Assessing the Broader Impacts of Publicly-funded Research

Claire Donovan

ORCID ID: 0000-0002-6105-7794

Bio

Dr Claire Donovan has been a Reader at Brunel University London since 2010, and previously held research and teaching posts at the Research School of Social Sciences, The Australian National University; Nuffield College, Oxford University; and The Open University. She has published widely on research evaluation and research policy, and has interests in the governance of social science, and gender and higher education careers.

Abstract

The chapter introduces the reader to the notion of the broader societal impacts of research, and to recent trends in public policy towards prioritising research that produces direct benefits to society. It explores the 'science-society' relationship and the obligation of publicly-funded researchers to engage in science that is relevant to society at large. It compares and contrasts top-down and bottom-up approaches to defining and measuring research impacts. Examples of different European approaches to impact assessment are presented (UK, The Netherlands, Ireland, Norway). The chapter reveals the inherently political nature of defining, measuring, and rewarding research impact, and what this form of science governance implies for future directions of state-funded research.

Keywords: research impact, impact agenda, science-society relationship, research evaluation, research policy, research funding, science governance.

1. Introduction

In general terms, broader impacts may be defined as the social, economic, environmental and cultural benefits that the wider public derives from research. However, this chapter demonstrates that broader impacts can be defined and measured in diverse ways, and that the choice of definition and approach to measurement is inherently political as these have potentially far-reaching consequences for the science system, the direction of research, and, ultimately, the future broader impacts that research may bring.

The idea of harnessing science policy to stimulate broader impacts from publicly-funded research is not new. For example, in the UK case broader impacts were a key consideration when establishing its national research council system. While decisions concerning competitive funding provided by these research councils were meant to be at 'arm's-length' from government interference (Haldane, 1918) a significant proportion of funds have always been dedicated to pursuing applied research important to national interests.

UK research council funding (approximately £3 billion per year) is distributed on the basis of a competitive application process, which since 2009 has included a 'Pathways to Impact Statement'[1] to describe the broader impacts that the proposed research may achieve and the practical steps to be taken to realize this impact (UKRI, 2018a).[2] More recently, the European Commission's Horizon 2020 Research and Innovation Programme funding, which totals €80 billion over seven years (2014 to 2020), explicitly includes impact criteria as one of three key assessment components (European Commission, 2017).[3] In both cases, an *ex ante* peer review process is used to assess impact claims that are made in advance of the research being conducted. These examples illustrate a contemporary trend in science governance

[1] This replaced 'impact pans' introduced in 2008.

[2] RCUK defines the broader impacts of research as '**the demonstrable contribution that excellent research makes to society and the economy**. This occurs in many ways – through creating and sharing new knowledge and innovation; inventing groundbreaking new products, companies and jobs; developing new and improving existing public services and policy; enhancing quality of life and health; and many more.' (RCUK, 2018b)

[3] For example, the Societal Challenges priority area of the EU Horizon 2020 Programme covers six societal challenges: '(i) health, demographic change and wellbeing; (ii) food security, sustainable agriculture, marine and maritime research and the bio-economy; (iii) secure, clean and efficient energy; (iv) smart, green and integrated transport; (v) climate action, resource efficiency and raw materials; and (vi) inclusive, innovative and secure societies.' (European Commission, 2011: 35)

towards explicitly linking potential broader impacts to the receipt of competitive research grant funding from the public purse.

However, a more recent development in science governance is linking *ex post* assessment of broader impacts to research funding. The most developed example is in the UK where the 2014 Research Excellence Framework (REF) used peer review to assess the quality, impact, and research environment of UK universities. Broader impacts were assessed for the period January 2008 to July 2013 through peer review of impact statements and impact case studies.[4] The outcome was that £1.6 billion per year has been distributed to universities in block funding following a formula based on institutional performance, of which approximately £300 million per year is linked to the outcome of the assessment of broader impacts. In the 2014 REF, broader impacts accounted for 20% of the overall assessment criteria, which will increase to 25% for the next REF exercise in 2021 (HEFCE, 2017).[5]

The examples above are prominent cases of employing research funding mechanisms to stimulate and reward publicly-funded research with broader impacts. This is set within a context of growing international interest in adopting similar mechanisms to encourage research with broader impacts, for example within *ex ante* grant assessment by the National Science Foundation in the USA (NSF, 2018; Holbrook and Frodeman, 2011), and within an *ex post* national research assessment exercise of university research in Australia (ARC, 2018).

While the idea of encouraging research with broader impacts is not new, the activity of formally assessing the broader impacts of publicly-funded research *ex post* and linking the results to block university funding is an important recent turn in science governance. It is therefore necessary to consider what the positive and negative effects of this trend might be. This chapter considers the 'science-society' relationship and the idea that publicly-funded science is obliged to produce outcomes relevant to society at large: i.e., should academics be free to pursue research in an area with no obvious public benefit? It compares and contrasts top-down and bottom-up approaches to science governance and to defining and measuring research impacts: i.e., is it more beneficial for governments to have a simple but narrow, or

[4] The review panels included academic members and 'user members' (i.e. non-academic users of research).
[5] For REF 2021, broader impacts are defined as: 'an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia', and there will be more detailed panel-specific (i.e. subject-specific) guidance (Research England, 2018: 107).

wide but complex, approach to thinking about impact and impact assessment? Examples of different European approaches to impact assessment are explored (UK, The Netherlands, Ireland, Norway) to highlight potential consequences for future research directions and thus the effectiveness of various modes of research governance. A central theme in this chapter is the politics of defining, measuring, and rewarding research impact: this is the key to understanding how various aspects of science governance may deliberately or unwittingly affect future directions of state-funded research, and ultimately, the public benefit derived from it.

2. The relationship between the state and publicly-funded universities

A fundamental question for science policy is how close the relationship should be between government and universities or publicly-funded researchers. For example, what is the appropriate balance between protecting academic freedom and directing research efforts towards producing results with direct benefits for society? Interest in incentivising research with broader impacts is on the rise internationally, and is a 'hot topic' of discussion for the scientific community, research funders and policymakers. This may fairly be described as a neo-liberal initiative, embraced by governments aligned with the political left, right, and centre, seeking economic returns from research that will increase national prosperity and international competitiveness, and in some cases that addresses pressing 'global challenges' such as climate change, migration, and public health.

Paul Nightingale and Alister Scott (2007) have employed the idea of the 'relevance gap' which may be used to describe the philosophical underpinnings of this neo-liberal imperative. They argue that there is a mismatch between the kind of research most needed by society, and the research that is actually being produced. Scientists receiving public funds are, they insist, obliged to pursue research that aims to solve social problems. Conversely, they maintain that governments have largely failed to audit publicly-funded research in terms of its usefulness for society, and this lack of an evidence-base has left science policy decision-making disconnected from actual science.[6]

[6] For a detailed account of the broader impacts of research identified in the UK's REF 2014 exercise, see the analysis of 6,679 REF impact case studies by King's College London and Digital Science (2015).

A vital question for science policy is whether scientists should be free to pursue research in an area with no obvious public benefit. Put another way, what should the balance be of research that targets broader impacts, versus blue-skies research with no strings attached? It remains to be seen what the long-term effects for the science and innovation system will be for tying a greater proportion research funding to short-term broader impacts, alongside a decrease in incentivising funding for blue-skies research.[7]

3. The politics of defining impact

The impact of research can be defined and measured in a variety of ways (Reale *et al.*, in press: 2-3; Greenhalgh *et al.*, 2016; Penfield *et al.*, 2014: 21-22). A spectrum of definitions of impacts exists, ranging from scientific impacts (e.g. the perceived influence of various academic publications), impacts on the science and innovation system, economic impacts, social impacts (e.g. on policy, civil society, healthcare outcomes, service delivery), environmental impacts, and cultural impacts. This is accompanied by a spectrum of measures (e.g. citations to academic publications, science and innovation indicators, economic indicators, other quantitative and qualitative indicators) and alternative modes of assessment, such as the use of case studies and narrative accounts. As we travel along the definition spectrum, the wider the definition becomes; and as we journey across the measurement spectrum, the further we move away from simple indicators to more complex qualitative or mixed-methods approaches. It follows that how we define and measure broader impacts is a political question, as this determines what types of impacts are deemed to be of value and potentially rewarded, and what types of impact are rendered invisible (Donovan, 2007a), as illustrated in §5 below.

Too narrow an approach to defining and measurement will exclude a range of broader impacts. For example, there is a common belief that high quality research leads to high quality impacts, and that scientific quality is a proxy for achieving broader impacts. Donovan and Butler (2007), however, demonstrated that in the case of economics in Australia, applied publications in locally-oriented and practitioner-focused scientific journals received a lower citation rating than theoretical or abstract publications in major international journals, yet

[7] For example, in the UK university block funding has traditionally been without strings, yet criteria for assessing broader impacts will account for 25% of the UK's REF 2021 evaluation criteria.

were linked to achieving the highest broader impacts. Often, science policy has been designed from a natural science perspective, excluding the interests of the humanities, arts, and social sciences (Donovan, 2005).[8] It follows that the widespread use of science, technology and innovation indicators that focus on returns to the economy and industry, exclude a wide range of broader societal impacts. Also, *ex ante* or *ex post* assessments seek to reward beneficial or positive impacts. This privileges researchers' viewpoints and conceals the prediction or reporting of possible negative impacts, and the fact that multiple stakeholders (e.g. civil society, the research beneficiaries) may hold different perspectives on the benefits or otherwise of scientific research.

The use of indicators or metrics to measure research impact is another political domain. While the use of 'impact metrics' is hotly debated, there is general agreement that while perhaps desirable for evaluation policy purposes, quantitative indicators of broader research impacts remain underdeveloped, and that best practice constitutes a mixture of case studies and narratives (supported by relevant indicators where these exist) will yield richer data (Wilsdon *et al.*, 2015: *x*; 128). In this sense, the use of simple metrics (most likely science, technology and innovation indicators) are not value-free as these can be seen to embed human values that privilege STEM subjects. Another contested area is the optimum method of assessment: using 'objective' data or peer review, or a combination of both. The case has been made that scientific research governance is unusual as academics tend to play a major role in designing their own research assessment exercises and in acting as their own assessors.[9, 10] There are concerns that while metrics are objective, peer review is biased (Butler and McAllister, 2009) and expensive (Dunleavey, 2011). However, the case has also been made that metrics are not necessarily significantly cheaper than peer review (Grant, 2016) and that left unchecked, metrics have the potential to be technologies of governance that privilege STEM subjects and the quantitative social sciences (Donovan, 2009; 2007b).

Finally, another interesting political dimension to consider is who is involved in producing definitions of research impact: science policymakers, data providers, the academic

[8] While the approach to assessing the broader impacts of publicly-funded research was being developed for Australia's Research Quality Framework, arts and humanities scholars, and their professional associations, successfully lobbied for the definition of broader impacts to be extended from 'economic, social and environmental' to also include 'cultural' (see Donovan, 2008).

[9] See Moran (2003) on the design and conduct of the UK's Research Assessment Exercise.

[10] See Derrick and Samuel (2016) and Samuel and Derrick (2015) on the role of research users as assessors of broader impacts during the 2014 REF.

community, research users, or potential research beneficiaries. The record has shown that more comprehensive (or bottom-up) consultative processes tend to produce wider definitions of broader impacts than centralised (or top-down) approaches (Donovan, 2008).

4. Political appropriation of the 'impact agenda': politics, power and knowledge

The term 'impact agenda' is used pejoratively to denote neo-liberal philosophy, or the interests of business or government, dominating science policy, dictating research directions and impinging upon academic freedom (Donovan, 2014). Assessing broader impacts of publicly-funded research may also be viewed as a cloak under which to conceal other types of political interests, for example, pursuing political struggles in terms of power and the control of knowledge. Conversely, the 'impact agenda' may be viewed as democratising research by opening up participation in science and science policy, and rewarding research that improves the quality of citizens' lives.

New Public Management (NPM) has become absorbed within science policy, embedding calculative practices in the assessment and reward of academic prestige (Miller, 2001; Rose and Miller, 1992; Rose, 1991). In the case of broader impacts, this form of science governance uses financing to steer actors towards producing 'excellence' and 'relevant' research, and towards inscription or self-regulation of behaviour. It may, however, be argued that political agendas are being pursed under the banner of value for money for taxpayers. The impact agenda can be viewed as providing political legitimacy for criticising academic culture as being detached from wider society (Nightingale and Scott, 2007), and for 'disciplining' the academy by weeding out what is perceived as ideologically-driven or useless research. We have already seen the importance of how impact is defined and assessed. It follows that this can be calibrated so that certain types of research may be labelled, intentionally or unintentionally, as being of 'low quality' academically or as 'not relevant' to society. It is research in the humanities, arts, and social sciences which is the most vulnerable.[11] On the other hand, the impact agenda may be regarded as a vehicle for making

[11] See Donovan (2008) for an account of how the introduction of assessing research impacts in Australia's Research Quality Framework was driven by the Australian Liberal (right-wing) government's suspicion that humanities research (and some social science research) had no genuine broader impact.

previously unrewarded applied research visible and desirable, and for encouraging the co-production of science with research users and research beneficiaries.

The notion of the impact agenda has been criticised as being a moral panic, because the majority of issues identified by the academic community as being harmful (in media reporting and academic journal papers) can be identified as perennial problems in science policy (Donovan, 2017a). These include threats to academic freedom, pressure to conduct relevant research, damage to the research system, and government philistinism and economic rationalism. However, impact-specific issues were identified in the form of the problem of presenting research impact in terms of individual attribution rather than contribution to a larger science ecosystem, time-lags between conducting research and achieving impact, negative impacts, including basic research in the assessment of broader impacts, and the paradox of 'high impact equals low quality'.

There has been a great deal of interest in the institutional effects of the impact agenda in terms of the UK REF, research management and academic identities (Chubb, Watermeyer and Wakeling, 2017; Oancea, 2014; Watermeyer, 2012). An important political dimension is what potential impact case studies are withheld from submission by university management procedures. Trisha Greenhalgh and Nick Fahy (2015) analysed impact case studies submitted to the 2014 REF assessment panel for Public Health, Health Services and Primary Care, and were surprised at the absence of participatory research, and patient and public involvement, which would normally be expected to deliver relatively high levels of research impact. They were concerned that the linear structure of case study reporting for the REF meant that this research was excluded. However, participatory health research tends to be ideological and critical of government policies, so we may speculate that university managers treated these potential impact case studies as politically sensitive and did not return them for the REF. If confirmed, this would be an example of university self-regulation rendering potentially politically-sensitive (yet impactful) research invisible to avoid being 'disciplined'.

5. Impact assessment in practice

The aim here is to present four different examples of European approaches to assessing the broader impacts of research. Each represents a different perspective on defining and measuring impact, and embraces different styles of governance. The UK REF is a national evaluation exercise tied to the distribution of university block funding, its impact component

combines a mixture of top-down and bottom-up science governance, and its definition of broader impacts is very wide; The Netherlands' Standard Evaluation Protocol is also a national evaluation exercise, although it is not tied to funding outcomes, its approach to science governance is largely bottom-up, and its definition of impact is open; Ireland's National Research Prioritisation Exercise is linked to competitive funding, and is a top-down approach that defines broader impacts in economic terms only; Norway's Publications Indicator is a national evaluation exercise tied to a relatively small amount of funding, is largely top-down, and focuses only on publication metrics. The purpose is to note any similarities and differences, and highlight potential consequences for future research directions and thus the effectiveness of various modes of science governance. For each country there is:

- a brief description of the national science policy context which led to assessing research impacts;
- an overview of whether there was any meaningful consultation with the academic community and research users, and an assessment of whether this was a top-down or bottom-up approach to research governance;
- the definition of broader impacts;
- analysis of whether broader impacts were assessed using quantitative indicators only, a mixture of quantitative and qualitative data, or qualitative data only;
- analysis of whether decisions were made on the basis of metrics and no peer review, light-touch peer review informed by metrics, or peer review only;
- an outline of any 'science wars' (i.e. preferential treatment of STEM, or hostility towards the humanities, arts or social sciences) or other obvious political struggles.

5.1 The UK's Research Excellence Framework (REF)

The UK's 2014 REF is the most comprehensive national assessment of the broader impacts of research, and it replaced the UK's Research Assessment Exercise (which was last conducted in 2008). It was initially announced that the REF 2014 would be a streamlined metrics-based exercise, including the assessment of broader impacts. However, after consultation with the academic community, a metrics-only approach was found to be controversial. The Higher Education Funding Council for England (HEFCE) commissioned a report on international

approaches to research impact assessment (Grant *et al.*, 2010), which recommended an exercise based on peer assessment of impact case studies.

HEFCE engaged in numerous consultations with the academic community and research users about various aspects of impact assessment, including how impact was defined. There was, therefore, a mixture of top-down and bottom-up approaches to research governance, with HEFCE acting as a buffer between the government and the academic community. In REF 2014 20% of the assessment was based on impact outcomes, and this will rise to 25% for REF 2021. The total institutional assessment (including assessment of research quality and research environment) determined each institution's level of block funding.

Broader impacts were defined as 'an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia' (HEFCE, 2011: 48), and more detailed descriptions were offered for various Units of Assessment (disciplines). Evidence of impact was presented in the form of an impact statement and impact case study narratives where quantitative and qualitative indicators could be provided in support, along with testimony from end users, if required. The assessment was conducted by peer review panels, comprised of academic peers and research users.

The exercise was explicitly not 'one size fits all', and there was sensitivity to the requirements of STEM fields and to the humanities, arts, and social sciences.

5.2 The Netherlands, Standard Evaluation Protocol (SEP)

In 2006, due to interest in assessing the broader impacts of research, which was missing from the Standard Evaluation Protocol (SEP), Evaluating Research in Context (ERiC) was set up (ERiC, 2010). This was a project group representing key stakeholders, tasked to recommend impact criteria, impact indicators, and a methodology for assessing research impact, which was then incorporated into the SEP. On a rolling basis, Higher Education research institutions are evaluated by external assessment committees, and the individual institutions each have a great deal of autonomy over how the process is organised and how they respond to recommendations. Currently the impact component of the SEP is a narrative self-assessment supported by relevant indicators of research targeted towards societal groups, products used by societal groups, and markers of recognition by societal groups (VSNU, NWO and KNAW,

2016: 25). This self-assessment is then evaluated by an external review committee, and is supplemented by interviews of research unit members by the committee on a site visit.

The broader impacts component of the SEP was designed by key sector stakeholders through the ERiC project, research institutions have a large amount of freedom in deciding which research units will be assessed and how recommendations are actioned, and the results are not tied to research funding. In this light, the governance process is bottom-up.

Broader impacts are defined as, 'added value for society the research unit's work has (had) or is being (has been) demonstrated at regional, national or international level' (VSNU, NWO and KNAW, 2016: 27). A short narrative account is provided by the unit under assessment, to which supporting quantitative indicators can be added. The evaluation is by peer review only, and the assessment committee is selected by a board at the institution being assessed. This involves consultation with the unit being assessed to ensure the review committee has relevant expertise in the unit's research and areas in which it may achieve broader impacts.

5.3 Ireland's National Research Prioritisation Exercise (NRPE)

The 2008 global financial crisis hit Ireland particularly hard, and public policy decision-making became driven by the need for economic relevance. In this respect, the higher education sector was viewed as vital to economic growth, particularly in terms of science and technology, and job creation, and also had to demonstrate the economic returns of public investment (Gibson and Hazelkorn, 2017). The government announced that the new National Research Prioritisation Exercise (NRPE) would be a deliberately top-down approach to research policy and funding, although excluding block funding. A steering group informed by economic and bibliometric data identified 14 priority areas, and six specific fields (biomedical science, nanotechnology, advanced materials, microelectronics, photonics and software engineering) were identified as 'platforms' to underpin these priorities (2017: 202). The humanities and social sciences research council, (IRCHSS) was merged with the equivalent STEM research council to form the Irish Research Council. While there is no formal national research evaluation exercise, it is felt that redefining the boundaries of research prioritisation for competitive funding has privileged STEM over the humanities, arts, and social sciences. A key concern is that moving the goalposts means that the humanities, arts and social sciences are at a competitive disadvantage when applying for competitive funds.

5.4 Impact in Norway's Publication Indicator

Since 2004, Norway has allocated competitive research funding on the basis of the Norwegian Publication Indicator, although this only accounts for around 2% of funding to the sector. It comprises of a national database of all peer reviewed scholarly literature, and a publication indicator is weighted for specific fields, with more points allocated for 20% of the world's top publications in each field (a list of the top 20% is revised annually in collaboration with the relevant research councils). The number of publications for each institution is calculated and then weighted (Silvertsen, 2016). This is top-down approach, with no peer review, and using metrics only. It has been adopted at the national level by Belgium (Flanders), Denmark, Finland, Norway and Portugal, and by some Swedish universities (Silvertsen, 2016: 79). There are concerns that there are asymmetries of database coverage which privilege STEM over the humanities and social sciences. For example, humanities and social sciences scholars are more likely to publish in the Norwegian language, and these publications are less likely to be ranked in the world's top 20 percent. Clearly, this is not an assessment of broader research impacts, although the inference may be made that scientific quality is a precursor to achieving research impact.

This snapshot of different European approaches to assessing the broader impacts of research serves to illustrate the power of linking research funds to the results of competitive research assessment. While in some cases, no funds or limited funds are allocated the outcomes may be used to form institutional rankings and thus are used bestow prestige. Bottom-up approaches produce more open and inclusive definitions of broader impacts, tend to include qualitative data, are more likely to involve peer review, and reveal a diverse range of impacts. Top-down approaches are data-driven, less complex, and have a narrower impact range, usually focusing on scientific impact or economic impact.

6. Conclusion

The chapter has outlined the idea of research producing broader societal impacts, and noted recent public policy trends to encourage and make visible research that produces direct benefits to society. It discussed the 'science-society' relationship, and the idea that publicly-funded researchers should engage in science that is relevant to society at large. It compared

and contrasted top-down and bottom-up approaches to defining and measuring research impacts. The key issue discussed was the politics of defining, measuring, and rewarding research impact.

Assessing the broader impacts of research is a relatively new phenomenon in science policy terms, especially linking the outcomes of large research evaluation exercises with significant funding allocations. It is not certain what the effects may be on the science system, but there are concerns about the neglect of longer-term blue-skies thinking, which could ultimately produce significant broader impacts. It is clear that research evaluation, and the allocation of research funding especially, are important elements in steering institutions and researchers towards producing broader impacts. Yet, there remains much to learn about intended and unintended consequences, for the science system as a whole, for institutional responses to impact assessment, and the effects of research governance on academic identities and careers.

But what does this ultimately entail for the 'science-society' relationship? Has the policy turn towards prioritising and assessing the broader impacts of research had any effect on the science system, or on the science that has been produced for society, or in creating more (beneficial) changes for society? Anecdotally, this has led to the creation of a more (possibly strategic) 'impact-aware culture' among scientists and more interest in co-producing science with research users (Donovan, 2017b: 2). Empirically, it may be too soon to provide evidence of any major shifts in research production. Perhaps the ultimate outcome has been the creation of an evidence-base to demonstrate to science funders and to society at large the value and usefulness of science.[12] It, however, remains unclear whether accounting for the broader impacts of research has created more impacts (i.e. benefits from science for society) or has simply acted to make existing broader impacts more visible.

[12] For example, the report *The Nature, Scale and Beneficiaries of Research Impact* (Kings College London and Digital Science, 2015) provides a comprehensive account of the broader impacts demonstrated in the UK REF.

References

ARC [Australian Research Council] (2018) *National Innovation and Science Agenda Measures*. <https://www.arc.gov.au/nisa-measures>, accessed 18 September 2018.

Butler, L. and I. McAllister (2009) 'Metrics or Peer Review? Evaluating the 2001 UK Research Assessment Exercise' in Political Science', *Political Studies Review*, 7(1): 3-17.

Chubb, J., R. Watermeyer and P. Wakeling (2017) 'Fear and Loathing in the Academy? The role of emotion in response to an impact agenda in the UK and Australia', *Higher Education Research and Development*, 36(3): 555-568.

Derrick, G. E. and G. N. Samuel (2016) 'The Evaluation Scale: Exploring decisions about societal impact in peer review panels', *Minerva*, 54(1): 75-97.

Donovan, C. (2017a) 'Moral Panic and the Impact Agenda', paper presented at the *Society for Research into Higher Education Annual Conference*, Celtic Manor, Newport, UK, 6-8 December 2017.

Donovan, C. (2017b) 'For Ethical "Impactology"', *Journal for Responsible Innovation*. doi: 10.1080/23299460.2017.1300756. <accessed 18 September 2018>

Donovan, C. (2014) 'Impact Agenda' in J. B. Holbrook (ed.) *Ethics, Science, Technology and Engineering: A Global Resource* (2nd edition). Macmillan Reference USA.

Donovan, C. (2009) 'Gradgrinding the Social Sciences: The Politics of Metrics of Political Science', *Political Studies Review*, 7(1): 73-83.

Donovan, C. (2008) 'The Australian Research Quality Framework: A live experiment in capturing the social, economic, environmental, and cultural returns of publicly funded research', *New Directions for Evaluation*, 118: 47-60.

Donovan, C. (2007a) 'The Qualitative Future of Research Evaluation', *Science and Public Policy*, 34(8), 585-597.

Donovan, C. (2007b) 'The Hidden Perils of Citation Counting for Australasian Political Science', *Australian Journal of Political Science*, 42 (4), 665–78.

Donovan, C. (2005) 'The Governance of Social Science and Everyday Epistemology *Public Administration*, 83(3): 597-615.

Donovan, C. (2014) 'The "Impact Agenda", in *Ethics, Science, Technology and Engineering: A Global Resource*, 2nd Edition, Ed. J. Britt Holbrook. Farmington Hills, MI: Macmillan Reference USA.

Donovan, C. and L. Butler (2007) 'Testing Novel Quantitative Indicators of Research 'Quality', Esteem and 'User Engagement': An economics pilot study', *Research Evaluation*, 16(4): 231-242.

Dunleavey, P. (2011) 'The Research Excellence Framework is Lumbering and Expensive. For a fraction of the cost, a digital census of academic research would create unrivalled and genuine information about UK universities' research performance', LSE Impact of the Social Sciences Blog, 9 June, <http://blogs.lse.ac.uk/politicsandpolicy/ref-alternative-harzing-google-scholar/>, accessed 18 September 2018.

ERiC [Evaluating Research in Context] (2010) *Evaluating the Societal Relevance of Academic Research: A guide*, ERiC publication 1001 EN, <https://pure.knaw.nl/portal/files/472346/ERiC_guide.pdf>, accessed 18 September 2018.

European Commission (2017) *Horizon 2020 Proposal Evaluation: Standard briefing* (version 2.6). <http://ec.europa.eu/research/participants/data/support/expert/h2020_expert-briefing_en.pdf>, accessed 18 September 2018.

European Commission (2011) *Impact Assessment: Commission staff working paper accompanying the Communication from the Commission 'Horizon 2020 - The Framework Programme for Research and Innovation'*, SEC(2011) 1427 final. Brussels: European Commissions.

Grant, J., P-B. Brutscher, S. Ella Kirk, L. Butler and S. Wooding (2010), *Capturing Research Impacts: A review of international practice*, RAND Europe. Bristol: Higher Education Funding Council for England.

Greenhalgh, T and N. Fahy (2015) 'Research Impact in the Community-based Health Sciences: An analysis of 162 case studies from the 2014 UK Research Excellence Framework', *BMC Medicine*, 13:232, <https://doi.org/10.1186/s12916-015-0467-4>, accessed 18 September 2018.

Greenhalgh, T., J. Raftery, S. Hanney and M. Glover (2016) 'Research Impact: A narrative review', *BMC Medicine*, 14:78, <https://doi.org/10.1186/s12916-016-0620-8>, accessed 18 September 2018.

Gibson, A. G. and E. Hazelkorn (2017) 'Arts and Humanities Research, Redefining Public Benefit, and Research Prioritization in Ireland', *Research Evaluation*, 26(3): 199-210.

Haldane (1918) *Report of the Machinery of Government Committee*. London: HMSO, Cmnd.9230.

HEFCE [Higher Education Funding Council for England] (2017) *Initial Decisions on REF 2021*, Circular letter 33/2017. <http://www.hefce.ac.uk/pubs/year/2017/CL,332017/> , accessed 18 September 2018.

HEFCE [Higher Education Funding Council for England] (2011) *Assessment Framework and Guidance on Submissions*, REF02.2011. Bristol: HEFCE.

Holbrook, J.B. and R. Frodeman (2011) 'Peer Review and the *ex ante* Assessment of Societal Impacts', *Research Evaluation*, 20(3): 239-246.

Kings College London and Digital Science (2015) *The Nature, Scale and Beneficiaries of Research Impact: An Initial Analysis of Research Excellence Framework (REF) 2014 Impact Case Studies*. Bristol: HEFCE.

Miller, P. (2001) 'Governing by Numbers: Why calculative practices matters', *Social Research*, 68(2): 379-396.

Moran, M. (2003) *The British Regulatory State: High Modernism and Hyper-Innovation*. Oxford: Oxford University Press.

Nightingale, P. and A. Scott (2007) 'Peer Review and the Relevance Gap: Ten suggestions for policy-makers', *Science and Public Policy*, 34(8): 543-553.

NSF [National Science Foundation] (2018) *Merit Review*. <https://www.nsf.gov/bfa/dias/policy/merit_review/>, accessed 18 September 2018.

Oancea, A. (2014) 'Research Assessment as Governance Technology in the United Kingdom: Findings from a Survey of RAE 2008 Impacts', *Zeitschrift für Erziehungswissenschaft*, 17(6): 83-110.

Penfield, T., M. J. Baker, R. Scoble and M. C. Wykes (2014) 'Assessment, Evaluations, and Definitions of Research Impact: A review', *Research Evaluation*, 23(1): 21-32.

Reale, E., D. Avramov, C. Kubra, C. Donovan, R. Flecha, P. Holm, C. Larkin *et al.* (in press) 'A Review of Literature on Evaluating the Scientific, Social and Political Impact of Social Sciences and Humanities Research, *Research Evaluation*, rvx025, <https://doi.org/10.1093/reseval/rvx025>, accessed 18 September 2018.

Research England (2018) *Draft Guidance on Submissions REF 2021*, 2018/01. Bristol: HEFCE.

Rose, N., & Miller, P. (1992). Political power beyond the state: problematics of government. British Journal of Sociology, 43(2), 173–205.

Rose, N. (1991) 'Governing by Numbers: Figuring out democracy', *Accounting, Organizations and Society*, 16: 673-692.

Samuel, G. N. and G. E. Derrick (2015) 'Societal Impact Evaluation: Exploring evaluator perceptions of the characterization of impact under the REF2014', *Research Evaluation*, 24(3): 229-241.

Sivertsen, G. (2016) 'Publication-Based Funding: The Norwegian Model' in M. Ochsner, S. Hug and H. D. Daniel. (eds) *Research Assessment in the Humanities*. Springer, Cham.

UKRI [UK Research and Innovation] (2018a) 'Pathways to Impact'. <https://www.ukri.org/innovation/excellence-with-impact/pathways-to-impact/>, accessed 18 September 2018.

UKRI [UK Research and Innovation] (2018b) *Excellence with Impact*. <https://www.ukri.org/innovation/excellence-with-impact/>, accessed 18 September 2018.

VSNU, NWO and KNAW [Association of Universities in the Netherlands, Netherlands Organisation for Scientific Research, and Royal Netherlands Academy of Arts and Sciences] (2016) 'Standard Evaluation Protocol 2015 – 2021'. <https://www.knaw.nl/en/news/publications/standard-evaluation-protocol-2015-2013-2021>, accessed 18 September 2018.

Watermeyer, R. (2012) 'From Engagement to Impact? Articulating the public value of academic research', *Tertiary Education and Management*, 18(2): 115-130.

Wilsdon, J., L. Allen, E. Belfiore, P. Campbell, S. Curry, S. Hill, R. Jones *et al.* (2015). *The Metric Tide: Report of the Independent Review of the Role of Metrics in Research Assessment and Management*. Bristol: HEFCE.