertaken by Houghton for the UK shows benefits/ costs ratios for three different scenarios relating to wider access to research publications.[187]

The scenarios analyzed were:

– **Green Access** – referring to self-archiving of accepted manuscripts into repositories driven by funder mandates;

– **Gold Access** – referring to publication of manuscripts in OA journals after payment of a publication fee (article processing charge);
it is subdivided into two sub-scenarios assuming a high and a low article processing charge (APC):

186 Source: Houghton, 2011, cited in: Vickery, Review of recent studies on PSI re-use and related market developments, at p. 37, available at: http://epsiplatform.eu/content/review-recent-psi-re-use-studies-published.

187 Heading for the open road: costs and benefits of transitions in scholarly communications, 2011, available at: http://www.rin.ac.uk/our-work/communicating-and-disseminating-research/heading-open-road-costs-and-benefits-transitions.

the high APC was set at £ 2,346 – corresponding to the "observed per-article publishing costs for author-side payment journals" (subtracting any assumed contribution from other funding sources, such as advertising) based on activity cost estimates sourced from publishers (adjusted to 2010 levels);
the lower APC was set at £ 1,457 – corresponding to weighted average charges currently being paid to Gold publishers;

	Green	**Gold (higher APC)**	**Gold (lower APC)**
Costs	£45.0m	£152.9m	£28.3m
Savings	-	£80.5m	£121.0m
Total net costs	**£45.0m**	**£72.4m**	**-£92.6m**
Economic benefits	£211.6m – £385.8m	£184.1m – £325.1m	£184.1m – £325.1m
Benefit – cost ratio	**4.7 – 8.6**	**1.7 – 2.7**	**10.8 – 15.7**

Table 5: Benefit/ cost ratios for selected OA models

There is also research undertaken in relation to the advantage for scientists in terms of an **increased number of citations** for OA articles: A meta-analysis undertaken by A. Swan[188] in 2010 concluded that 27 out of 31 research papers looking into this matter suggest that OA articles are more cited than non-OA articles.

Size of OA citation advantage by discipline	**% increase in citations with Open Access**
Physics/ Astronomy	170-580
Mathematics	35 to 91
Biology	-5 to 36
Electrical engineering	51
Computer science	157
Political science	86

188 Swan, A. (2010) The Open Access citation advantage: Studies and results to date. Technical Report , School of Electronics & Computer Science, University of Southampton.

Philosophy	45
Medicine	300 to 450
Communication studies (IT)	200
Agricultural sciences	200 to 600

Table 6: Citation advantage by discipline

Source: Data from: Swan, 'Open Access citation advantage'[189]

(9) How is scientific information preserved? What are the challenges?

The issue of the digital preservation of scientific information concerns how the digital record of science can be stored efficiently, and kept accessible, understandable and re-useable in the future. The increasing quantity of native-born digital scientific information, be it as scientific journals, data or software, has shifted the balance, roles and responsibilities regarding digital preservation. In the analogue world, the task of long-term preservation was the sole responsibility of libraries, but this is not longer the case.

With the advent of the Internet, most scientific journals are accessed from publishers' servers, and therefore many libraries do not possess physical copies of the journal articles that need to be preserved. It therefore falls to publishers to ensure permanent long-term access to scientific information. A PARSE-Insight study looked into the preservation of scientific content in Europe.[190] It showed that most scientific journals (93 %) are subject to preservation measures or policies implemented by publishers. The same study shows, however, that only 23% of small publishers have reported undertaking a dedicated preservation strategy. Some publishers (52 %) have transferred preservation responsibilities to a third party (for example, JSTOR, Portico, LOCKSS). Alternative solutions are also being implemented, notably through national library services such as the e-Depot at the Koninklijke Bibliotheek in the Netherlands. Its digital archiving services are available to publishers worldwide and are used by many major publishers. It is also considering developing preservation services for open access journals.

While the PARSE-Insight Study highlighted that the preservation of scientific journals is reasonably well-organised at present, there is concern about entrusting preservation entirely to private enterprises. Their preservation efforts depend on the underlying business case and the economic well-being of the company.

Legal deposit, i.e. the obligation for content producers to make one or more copies of scientific publications available to a designated deposit body, is a central issue for preservation. Although Member States have started extending deposit arrangements to digital information, this is progressing at different speeds and covers different types of information. PEPRS (Piloting an E-Journals Preservation Registry Service) is a registry service providing

189 A. Swan, Open Access citation advantage. Studies and results to date, available at: http://eprints.ecs.soton.ac.uk/18516/2/Citation_advantage_paper.pdf

190 http://www.parse-insight.eu/downloads/PARSE-Insight_D3-6_InsightReport.pdf

easily accessible information about inclusion of journals in preservation services and highlighting those e- journals for which no arrangements exist.[191]

The investment required to set up a repository is estimated to be between USD 8000 (EUR 5800) and USD 1,800,000 (EUR 1,309,000), with a mean of USD 182,550 (EUR 132,800) and a median of USD 45,000 (EUR 32,700). The estimated cost of the daily ongoing operations budgets is USD 8600 (EUR 6250) to USD 500,000 (EUR 364,000), with a mean of USD 113,543 (EUR 82,585) and median of USD 41,750 (EUR 30,370). The success of institutional repositories will depend largely on the compliance rate by researchers in depositing their manuscripts. Recent data estimates that the average number of journal articles in repositories is 7523 plus a further 6888 articles from non-refereed publications.

(10) Why and how are research data different from publications?

The pace of innovation in data-intensive research is increasing rapidly. Researchers collect huge amounts of data, but this data – even when underpinning scientific publications – is only rarely available. Even when it is available, it may not be presented in a form that is easily understandable and reusable by others. In many scientific fields, each dataset is unique, costly and irreproducible; if the data is not preserved, it is lost for ever. As an illustration, analysing the state of the Earth, its environment and its variability over time, requires a large number of observations. It is impossible to go back in time and resample environmental data; therefore global and complete measurements need to be taken. Earth observations are of unique value to understanding climate change and natural hazards, and in developing an appropriate response to climate change and related threats.

Opening up opportunities to access and (re)use this data in combination with its related publications, and to build on it, e.g. through data-mining, will benefit innovation and research.

The potential benefits of increased access to, and re-use of, research data include:

- maximised investment in data collection;
- broader access where the cost of repeating research would be prohibitive for individual researchers/institutions;
- potential for new discoveries from existing data;
- increased research impact and reduced time-lag in realising those impacts;
- new collaborations and new knowledge-based industries would form;
- increase in data quality and prevention of fraudulent behaviour by researchers;
- transparency in research funding;
- increased visibility and promotion of institutions and researchers;

191 http://peprs.org/peprs/peprs.asp

- enabling greater cross-sector collaboration and opportunities including researchers outside the core of higher education and public sector research networks, researchers in industry, government and non-government organisations;

The increasing availability of primary sources of data in digital form has the potential to shift the balance away from research based on secondary sources (such as scientific publications), thus positioning data as the central element in the scientific process. In this context, the ability of researchers to extract further meaning from masses of data stored in institutional, national or community repositories is a key factor. The deployment of standardised mechanisms to store, archive, authenticate, access, transfer, preserve, curate, certify and interpret scientific data is therefore required. Furthermore, the deployed scientific data infrastructure will require adaptation in cultures and new approaches and competences, given the intrinsic relation between data and associated software to read, interpret and process it. Some publishers are taking steps to sustain the scientific record by creating permanent links between the journal article with the relevant databases, an action positively seen by researchers. It is important that these efforts are made jointly with those responsible for the long-term accessibility and preservation of these databases.

We may also see the emergence of re-use 'industries' in some areas of research and observation (e.g. with geospatial, meteorological and oceanographic data, etc.,), with activities stimulating storage, discovery and access to datasets.

Studies have been undertaken on the preservation of data by researchers[192]. 40% of researchers have reported that they store between 1GB and 1TD of data. 11% are not aware of how much information they store. There is a variety of places where data are stored: 59% report to lodge data into a server of the organisation they adhere to, 51% keep data on their personal workstation. Only 20 % submit data to a digital archive. It may be concluded therefore that there is a certain lack of trust on the side of researchers on the capability of digital repositories to provide adequate research data.

Very few research funding organisations and universities undertake proper research data preservation activities. Quality standards for content in terms of authenticity and provenance, and quality standards for services are critical to both access and preservation of research data. Digital preservation solutions are undoubtedly partly technical, and the tools being created will enhance digital longevity, but these solutions are also equally dependent on organisational issues. Many significant challenges remain before a highly efficient and accessible infrastructure populated with useful scientific data can exist. Many of the challenges outlines are already being addressed, but further efforts are needed in the following areas:

- Authentication mechanisms are needed to make sure that data and collections can be trusted The data need to be in a form that makes reuse possible;

- Interoperability of data resources is needed to make collaboration among research teams and disciplines possible;

- The security and integrity of data resources should be improved to increase the confidence of data creators.

192 http://www.parse-insight.eu/downloads/PARSE-Insight_D3-6_InsightReport.pdf

Another development is the formation of virtual communities of researchers participating in large-scale web-based collaborations. Within those communities, researchers are opening up their results at an early stage to the research community and interact with other researchers who can analyse the data or re-use them with other datasets.

Enhanced information technologies produce ever-growing amounts of data: As reported in the report "Riding the wave": Currently, about 2.5 petabytes – more than a million, billion data units – are stored away each year for mammogrammes in the US alone[193]. These could be a goldmine of data for epidemiological and drug research, if made accessible in appropriately anonymous form to researchers. Another example is decoding of the human genome and genome-based research: By August 2009, digital records of more than 250 billion DNA bases, from various species, were stored in the US government's public GenBank database. An entirely new discipline of science had emerged: systems biology. This uses computers to simulate, at the sub-molecular level, exactly how DNA, proteins and the other chemical components of life interact – and in time, it will transform the practice of health sciences.

A robust infrastructure including technological and organisational aspects is needed in order to maximise the effectiveness of use and re-use of research data,.

In addition to the challenges these vast amounts of research data create, they also open the possibility to completely new ways of doing science. In data-driven science, this abundance of research data can be explored to create and test new hypotheses. There is now widespread recognition that data are a valuable long-term resource and that sharing them and making them publicly available is essential if their potential value associated with re-use is to be realised.

Given the increasing importance attained to research data, many research funding organisations/universities are introducing measures to encourage and facilitate research data publishing and making it widely available for access and re-use, in particular when those datasets have been produced with public funding. This approach requires effective planning and management of data through the life-cycle of a project. Although in general funding bodies tend towards encouragement rather than enforcement, funding bodies such as the UK Research Councils, NIH and NSF have developed several sets of actions that may be seen as paving the way for a pan-European approach.

The issue of economic sustainability of digital preservation has been object of several studies aiming at identifying the necessary conditions and actions to be implemented to achieve sustainability in the long term. The study "Sustainable Economics for a Digital Planet: ensuring long-term access to digital information Blue Ribbon Report"[194] has identified six necessary conditions:

- Timely actions to ensure access;
- The recognition of the benefits of preservation by decision makers;
- The selection of materials with long-term value;
- Incentives for decision makers to act in the public interest;

193 http://cordis.europa.eu/fp7/ict/e-infrastructure/docs/hlg-sdi-report.pdf, p. 10.

194 http://www.jisc.ac.uk/publications/reports/2010/blueribbontaskforcefinalreport.aspx

- Appropriate organization and governance of preservation activities;
- On-going and efficient allocation of resources to preservation.

(11) How much is the European Union investing into research?

EU Member States' investment in R&D, reached EUR 236 billion in 2009. Under the Lisbon Agenda, the EU's goal in the area of R&D was to achieve a R&D intensity (i.e. expenditure as a percentage of GDP) of at least 3 % by 2010. Two thirds of R&D expenditure were set to be financed by the private sector. However, in 2009 R&D intensity stood at 2.01 % (compared to 1.9 % in 2007). R&D intensity remains significantly lower in the EU than in other major economies. The 3 % intensity target will still be maintained for the next ten years as one of the key targets of the Europe 2020 strategy. Given the above, the EU's stakes in efficient access and dissemination are high, not only because the output of the scientific publishing process of crucial importance for society's development, but also because its investments are very relevant, since much of this activity is publicly funded. The combined R&D expenditure in 2009 public sources accounted for 36 % of the EU's R&D expenditure, or EUR 87 billion[195].

Opening up access to research results is an important way to maximize the society's collective investment on research.

FP7 is running over the period 2007-2013 is endowed with a total budget of over € 50 billion accounting for 4 percent of the EU budget. The framework programme accounts for about 5-6 percent of EU's overall budget for the same period.

In line with the EU's high investment in research, framework programme projects generate many publications and thereby contribute directly to Europe's total output in terms of scientific publications. Some indications on the publication output of Community (co-)funded research can be given on the basis of earlier programmes. For example the first figures of the OA Pilot in FP7 indicate that so far the total number of publications harvested by OpenAIRE is 1275 of which 1204 are OA.[196]

195 http://ec.europa.eu/research/innovation-union/pdf/competitiveness-report/2011/part_1.pdf

196 http://www.openaire.eu/fr/component/openaire/statspublications/default/539

Annex 2: Executive summary of the 2011 Questionnaire to European Research Area Council

In late 2008, the European Commission prepared a questionnaire on OA and preservation policies in Europe, with a view to taking stock of the status of implementation of the 2007 Council conclusions on Scientific Information. The questionnaire was presented to CREST members and observers, who in some cases designated national experts to respond to it. After replies were collected, a summary of responses was prepared, released and presented to CREST in 2009. It highlighted that many initiatives existed at the level of universities, research councils and other non-governmental organisations, but that national policies were still lacking. The Commission has taken the initiative of updating the collective knowledge available on the situation in Europe with a second questionnaire to ERAC members and observers. The questionnaire was sent to all ERAC members and observers on 25 November 2010. The Commission received 29 responses between 21 December 2010 and 11 March 2011.

(1) Access and dissemination

Much of the debate revolving around access to scientific information has focused on peer-reviewed scientific publications in journals (publications resulting from research projects partly or fully publicly funded), but further areas are also crucial, for example doctoral and masters theses and research data. Research results are generated and circulate within specific environments and raise specific legal issues such as copyright and VAT rates for electronic products. Moreover, repositories play a crucial role in collecting, preserving and disseminating digital intellectual output from research. Other issues deal with access and dissemination activities at national level. They include overall national policies regarding publications and data, the development of repositories and stakeholder involvement.

(2) Implementation of the 2007 Council Conclusions on Scientific Information

In addition to asking respondents to describe the policies in place for dissemination of and access to scientific information, some closed questions were included in the survey, for example whether, generally speaking, the situation regarding OA has improved since 2009 (previous survey), and whether the country has experienced problems implementing the 2007 Council Conclusions on Scientific Information. The general impression is that, compared to 2009, the situation has improved in many countries. Only very few respondents have replied that there has been no improvement at all in their country.

(3) General policies and strategies

Respondents were asked to describe the policies in place for the dissemination of and access to scientific information, including information on how these policies are financed. A growing number of countries have put or are currently putting in place clear strategies regarding access and dissemination, usually with a focus on open access or repositories. Open access has been incorporated into national strategy for science and research in some countries. As regards infrastructure, national archives for open access content or national harvesting systems that can access open access material through national portals have been set up in some countries.

(4) Open access to publications resulting from publicly funded research

Open access refers to free-of-charge accessibility of outputs, such as research articles, over the Internet. A frequent bottleneck to achieving a more widespread use of open access and faster development of policies is lack of awareness and understanding of open access amongst researchers and policymakers. The questionnaire asked respondents to describe policies and other arrangements in place aiming to provide open access to peer-reviewed scientific journal articles resulting from public research funding. Some countries have made considerable progress on open access, while others are slower to initiate developments. At institutional level, individual universities have launched projects on open access, and there has been progress on the development of deposit and curation points. Some countries have high-level OA and preservation policies. At national level, arguments for open access have successfully been taken to the governmental level in some countries, and in some cases even incorporated into the national strategy for science and research. Where national-level or institutional-level policies have been adopted, there is success in increasing the amount of material openly available and in raising awareness of open access amongst authors. Policies usually make the case for open access and are accompanied by guidance to researchers. However, a relatively good level of policy development does not mean that open access has been fully achieved in the EU.

(5) Open access to other publicly funded research results

While the debate on open access has up to now focused on scholarly literature, research data (be they numerical, graphical, audio or video files, etc.) and the general objective of gaining open access to data (‘open data’) is increasingly in the spotlight. The importance of research data is likely to grow in the coming years as information society tools have made it possible to access data directly, and because new information services are combining journal articles and data, hence applying new search techniques such as data mining. There are already many policies from research funding agencies covering the accessibility of data created during work they have funded, and the number is expected to grow. Further developments are linked with e-science infrastructures and with relevant intellectual property rights issues. Policies on open access to research data remain less developed than policies on open access to publications, but the general concern for unlocking the full value of scientific data is growing, as reported in the 2010 report ‘Riding the wave':. Several respondents referred to European projects such as Europeana and e-infrastructures, activities that are typically covered in the European Commission by the Directorate-General for Information Society and Media. Some respondents also mentioned activities in the European Bioinformatics Institute (EBI), which is a centre for research and services in bioinformatics that manages databases of biological data and provides free access to all its data resources. Less in the public eye than publications and data are doctoral and masters theses. Open access to this highly valuable resource is progressing rapidly in Europe and is encountering fewer obstacles than publications and data.

(6) Repositories of scientific information

Well-designed e-infrastructure can enhance access and dissemination. In infrastructural terms, Europe is doing well. Replies to the question about repositories show a great deal of successful national activities, and many of these look to standards developed at European level. There are too many initiatives in Europe to be reported in an exhaustive manner, but they are all paving the way towards open access. Several countries have created national repository infrastructures. As reported by one respondent, this is both a complex and dynamic situation since the infrastructure is provided and supported by a number of independent organisations, including funders and universities. As illustrated in the comment of another

respondent, there are many important initiatives that are growing fast, but they can easily remain ‘islands’ that are not sufficiently interconnected.

(7) Specificities of research results

The Internet makes instant access to and dissemination of information possible. New information and communication tools offer innovative ways to add value. The rapidly increasing use of digital content in research and in the dissemination of knowledge has quickly become a main characteristic of modern science, challenging traditional ways in which research is conducted. Repositories are important places to store knowledge, but scientific journals still hold a central role within the scientific information system. The peer-review process remains the central quality-control mechanism, and journals remain a main vehicle for spreading research results. Technological changes have offered publishers tremendous opportunities that they have embraced in a creative way, but they also brought about complexity in areas such as copyright and VAT rates. Business relationships with publishers remain of a complex nature for all actors involved. Despite the fact that most governments keep investing in the dissemination of scientific information, research libraries often have to find creative solutions within a limited budget, and despite their increasing responsibilities for access and dissemination. Moreover, journals are still central for scientists’ careers in connection with journal impact factors, the criticised, but much-used bibliometric indicator. Finally, open access is developing rapidly but ways of measuring its growth and impact are still under development.

(8) Long-term preservation

Long-term preservation is a closely related, yet distinct, issue from access and dissemination. Preservation concerns ensuring the long-term storage, care and continuing free accessibility of (research) outputs. It is something that has largely fallen to national libraries or other national-level organisations to tackle. There are also significant players in the area of preservation on an international scale. While many of the responding countries have put in place notable initiatives or strategies regarding the digital preservation of cultural heritage in general, specific attention to the preservation of scientific information needs to be further developed within most existing national policies and legislative frameworks. Moreover, researchers do not seem to always be aware that the preservation of scientific information articles and data is a key issue, although some progress has been made.

(9) Cooperation and coordination

Global challenges call for global responses. The question regarding cooperation focused on coordination among Member States in order to define common national funding body principles on open access, to improve the transparency of the contractual terms of "big deals" financed with public money, to assess the possibilities for achieving economies of scale, and to achieve the interoperability of repositories. There are many networks and national or international events, as well as projects and conferences in which professionals and relevant stakeholders meet. The goal is often how to identify common agendas and how to implement common initiatives. The role of international organisations and umbrella structures is regarded as crucial. The involvement of all stakeholders is very important, whether on the topic of revisiting agreements with publishers, coordinating advocacy activities or encouraging the sharing of good practices.

(10) Role of the European Commission and the European Union

Discussions involving the Commission, other European institutions and European governments help to define the Commission's guidance for national authorities and bodies. The question asked in this section was about the role that respondents see for the European Commission/EU. Answers sometimes went further than considering how and when, in a sector where both public and private interests are strong, the EU can speak with a 'single voice'. Respondents were generally very favourable regarding the role that the Commission and/or the EU has or could develop further, whether on specific topics (data, copyright etc.) or regarding the benefits that Member States could derive from EU action. As one respondent underlined, there is considerable potential for international bodies to play a leading role in coordinating both nationally and internationally funded work. It is increasingly important that national infrastructures, embedded in national university and research environments, are seen as the basis on which international developments build in many disciplines, perhaps especially outside 'big science'. It was generally felt that the European Commission has the position and visibility to play a leading part in the debate on access to and preservation of scientific information.

Annex 3: Survey on Open Access in FP7 – summary of responses.

In May 2011, the Commission identified the 811 projects concerned at the time and sent a questionnaire to all project co-ordinators in order to collect feedback on experiences on both the implementation of the pilot and the reimbursement of OA publishing costs. 194 answered were received by the end of August 2011. They provide important input for the future of the OA policy and practices in Horizon 2020 (the future EU Framework Programme for Research and Innovation), and for the preparation of a Communication from the Commission and Recommendation to Member States on scientific publications in the digital age.

Results

General considerations

For almost 60% of respondents who expressed an opinion, getting a common understanding in the consortium on how to best share research outcomes is considered easy or very easy. Also for 60% of respondents with an opinion, understanding legal issues regarding copyright and licences to publish is difficult or very difficult.

Self-archiving (Open Access Pilot in FP7)

The majority of respondents find it easy or very easy to have time or manpower to self-archive peer-reviewed articles and also to inform the Commission on the failure of making best efforts to ensure open access to the deposited articles. Many respondents however do not know the toolkits provided by the Commission for the purpose of offering support to beneficiaries of projects participating in the pilot. Nevertheless when they do, the majority of respondents with an opinion find them useful.

Identifying a new, satisfactory publisher is rather difficult for the majority of respondents, yet 40% of respondents with an opinion find it easy or very easy. Changing publisher or journal is also rather difficult for the majority of respondents – and is equally difficult to all FP7 research areas concerned, yet 35% of respondents with an opinion still find it easy or very easy. Difficulties are arising when the implementation of the OA mandate becomes concrete: negotiating with the publishers/journals is considered difficult or very difficult by almost 75% of respondents with an opinion.

Half of respondents do not know or have no opinion about which publishers to be in contact with regarding their open access publications. For the majority of respondents who had contact or intend to have contact with publishers, Reed Elsevier comes first, closely followed by Springer, then Wiley-Blackwell, Nature Publishing Group and Taylor & Francis. AAAS and Sage are also named.

Respondents reported a total of 534 articles deposited or to be deposited in a repository, out of which 406 are or will be open access. According to the figures given by respondents, a total of 68 articles are both deposited and made open access. Reasons given for not providing open access are first the publisher's copyright agreement that does not permit deposit in a repository, followed by lack of time or resources. The highest number of articles deposited is in FP7 research area ICT, followed by the areas Environment and Health. There are more articles deposited as the project is older.

The EU-funded portal OpenAIRE ('Open Access Infrastructure for Research in Europe'[197]) has been supporting the pilot since 2009 with mechanisms for the identification, deposit, access and monitoring of FP7-funded articles. Half of respondents did not know about the portal before answering the questionnaire, the other half had known it mostly through the CORDIS website and various EC-related events, yet word of mouth and contact with their EC project officers were also reported.

OA publishing (Reimbursement of costs in FP7)

The majority of respondents did not know about the possibility to request full reimbursement of publication costs during the lifespan of FP7 projects and only 25% of respondents with an opinion think that the option is well-known in the consortium. Nevertheless, the older the project, the more known the option. In total, almost half of respondents replied they intend to make use of this possibility in the future.

Only eight projects among all respondents reported the use of reimbursement of OA publishing so far, with total costs from 0€ up to 6100€. Seven replied they would use this possibility again, only one was not sure.

When asked about financial aspects, about half of respondents are of the opinion that it is expensive (i.e. it is better to spend project money on other activities), the other half of respondents is not of such opinion. The vast majority of respondents are of the opinion that the possibility of reimbursement of OA publishing costs is restricted by the fact that most publishing activities occur after the project end (i.e. too late for reimbursement to be claimed).

Nonetheless, almost 70% of those respondents with an opinion think that it is better to use self-archiving than OA publishing to satisfy the open access requirement in FP7.

OA policy in the EU Framework Programmes

The questionnaire was taken as an opportunity to ask forward-looking questions with regards to open access to data, the best sources of information about EC policies in the field, and EC support to FP7 researchers.

Three quarters of those respondents with an opinion would agree or strongly agree with an OA mandate to data in their research area, providing that all relevant aspects (e.g. ethics, confidentiality, intellectual property etc.) have been considered and addressed. There are some differences depending on the FP7 research area with most agreement in Environment, ICT and e-Infrastructure, and less agreement in Energy. Only a small number of respondents, 13%, have no opinion on the question.

CORDIS website and the Participants Portal are considered together the best source of information to get information about future EC OA policies. EC project officers and national contact points are also highly ranked. OpenAIRE is also viewed as a valuable source of information.

In a last question, project co-ordinators were asked how the European Commission could help researchers comply with its OA policy. For many respondents, the implementation of open

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access can be perceived as a burden. Most comments relate to the following five main categories, in order of importance:

- Information: The prevailing comment is, unsurprisingly, about information, the lack thereof and the best ways to inform project co-ordinators and the consortium on open access requirements in FP7. Information is welcome at every stage of the process, from the launch of the call, to the time of contract negotiations, the signature of the grant agreement, the kick-off meeting and the outset of the project. Many respondents stress the need to send an info-package to all applicants to FP7 calls, make use of reminders, and inform administrative persons in charge of EU funds as well as National Contact Points.

- Publishers: There are many comments asking the European Commission to inform publishers of FP7 requirements (in fact it is already the case for all main publishers) and directly negotiate with them. In practice, there are suggestions to encourage publishers to agree on modifications to bring on their usual rules on copyright and licences, to force them to lower their fees, or to make papers available on the project's website regardless of the publisher's policy. Some respondents ask to put more workload on the publishers and less on the projects, others encourage policy actions. There is also a proposal to ask the Commission to set up its own peer-reviewed open access publication mechanism.

- Promotion: There are many comments focusing on the promotion of the benefits of open access in general and training of all involved partners (including within the Commission), with a stress to inform (sometimes reinsure) private partners that benefit of FP7 funds of the benefits of open access.

- Self-archiving and OA publishing: many respondents suggest setting a system that would fund OA publishing separately from the grant agreement and its limitation in time. There is no apparent preference from one system (self-archiving) above the other (OA publishing).

- Support and assistance: Many suggestions are made to offer support and assistance to grantees such as having a Commission help desk (in fact already a feature of OpenAIRE). The Commission is asked to be concrete and detailed in its guidance, but also simple, short, to the point and updated. Support on how to deal with legal issues related to IPR and licences is also welcome.

Additional comments focus on the enforcement and monitoring of open access requirements in FP7 and make practical suggestions with regards repositories.

Conclusions

The dissemination of research results in FP7, including self-archiving and costs related to open access, is often an underestimated aspect. It however requires specific measures and sustained investment. Despite recognised benefits, the implementation of open access remains a challenge. Open access also raises technical questions and legal issues, linked in particular to how researchers exercise their copyright. Further difficulties are the lack of awareness of researchers and of concrete support for them to practice open access.

Annex 4: Frequently Asked Questions (FAQ) about Open Access

1. Does Open Access mean access to knowledge at no cost to the user?

Yes, Open Access (OA) scientific information is openly accessible at no cost, over the Internet, for the user/reader. Publically funded research has already been paid for by the tax payer and access to it should not result in further costs.

2. Does Open Access only refer to publications?

Open Access can refer to any form of scientific information, whether publications or data. However, the FP7 Open Access Pilot focuses on peer-reviewed publications in scientific journals.

3. Does Open Access interfere with the commercial exploitation of research results, e.g. through patents?

No, the decision whether to commercially exploit results, through patents or otherwise, is made before the decision to publish (open access or otherwise).

4. Are OA publications of lower quality?

No, they go through the same peer review process as other publications.

5. Is an OA requirement an obligation to publish?

No, it is up to researchers whether they want to publish their research or not.

6. Does this mean more bureaucracy and protracted negotiations with publishers for researchers wishing to publish their results?

No, in the FP7 open access pilot scheme an OA toolkit, including a model agreement between researchers and publishers, has been developed which is freely available.

8. How will publishers be able to recoup their investments in the publishing process with OA procedures?

As concerns Gold OA, publishers will simply be paid by the author (instead of the subscribers). The author will then be able to claim back these costs (which range from a few hundred to several thousand €) back from his/her institution or, in the case of FP7 projects, from the European Commission. As concerns Green OA, articles will not be made available in the repository for a certain time, the so called "embargo period" (which typically ranges from 6-12 months, depending on the scientific field). This allows the publisher to recoup their investment by offering the publication for a fee during this time period.

7. Where can I find more information?

A variety of information on Open Access background, the Open Access pilot in FP7 and relevant EC funded projects is available at http://ec.europa.eu/research/science-society/ under the heading "Open Access" and on the website of the OpenAIRE project at http://www.openaire.eu/en. You can also contact the European Commission's Open Access team at RTD-OPEN-ACCESS@ec.europa.eu

Annex 5 – Key indicators on OA publishing in MS

Member State	Existing funder mandates for OA publishing[198]	No. of OA journals in 2011[199]	No. of OA repositories[200]	Share of the EU public R&D expenditure[201]	Share of EU GDP[202]
Austria	1	38	9	2.15%	2.3%
Belgium	1	23	29	2.27%	2.8%
Bulgaria	None	31	5	0.12%	0.2%
Cyprus	None	4	1	0.08%	0.1%
Czech Republic	None	54	6	0.91%	1.2%
Denmark	1	31	10	2.21%	1.9%
Estonia	None	20	5	0.11%	0.1%
Finland	None[203]	38	15	2.0%	1.4%
France	1	138	62	16.31%	15.8%
Germany	4	242	151	22.06%	20.2%
Greece	none	37	14	0.74%	1.8%
Hungary	1	20	11	0.50%	0.7%
Ireland	4	9	14	1.14%	1.2%
Italy	1	195	69	11.07%	12.7%
Latvia	1[204]	2	3	0.07%	0.1%

198 According to openaire.eu (retrieved on 20 Dec 2011).

199 According to www.doaj.org (retrieved on 20 Dec 2011).

200 According to www.opendoar.org (retrieved on 20 Dec 2011).

201 Based on the total federal or central government budget appropriations or outlays on R&D, excluding EU funding, as per 2008 (2007 for Greece and Portugal), as reported in http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-32-10-225/EN/KS-32-10-225-EN.PDF.

202 Based on Eurostat figures ' Gross domestic product at market prices' for 2010.

203 Mandate under preparation (source: Responses to the ERAC questionnaire).

204 Mandate in statutory law.

Lithuania	1[205]	24	3	0.09%	0.2%
Luxembourg	None	1	--	0.19%	0.3%
Malta	None	2	--	0.01%	0.04%
Netherlands	None	51	24	4.71%	4.8%
Poland	None	133	75	1.22%	2.8%
Portugal	None	57	40	1.36%	1.4%
Romania	None	217	1	0.62%	1.0%
Slovak Republic	None	26	--	0.19%	0.5%
Slovenia	1	33	3	0.22%	0.3%
Spain	4	400	83	12.96%	8.6%
Sweden	5	51	45	2.96%	2.8%
UK	15	530	203	13.05%	13.9%

205 Mandate in statutory law.

Annex 6 - Glossary

Open Access (OA)	The policy and practice of granting immediate and free internet access to scientific results (including peer-reviewed journal articles); for some it includes also the right to use and re-use the information contained (conditions such as a request to provide attribution can apply)
Green Open Access	The practice of self-archiving some version of an article either on the author's website or (preferably) in a repository. Ideally the final publishers version is archived, i.e. the version that has been peer-reviewed and edited with citable page numbering.
Gold Open Access	The costs/fees of publishing in a journal or of a monograph for making it openly accessible are covered by authors (or the institution they are affiliated to) instead of readers paying via subscriptions.
Repository	Online database run either by an institution for research of all affiliated staff or across institutions on a subject basis in view of granting access to the publications.
Science, technical and medical publishing (STM)	Term used to refer to an important segment of scientific publishing, covering natural science, technical and engineering studies and medical studies; used in order to show the commonalities in the concern across those disciplines
Impact factor	A traditional metric indicator for scholarly journal quality, along with citation counts
Big deal	Sales practice of commercial publishers to offer big bundles of print and electronic publications to libraries at sometimes considerably reduced prices; usually does not leave libraries the choice for individual cancellations;
(Funder/institutional) mandate	Relates to the policy and practice of funding institutions giving research grants or of academic institutions to request the research

	output to be made openly accessible
Serials crisis	Describes the phenomenon that prices for scientific journals have been rising far above inflation levels for many years
Digital Object Identifier (DOI)	A character string (a "digital identifier") used to uniquely identify an object such as an electronic document on the Internet; is part of the document metadata; helps to retrieve exactly the version of a document
Embargo period	Period within which an article published in a commercial journal may not be made openly accessible due to request by publisher
Peer review	Involves the systematic, critical review of a submitted scientific article by two or more fellow scholars of the same scientific discipline as the author. These "peers" are selected by the journal editor and are requested to assess the scientific article in respect of its originality, methodological soundness, the significance and strength of its conclusions.
Article processing charges (APC)	The fee charged by publishers to offset the costs of publishing a journal article, where those costs are not covered by a subscription model
Harvester	Computer software technique of extracting information from websites
Open Archives Initiative Protocol for Metadata Harvesting (OAI –PMH protocol)	A protocol developed by the Open Archives Initiative. It is used to harvest (or collect) the metadata descriptions of the records in an archive so that services can be built using metadata from many archives.
Hybrid journal	Journal publishing articles under the Gold Open Access model and articles requiring a subscription

Born-digital content	Content which is created (and published) in digital format only.
Publicly funded research	Publicly funded research refers to research undertaken by the government itself, or through grants to academic and other researchers outside the government