

Maximising the Return on UK's Public Investment in Research

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The United Kingdom is not yet maximising the return on its public investment in research. Research Councils UK (RCUK) spend [£3.5 billion](#) pounds annually. The UK produces at least [130,000](#) research journal articles per year, but it is not the number of articles published that reflects the return on the UK's investment: A piece of research, if it is worth funding and doing at all, must be not only published, but used, applied and built upon by other researchers. This is called 'research impact' and a measure of it is the number of times an article is cited by other articles ('citation impact').

But in order to be used and built upon, an article must first be accessed. A published article is accessible only to those researchers who happen to be at institutions that can afford to subscribe to the particular journal in which it was published. There are [24,000](#) journals in all, and most institutions can only afford a [small fraction](#) of them. In paper days, authors used to supplement this paid access to their articles by mailing free reprints to any would-be users who wrote to request them. The online age has made it possible to provide free 'eprints' (electronic versions of the author's draft) to all potential users who cannot afford the journal version by '[self-archiving](#)' them on the author's own [institutional website](#).

The online-age practice of self-archiving has been shown to increase citation impact by a dramatic [50-250%](#), but so far only [15%](#) of researchers are doing it. A recent UK international survey has found that [95%](#) of authors *would* self-archive – but only if their research funders or their institutions *required* them to do it (just as they already require them to 'publish or perish'). The solution is hence obvious:

After lengthy deliberations first initiated in 2003 by the UK Parliamentary [Select Committee](#) on Science and Technology, [RCUK](#) have proposed to adopt a policy requiring UK researchers to deposit, on their university's website, the final author's draft of any journal article resulting from RCUK-funded research. The purpose of the proposed policy would be to maximise the usage and impact of UK research findings by making them freely accessible on the web ("open access") for any potential users in the UK and worldwide who cannot afford paid access to the published journal version. How does this maximise the return on the UK public investment in research?

It is not possible to calculate all the ways in which research generates revenue. A good deal of it is a question of probability and depends on time: Although everyone thinks of an immediate cure for cancer or a cheap, clean source of energy as the kind of result we hope for, most research progresses gradually and indirectly, and the best estimate of the size and direction of its progress is its citation impact, for that reflects

the degree of uptake of research results by other researchers, in their own subsequent research. Citation impact is accordingly rewarded by universities (through salary increases and promotion) and by research-funders like RCUK (through grant funding and renewal); it is also rewarded by libraries (through journal selection and renewal, based on a journal's average citation "impact factor"). Counting citations is a natural extension of the cruder measure of research impact: counting publications themselves ("publish or perish").

If citations are being counted, it is natural to ask how much they are worth.

The marginal dollar value of one citation was estimated by [Diamond](#) in 1986 to range from \$50-\$1300 (US), depending on field and number of citations. (An increase from 0 to 1 citation is worth more than an increase from 30 to 31; most articles are in the citation range 0-5; UK research averages 5.6.) If we convert from dollars to UK pounds sterling (£27-£710) and update by 170% for [inflation](#) from 1986-2005, this yields the range £46-\$1207 as the marginal value of a UK citation today. Self-archiving, as noted, increases citations by 50-250%, but, as also noted, only 15% of the articles being published are being self-archived today.

We will now apply only the most conservative ends of these estimates (50% citation increase from self-archiving at £46 per citation) to the UK's current annual journal article output (and only for the approximately 130,000 UK articles a year indexed by the [Institute for Scientific Information](#), which covers only the top 8000 of the world's 24,000 journals). If we multiply by the 85% of the UK's annual journal article output that is not yet self-archived (110,500 articles), this translates into an annual loss of £2,541,500 in revenue to UK researchers for not having done (or delegated) the few extra [keystrokes](#) per article it would have taken to self-archive their final drafts.

But this impact loss translates into a far bigger one for the British public, if we reckon it as the loss of potential returns on its research investment. As a proportion of the RCUK's yearly £3.5bn research expenditure (yielding 130,000 articles x 5.6 = 761,600 citations) our conservative estimate would be a 50% x 85% x £3.5bn = £1.5bn worth of loss in potential research impact (323,680 potential citations lost). And that is without even considering the wider loss in revenue from potential practical applications and usage of UK research findings in the UK and worldwide, nor the still more general loss to the progress of human inquiry.

The solution is obvious, and it is the one the RCUK is proposing: to extend the existing universal 'publish or perish' requirement to 'publish and also self-archive your final draft on your institutional website'. Over [90%](#) of journals already endorse author self-archiving and the international author survey -- plus the actual experience of the two institutions that have already adopted such a requirement (CERN and University of Southampton ECS) -- has shown that over [90%](#) of authors will comply.

The time to close this 50%-250% research impact gap is already well overdue. This is the historic moment for the UK to set an example for the world, showing how to maximise the return on the public investment in research in the online era.

How self-archiving increases citation impact:
<http://opcit.eprints.org/oacitation-biblio.html>

How much a citation is worth:

<http://www.garfield.library.upenn.edu/essays/v11p354y1988.pdf>

How much time and effort is involved in self-archiving

<http://eprints.ecs.soton.ac.uk/10688/>

RCUK self-archiving policy proposal:

<http://www.rcuk.ac.uk/access/index.asp>

Directory of publishers' policies on author self-archiving:

<http://romeo.eprints.org/>

JISC user survey on self-archiving:

<http://eprints.ecs.soton.ac.uk/11006/>