

Public Access to Federally Funded Research: Contributions to Economic Development, Competitiveness, and Innovation

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As interest in ensuring public access to the results of research funded with public tax dollars continues to grow, this issue has consistently risen in profile in public policy conversations, in the US and around the world. As research funders, both private and public, gain experience in deploying policies that require expanded access to their funded research, there has been an increasing emphasis on attempting to quantify the social and economic returns to the public that might result from such policies, and the potential contributions that greater access can make to national economic development, competitiveness, and innovation efforts. There have been a number of recent reports and initiatives, both domestic and international, that have made substantive contributions to our understanding of this issue, and that are worth noting.

Why Share Research Results?

The basic drivers behind the push for policies that support greater access to the results of research are universal. Scholars conduct research so new ideas can be generated, new discoveries can be uncovered, and our collective understanding of the world and our interactions with it can be enhanced. They have long understood that communication of their findings is part-and-parcel of the research process; they don't consider their work to be finished until the process of sharing their results is complete.

Research funders recognize the necessity of sharing research results as well. Agencies invest in scientific research expecting that it will result in increased benefits, both social and economic, to the public. They recognize that research is

a cumulative process, and that progress can only be made when researchers can not only *see* the work that others have done, but also *use* it—when they can build on prior work to create new knowledge. Likewise, funders understand that their investment in scientific research can only gain in value when the findings of that research are made accessible and allowed to be used to their fullest potential.

Journals have long been the main outlet for communicating scientific research results. As the Internet burst onto the scene, it became possible to share these results with the widest possible audience—to share them with anyone, in any place, at anytime. For the first time in history, it is possible to make scientific findings readily accessible to researchers, faculty, and students in academe, and also to the wider universe of users (entrepreneurs, health care providers, small business owners, patients, and other members of the general public) to whom the cost of subscriptions to journals has been an insurmountable barrier. It is also possible for these research findings to be used in new ways in the digital environment that advance the public purposes of research further than ever before.

This wider group of stakeholders, particularly entrepreneurs and small to medium-sized business enterprises (SMEs), has the potential to provide an important engine for driving economic development, innovation, and job creation. Removing any barriers that these stakeholders face in gaining access to

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basic and applied research information is an important step in fueling innovation. The innovative development of new products and services, and of new methods and processes, is widely seen as a driving force of economic growth. Because SMEs are such an integral part of this development process, they are increasingly the focus of government policy.

The European Council, for example, recently noted, “Small and medium-sized enterprises (SMEs) form the backbone of the European economy and have the potential to contribute significantly to creating more growth and jobs in the European Union.”¹

Research Policy Imperatives

Some have argued that journal articles reporting on publicly funded research are of little interest to stakeholders outside of the academy, and that, in any case, these stakeholders have no problem accessing such articles should they want to.

However, a recent report by the Publishing Research Consortium indicated that more than 70% of the SMEs surveyed reported experiencing difficulties in accessing such information.² Providing better access for non-academic stakeholders, especially SMEs, is an important consideration in creating an effective innovation agenda.

As awareness of the potential benefits of opening access to scientific research results has increased, a growing number of funders have directly addressed this issue. In its 2005 report on scientific publishing, the international Organisation for Economic Co-operation and Development succinctly captured the policy imperative, specifically noting the potential for improved ROI:

Governments would boost innovation and get a better return on their investment in publicly funded research if they made research findings more widely available, and by doing so, they would maximize social returns on public investments.³

Over the past several years, a number of policies requiring deposit of publicly funded research outputs in open online repositories, and ensuring free access to the general public within a specified time frame have been proposed, and in some cases, implemented. The most visible US policy that addresses this call is that of the National Institutes of Health, which in 2008 required that all researchers funded by NIH deposit a copy of any manuscript reporting on the results of NIH-funded research into the agency's online repository (PubMed Central) to be made publicly accessible no later than 12 months after appearance in a peer-reviewed journal.

The European Union (EU) has taken an even more aggressive stance, by adopting what they term the "Fifth Freedom,"⁴ the free movement of knowledge, as a core tenet of the EU's basic mission. The EU has proposed a policy similar to that of the NIH for the results of its funded research, with an even shorter embargo period of six months. These examples are just two of more than three dozen policies that have been established by public funding bodies around the world.⁵

Studies of ROI in Open Access Policies

While there is ample anecdotal evidence of the benefits of policies mandating open access to publicly funded research, the relative costs and benefits and the actual return on investment have not been fully studied. However, in just the

past two years, we have seen significant progress made in attempts to identify metrics for demonstrating the ROI in open access dissemination of publicly funded research, and to quantify the costs and benefits of doing so.

European Studies

The most visible work to date has been done by a team from the Centre for Strategic Economic Studies at Victoria University, lead by economist John Houghton. Beginning in early 2009, studies by Houghton were commissioned by research funders and government agencies in a number of countries interested in exploring the actual costs and benefits to a national economy of opening up access to research results.

A prime example of the kind of project that Houghton's team undertook was an effort funded by JISC in the UK. Houghton and his colleagues sought to describe models of scholarly publishing that result in varying levels of access to articles: the current system of subscription access journals, a system of open access journal publishing, and open access archiving in digital repositories. They attempted to identify, in detail, every dimension of cost and benefit for each of these three models.

The JISC study further examined which stakeholders would be affected, and how, by each of the costs and benefits identified. And perhaps most critically, the team also sought to quantify the costs and benefits and, where possible, to identify these outcomes for each of the three models examined for the main players in the scholarly communication system. The final report, *Economic Implications of Alternative Scholarly Publishing Models: Exploring the Costs and Benefits*, estimates that, in 2007, publication of everything under the subscription model would have cost UK institutions £230 million. In contrast, the estimated cost for publishing everything under the open access model would have been £150 million. The study also looked at the cost for self-archiving the articles instead and estimated this at just £110 million.⁶

Similarly, another study commissioned by the SURFfoundation in the Netherlands, *Costs and Benefits of Research Communication: The Dutch Situation*,⁷ also compares the three access models, and concludes that an open access model offers the greatest financial advantage. This report examined the costs of financing an open access model on a national level, and concluded that adoption of this model could lead to an annual saving of €133 million for the Netherlands.

These reports are part of a larger series of similar studies funded by the

European Knowledge Exchange.⁸ The series conclusions have been widely reported on, and have resulted in a survey detailing the cost/benefit effects of open access in the countries covered. Perhaps one of the most valuable outputs of these studies has been the open publication of the model used by the researchers who conducted this work. The model was based on the Scientific Communication Life Cycle Model developed by Bo-Christer Bjork,⁹ and has been substantially developed and extended to capture all of the activities and related costs throughout the scholarly communication process to highlight the differences between alternative publishing models. The model is freely available online,¹⁰ and can be used by anyone who wants to challenge any of the assumptions made by the researchers, or to examine their own set of economic data.

United States Study

Earlier this year, Houghton's work was applied to a US scenario for the first time. The study, *Economic and Social Returns on Investment in Open Archiving Publicly Funded Research Outputs*,¹¹ uses the same basic methodology as the European research but has a slightly different focus. Houghton's research this time focused specifically on the proposed Federal Research Public Access Act (FRPAA, H.R. 5037 and S. 1373)—a bill currently before the US Congress that seeks to maximize the public's return on research investment by delivering open online access to the results of research funded by 11 federal agencies, no later than six months after publication in a journal.

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Houghton's US study outlines one possible approach to measuring the potential return on public investment in research and development (R&D). It examines the effect of a set of key variables that influence the potential return and looks at variables that affect both *access* to research (including an examination of content embargoes) and the

efficiency with which research is applied in practice. Similar to the studies conducted in Europe, the US study's preliminary models suggest that FRPAA's enactment could lead to a positive return on the public's investment. The report projects that more than \$1 billion in benefits could be returned to the US economy over 30 years—an amount more than five times the costs of archiving the same material over the same period.

To address the efficiency aspect, Houghton's model relies on studies that

Application of ROI Models to the University Environment

This more open model of research is consistent with the research mission of the university to create and disseminate knowledge—and appears to lead to both broader and deeper research while increasing the pace of innovation.*

While the major focus of the series of studies recently carried out by Australian economist John Houghton and his colleagues has been on modeling the potential costs and benefits of open access to national funding agencies, the economics of open access is also of deep interest to the higher education community.

Consequently, Houghton, joined by UK researcher Alma Swan, conducted a follow-up study examining the likely economic outcomes of open access at an institutional level. Houghton and Swan look at the three most common routes by which open access is currently implemented:

- First, through the collection of copies of published articles in repositories while the articles continue to be published in journals and the journals sold on subscription to libraries (“green” open access).
- Second, through open access journals that charge an article-processing fee for each article published (“gold” open access).
- Third, through repositories collecting unpublished articles and using quality-control services to manage the articles through peer review and to apply editorial procedures on the articles before they are opened up from the university repository (“green” open access with overlay services).

Houghton and Swan examined the effects of each potential route on higher education institutions of varying size and research intensity. In their initial findings, the authors find that open access would result in savings for most institutions regardless of the routes that is taken. However, for larger research universities, the level of article processing fee is a key variable—if the charge per article reaches too high a point, “gold” open access may prove more expensive for those institutions.

To encourage individual institutions to examine the potential economic impacts of open access under the circumstances specific to their campuses, Houghton and Swan have also provided a working model for open use by the community, available at [http://www.cfses.com/EI-ASPM/Institutional EI-ASPM Cost Model \(USA\).exe](http://www.cfses.com/EI-ASPM/Institutional%20EI-ASPM%20Cost%20Model%20(USA).exe).

* Digital Connections Council, Committee for Economic Development, *Harnessing Openness to Improve Research, Teaching, and Learning in Higher Education* (Washington, DC: Committee for Economic Development, November 2009), 3, http://www.ced.org/images/library/reports/digital_economy/dcc_opennesedu09.pdf.

indicate that freely accessible papers are downloaded and cited more often than papers available only via subscriptions. The study suggests that even a modest 1% increase in the accessibility and efficiency of the papers covered by this proposed legislation could result in a 20% annual return on the 11 agencies' investments in research and development.

Houghton's US study closely examines the model's sensitivity to critical assumptions and broadly concludes that the benefits of public access would exceed the costs over a wide range of scenarios. However, Houghton and his team recognize that these studies represent a starting point for detailed economic analysis. Crucially, the study also defines additional data and model developments that the authors suggest can help to fine-tune future estimates of the policy's impact, and they also encourage the use/evolution of the model by any interested stakeholders. While some publishing trade organizations (most notably STM, the International Association of Scientific, Technical & Medical Publishers) have criticized the report's findings in a press release,¹² no alternative economic data or models have yet been provided.

Conclusion

Collectively, this series of reports and studies focusing on developing effective mechanisms to quantify the potential return on investment in scientific research through providing greater access provides an important new data set to be considered in policy deliberations. Continuing to refine such models, or creating additional models, can only serve to enhance our understanding of the potential impact of opening up access to the results of publicly funded research.

¹ Council of the European Union, "Presidency Conclusions of the Brussels European Council," March 13/14, 2008, rev. May 20, 2008, p. 7, http://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/en/ec/99410.pdf.

² Mark Ware, *Access by UK Small and Medium-Sized Enterprises to Professional and Academic Information*, ([London]: Publishing Research Consortium, August 2009), 13, table 2, <http://www.publishingresearch.net/SMEaccess.htm>.

³ Organisation for Economic Co-operation and Development, "Governments Should Improve Access to Publicly Funded Research, Finds OECD Report," news release, Sept. 22, 2005, http://www.oecd.org/document/1/0,2340,en_2649_201185_35397879_1_1_1_1,00.html. See also the full report: John Houghton and Graham Vickery, *Digital Broadband Content: Scientific Publishing* ([Paris]: Organisation for Economic Co-operation and Development, 2005), <http://www.oecd.org/dataoecd/42/12/35393145.pdf>.

⁴ "Presidency Conclusions of the Brussels European Council," p.5.

⁵ ROARMAP (Registry of Open Access Repository Material Archiving Policies), <http://www.eprints.org/openaccess/policysignup/>.

⁶ John Houghton et al., *Economic Implications of Alternative Scholarly Publishing Models: Exploring the Costs and Benefits*, ([Bristol, England]: JISC, John Houghton et al., January 2009), 167, 224,

<http://www.jisc.ac.uk/publications/reports/2009/economicpublishingmodelsfinalreport/>.

- ⁷ John Houghton, Jos de Jonge, and Marcia van Oploo, *Costs and Benefits of Research Communication: The Dutch Situation* ([Utrecht]: SURFfoundation, May 2009), <http://www.surffoundation.nl/en/actueel/Pages/OpenAccesspublicationcansavetheNetherlandsupto133millioneuros.aspx>.
- ⁸ John Houghton, *Open Access—What are the Economic Benefits? A Comparison of the United Kingdom, Netherlands, and Denmark* ([Copenhagen]: Knowledge Exchange, June 2009), <http://www.knowledge-exchange.info/Default.aspx?ID=316>.
- ⁹ Bo-Christer Björk, “A Model of Scientific Communication as a Global Distributed Information System,” *Information Research* 12, no. 2 (January 2007), <http://informationr.net/ir/12-2/paper307.html>.
- ¹⁰ Ibid.
- ¹¹ John Houghton, Bruce Rasmussen, and Peter Sheehan, *Economic and Social Returns on Investment in Open Archiving Publicly Funded Research Outputs* (Washington, DC: SPARC, July 2010), <http://www.arl.org/sparc/publications/papers/vuFRPAA/index.shtml>.
- ¹² “STM, PA & ALPSP respond to Houghton JISC Report,” April 6, 2009, <http://www.stm-assoc.org/news.php?id=217>

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