Assessing the broader impacts of research

A review of methods and practices

Liv Langfeldt and Lisa Scordato

Working Paper 8/2015

NIFU

Assessing the broader impacts of research

A review of methods and practices

Liv Langfeldt and Lisa Scordato

Working Paper 8/2015

Working Paper 8/2015

Published by Nordic Institute for Studies in Innovation, Research and Education (NIFU)
Address P.O. Box 5183 Majorstuen, N-0302 Oslo. Office address: Wergelandsveien 7, N-0167 Oslo

Project No. 12820544

Customer Formas - Forskningsrådet för miljö, areella näringar och samhällsbyggande
Address Kungsbron 21, Box 1206, 111 82 Stockholm

ISBN 978-82-327-0093-6
ISSN 1894-8200 (online)

www.nifu.no

Preface

This study was commissioned by the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas). It maps how societal and broader impacts are assessed in four funding agencies outside Sweden (NERC in the UK, NSF in USA, Horizon 2020 and the Research Council of Norway). Experiences with different practices and methods are discussed in order to provide Formas with information for developing their own practises.

Liv Langfeldt, assisted by Lisa Scordato, conducted the project.

We are indebted to the informants at NERC, NSF, RCN and DG RTD, who took the time and effort to assist our data collection and share their experiences concerning impact assessments.

Oslo, April 2015

Espen Solberg
Head of Research

Contents

Executive summary **7**

1 Introduction **9**

2 Allocating research grants: Assessing relevance and future benefits **12**

3 Relevance monitoring during projects **19**

4 Retrospective evaluation of broader impacts of research **25**

5 Discussion **33**

References **38**

Appendix **40**

Notes **42**

Executive summary

In the past decades, we have seen increasing concern about the ability to account for the benefits of public expenditures on research, and impact is a key issue on the research policy agendas, as well as in the evaluation schemes of major funding agencies. This study examines how *societal and broader impacts of research* grants/projects are assessed in four funding agencies: NERC in the UK, NSF in the USA, DG RTD/Horizon 2020 and the Research Council of Norway. Experiences with different practices and methods are discussed, covering both prospective assessments (proposal review), monitoring of projects and retrospective assessments, as well as the possible links between these three stages of impact assessments. The scope of the study is small, based on a limited number of organisations and information sources, and results cannot be expected to be valid beyond the four organisations.

Prospective assessments: The potential non-academic relevance and impacts are considered in the review of research grants in all the four organisations. Still, it is only Horizon 2020 (not including ERC) which has a 'measurable' impact criterion and in this way ensures that impact is given weight in the final conclusions (minimum threshold for each criterion and fixed weighting into an overall score). Other organisations have chosen more open approaches: In NERC impact is commented on (and the applications' 'Pathways to Impact' statements need approval), but impact is not part of the rating or ranking of proposals. In NSF proposals are given one overall assessment (including both intellectual merit and broader impacts), whereas in the Research Council of Norway there are some funding schemes where impact is *not* considered in the review process, and other schemes where it is a selection criterion, but still without fixed weighting. In sum, we find both soft and firm approaches for prospective assessments. The *soft* approaches are applied to all kinds of funding schemes, and aim to incentivise broader impacts, while leaving much to the discretion of the reviewers and impact is not necessarily a selection criterion. These approaches are open to the initiatives of the research community and the expertise of the reviewers and are in this way adaptable to all kinds of research. On the other hand, *firm* approaches apply separate impact criteria, minimum thresholds and fixed weighting of impact, leaving less to the discretion of experts and review panels. In this way, it is ensured that impact is given weight in the selection process, and research with broader impacts is more firmly incentivised.

Monitoring projects: To what extent and how do funding agencies monitor the research projects they have funded in order to enhance societal relevance/impact of the research? In all agencies, impact-related activities and outputs need to be reported in the progress reports from projects, but these are not (regularly) used for monitoring the individual projects. Sanctions apply if progress reports are not delivered (payments/further proposals are withheld), but there are no defined sanctions related to lack of preliminary outputs or outcomes of projects. The agencies consider that research is complicated and takes time, and do not expect much output, outcomes or impacts during projects. Hence, impact

monitoring is not a priority. When the project portfolio is monitored, the purpose is programme management and accountability. The aggregated information from the progress reports is used for overviews and annual reports (on programme or agency level), and informing decision-making more generally, not for monitoring the projects. On the other hand, the funding agencies are concerned to facilitate and incentivise impact. There are conferences and knowledge exchange with stakeholders, and researchers are trained in user interaction and handling of the media.

Retrospective assessments: The studied organisations have no set methodology for retrospective evaluation of the broader impacts of research projects and programmes. Often projects and individual programmes are *not* regular objects of retrospective impact assessments. Programme evaluations are perceived as less relevant for policy-making, as impacts may not appear until several years after the completion of the programmes, and long-term impacts of research are likely to derive from multiple programmes and funding sources. Retrospective evaluations of impacts more often focus on research areas, research centres, or types of funding instruments/groups of programmes. A variety of methods are combined for these evaluations, and adjusted to evaluation objectives and the fields of research. There is an increasing emphasis on case studies and methodologies combining case studies and e.g. expert panels are developed and tested. On the other hand, we find somewhat limited belief in metrics in order to capture and measure the broader impacts of research. Broader impacts are perceived to be hard to capture, vary extensively between projects and be underreported. Hence, available metrics such as patents and spinouts only account for a small part of it. There are however, general ambitions, as well as specific initiatives, to improve databases and develop methodology for retrospective evaluation of impact. Chapter 5 contains a summary of strengths and weaknesses of quantitative methods and case studies in retrospective evaluations of broader impact, illustrating that what is a weakness of case studies is often a strength of quantitative methods and vice versa. By combining the methods, the evaluators seek to combine the strengths and limit the weaknesses.

Systematic approaches across all three stages: To what extent are the three stages of impact assessments linked? In the studied organisations, such links exist at overall levels, but not at project level. According to our informants, for basic research such linking would not be much useful for following up individual projects. The reason is mainly the same as for not monitoring impact at project level: research is complex, takes time, have extended and combined effect beyond the individual projects and basic research may prove to be valuable to society decades after it was performed. At the overall level, the agencies try to link the stages in their evaluation policy and to develop databases that enable overall analysis, monitoring and evaluation of the project portfolio. Good databases should contain data from all three stages, and are perceived as important building blocks facilitating monitoring and evaluation, and for getting an overview of activities as input to policy-making. Moreover, the linkages between the stages may enhance impacts though coordinated aims and measures, and strengthened incentives for broader impacts.

1 Introduction

Research grants and impact assessments

In this report, we set out to examine four questions dealing with the assessment of societal/wider impact of research grants, covering both prospective assessments, monitoring of projects and retrospective assessments, as well as the possible links between these three types/stages of reviewing impact:

1. *Prospective assessments* (research proposals)*:* To what extent do funding agencies' procedures, criteria and methods for assessing research proposals address the wider relevance and potential use of the research, and to what extent are they concerned with picking the most 'relevant' winners?

2. *Project monitoring:* To what extent and how do funding agencies follow-up/monitor the research projects they have funded, in order to enhance societal relevance/impact of the research?

3. *Retrospective assessments*: Which methods are applied by funding agencies to assess the societal/wider impact of completed projects? What are the experiences with, and perceived pros and cons of, case studies/narratives versus quantitative methods in assessing impact of completed projects?

4. *Systematic approaches:* To what extent and how do funding agencies have a systematic approach to enhancing relevance – including all three stages: selecting projects, monitoring projects and assessing the impact of projects?

In the past decades, we have seen increasing concern about the ability to account for the benefits of public expenditures on research. Assessing the societal impacts of R&D is now a key issue on the research policy agendas and in the evaluation schemes of major funding agencies. According to OECD there are three main rationales for impact assessments in STI-policy: 'to fine-tune and improve existing policy interventions; to inform spending priorities and focus future policy interventions on areas with the greatest expected impact; and to hold actors accountable for their performance and spending' (OECD 2014:106). Taken together, the three types/stages of impact assessments listed above cover these rationales: make priorities/select research projects with expected benefits for society, improve policy instruments/enhance benefits from funded research, and retrospective assessments for ensuring accountability. The assessment on the different stages may of course also have broader and multiple objectives, e.g. that retrospective assessments should offer learning concerning how funding instruments best provide for societal impacts.

It should be emphasised that societal relevance, societal impact and wider impact can be elusive terms, and that discussing and defining these terms is outside the scope of this study. This report takes as a starting point that wider or societal impact refers to all kinds of values/effects research may have outside academia, and that wider or societal relevance refers to the extent research is expected to have such value/effect. We furthermore study the various meanings of 'relevance' and 'impact' by examining the criteria funding agencies use when assessing it.

Data and information sources

The study is based on three main data sources: Available literature, funding agencies web sites and information from key informants in selected funding agencies. In adjusting the data collection to the time frame of the study, we have focused on the practices of four selected funding agencies/programmes:

- The National Science Foundation (US), NSF
- Research Councils UK (RCUK), represented by the Natural Environment Research Council (NERC)
- The Research Council of Norway, RCN
- EU Framework Program/Horizon 2020, EU FP7/H2020

The selection of funding agencies included in the study was based on NIFU's previous information, information from other projects, preliminary web-searches and interesting cases found in the literature. NSF and the EU FPs were considered interesting cases because of long-time practices in prospective impact assessments (of grant proposals), RCUK was selected because of its overall 'Pathways to Impact' agenda, and the RCN was included because of its long-time involvement in quantitative ex post assessments based on user surveys. In order to be able to include the process perspective – the extent to which there is a systematic focus on relevance/impact in the review of application, in the follow-up during projects and in ex post assessments – we included all three stages for all selected agencies. It should be underlined that the agencies/programmes were selected because of their special concerns and practises in impact assessments, and that we do not expect our study to be representative of what goes on in other funding agencies.

As mentioned, the study draws on three main information sources:

- *Literature:* We searched the academic literature on grant review processes/prospective assessments of societal impacts, previous studies of practices, criteria and experiences for impact assessment, as well as discussions on procedures and methods for impact assessment. The scope of the study permitted including a limited number of publications (see list of references in the back of the report).
- *Descriptions at funding agencies web pages:* Information about ex ante and ex post assessments of relevance/societal impact was retrieved from the web sites of the selected agencies. The web-searches were directed at funding agencies' practises, criteria, experiences, and the relative weight on societal vs. academic relevance and impact. In studying how societal relevance and impacts are dealt with, we specifically looked at the procedures and guidelines for reviewing grant applications, the reporting from projects and ex post review. Limited information was found on the follow-up during projects to enhance societal relevance.
- *Additional information from key informants at the selected funding agencies:* Data was collected via phone and emails from key informants in the selected funding agencies. The informants were asked to elaborate practices and experiences concerning facilitating and assessing societal relevance and impact at all three stages: application review, follow-up during project and post project. A first draft of chapter 2, 3 and 4 was sent the informants for comments before finalising the report. The key informants were limited to one in each of the four organisations – typically a head of a relevant department or evaluation unit. In most cases, these persons involved additional colleagues when commenting/correcting the draft version. In the case of NSF, only limited

feedback on the draft version was provided, and the risk that the text contains misconceived information is larger than for the other organisations.

In sum, the scope of the study is small, based on a limited number of organisations and information sources, and we cannot expect any representativeness of results beyond the four organisations. However, the study provides an updated overview of experiences from different organisations, presented from a new three-stage perspective on impact assessments.

2 Allocating research grants: Assessing relevance and future benefits

A main task of research funding agencies – research councils and research foundations – is to design competitive funding schemes and organise the selection of applications for funding. In order to prioritise and promote the non-academic relevance of research, aims concerning wider/societal benefits may be incorporated into the work-plans of the funding schemes as well as into their selection procedures. At this stage, possible strategies for ensuring relevance include priority setting/thematic programmes (to build capacity in high priority/relevant areas), dual selection criteria, hybrid review panels/juries, and requiring user support or involvement in terms of user support letters for the proposed projects, user co-funding or user involvement in projects/fund consortia (Rip 2000). The key question in our context is the assessment of future relevance/benefits of *proposed projects*. Whereas assessment of future relevance/ benefits is part of the priority setting when designing thematic research programmes/ funding schemes, these processes are outside the scope of this report. Below we focus on the procedures and criteria for reviewing project proposals, including the involvement of peers, users and other stakeholders in the assessments, as well as criteria/requirements for user involvement in the projects.

A key issue discussed in the literature, is the respective roles of peers and users (or lay people) in the selection process. As a backdrop to this question/discussion, a short introduction on the nature and challenges of peer review is useful. In most cases, funding agencies base the project selection on assessments performed by researchers competent in the field[1] of the proposal, that is peer review. The literature on peer review addresses a number of challenges in assessing and selecting research proposals. Peer review is a key institution in the research community, but not an unproblematic instrument for ensuring wider/societal relevance or benefits of research, nor for predicting scientific success. Peer review is part of the discussion defining the characteristics of good research. It defines losers and winners in the competition for positions, grants, publication of results, and all kinds of awards. The reviewers are the gatekeepers that ensure that the traditions and standards of good research are fulfilled. Other important aspects of peer review include incentive effects and cumulative advantages: The competition for recognition and resources inherent in peer review has an important mission in promoting better research. And as peer review distributes reputation and research resources (what add up to what we may call academic capital), it is also part of the processes of cumulative advantages building up strong research groups (Langfeldt 2006). As different reviewers may have substantially different assessments of the same research, peer review may also be an arena for power struggles between conflicting schools and paradigms. This may be a particular challenge for funding agencies when trying to promote original and interdisciplinary research. Concerns for biases in grant peer review include claims that it is biased against high-risk/high-gain projects, interdisciplinary projects as well as different forms of cronyism (Cole et al. 1981; Chubin and

Hackett 1990; Cicchetti 1991; Travis and Collins 1991; Langfeldt 2006; Demicheli and Di Pietrantonj 2007).

The question then arises whether project selection based on peer review is an adequate procedure when promoting wider/societal benefits of research. And to what extent should users/stakeholders or the general public take part in project assessments? On the one hand, some scholars question peers' qualifications as well as their willingness to assess social relevance and 'wider impacts' of research proposals, or they more generally question the possibility of adequate prospective assessments of impacts (Rip 2000; Nightingale and Scott 2007). It is held that scientists 'tend by default to focus on scientific criteria in their judgements', and that peers cannot be relied on for assessing wider impact: 'They might invoke the three Sirens of: academic objectivity; academic autonomy; and academic quality, to avoid having to deal with relevance criteria' (Nightingale and Scott 2007: 551). Others consider that peers need to be involved in the assessment of wider relevance of research proposals, and argues that 'there is little evidence to suggest that peer review is any less effective at ex ante assessments of societal impact than it is at ex ante assessments of scientific, technical, or intellectual merit' (Holbrook and Frodeman 2011: 240). Furthermore, the issues of academic autonomy is used as an argument for – and not only against – involving peers in assessing relevance and impact: in order to strengthen academic autonomy peers should include a broader range of considerations in their judgements (Frodeman and Briggle 2012: 3).

Below we examine practices for relevance and impact assessments of research proposals in selected funding agencies: What kind of competence is used in assessing project proposals, what are the review criteria/guidelines, and what are the demands for user support/involvement in proposals?

Practices in selected agencies

The weight peer reviewers put on the wider relevance when assessing research proposals may vary – depending on the guidelines provided to the reviewers, as well as the reviewers' individual concerns for non-academic relevance and their perception of the objectives of the involved funding schemes. Funding agencies also vary in terms of how much they ensure weight on the societal relevance of applications impact/relevance by emphasising wider relevance criteria in the guidelines for reviews, or by involving reviewers from outside academia in the review of the research projects. There are also different demands for formal user involvement in projects and 'impact descriptions' in the proposals.

Natural Environment Research Council, UK

Research Councils UK (RCUK) have special emphasis on impact. In their own words they are 'committed to excellence with impact', and invest in the best research 'whilst aiming to enhance the impact of that funding on society'[2]. In this report, we look at the practises of *Natural Environment Research Council* (NERC), one of the seven research councils dedicated to RCUK's 'Pathways to impact' agenda. NERC demands all applications to contain a description of the potential societal and economic impact of the project, and to outline the steps to facilitate this impact. Under responsive mode funding (independent, researcher-initiated projects), applications are assessed by peers[3], whereas for strategic programmes both peers and users participate in the assessments. In the latter about 1/3 of the panel members are users (both business and public policy). The criteria for assessing the proposals include scientific excellence and specific objectives and requirements of the relevant call/programme ('fit to scheme'). Impact assessment is not part of these criteria, but is commented separately by the reviewers and an acceptable 'Pathways to impact' is a condition for funding. Hence, if the applicant's description is not satisfactory, the grant will be postponed (or rejected if a satisfactory description is not received). The reviewer guidelines emphasise that the 'Pathways to impact' should:

- be project-specific and not generalized;
- be outcome-driven;
- identify and actively engage the key relevant research end-users and stakeholders at appropriate stages;

- demonstrate a clear understanding of the project-relevant needs of end-users and consider ways for the proposed research to meet these needs;
- contain evidence of existing engagement with relevant end users e.g. via letters of support/supporting statements;
- detail the planning and management of associated activities including timing, personnel, budget, deliverables and feasibility.[4]

If the review panel considers the 'Pathways to Impact' not acceptable, the panel is asked to give written feedback/details on the actions/improvements required of the applicants to raise it to an acceptable level. Another UK agency, the Biotechnology and Biological Sciences Research Council (BBSRC), have defined separate scoring criteria for 'Pathways to impact', according to three levels: excellent, satisfactory or unsatisfactory. And unlike the NERC process, the scores on 'Pathways to impact' may affect the ranking of the proposals.[5] As in NERC, a satisfactory 'Pathways to impact' is a condition for funding from BBSRC, and no grant is announced before an acceptable (revised) description is received.

The National Science Foundation, USA

In the US, we find similar demands for impact descriptions in project proposals to the National Science Foundation (NSF). Since 1997, the NSF has had 'broader impact' as a key criterion in its review of project proposals. Applicants are required to include a separate section in their project description discussing the broader impacts of the proposed activities. Proposals are assessed by experts[6] (peers) concerning both intellectual merit and broader impacts. Intellectual merit is understood as the 'potential to advance knowledge and understanding within its own field or across different fields', and broader impacts as the 'potential to benefit society and contribute to the achievement of specific, desired societal outcomes'. The description of the criterion was changed in 2013, based on recommendations in a report pointing out that the criterion was not clearly understood and not consistently implemented.[7] Whereas the two criteria are not rated separately and there is no rules for any relative emphasis of them in the overall rating and ranking, the reviewers are asked to provide a summary statement on the relative emphasis they have put on the two criteria. Hence, the relative importance of the two criteria is much up to the individual reviewers, and the programme officers may consider this in their recommendation regarding the proposals. Moreover, broader impact is a comprehensive criterion, including any potential benefits to society relevant to the proposed project. In sum, both scientific merit and broader impacts are assessed for all proposals, but the relative emphasis put on broader impacts is much up to the discretion of the individual reviewers and furthermore considered by the programme officers.

The Research Council of Norway

In the Research Council of Norway (RCN), there are *no general impact criterion* for the review of ordinary *researcher projects* (which is a project type across all RCN divisions and various types of funding schemes). Individual calls and thematic research programmes may have particular objectives related to societal benefits and include societal impact as a key review criterion, and relevance relative to the call is a standard criterion for RCN researcher projects; hence, for programmes with strategic aims, broader/non-academic relevance is a review criterion.[8]

Moreover, the RCN funds projects aimed at *knowledge-building for industry*, and for these projects there are several review criteria to cover non-academic relevance and impact. The reviewers are asked to assess:

- *'Relevance and benefit to trade and industry*', including 'The need for this expertise among the participants from industry; The need for this expertise within Norwegian industry at large; The potential of the increased expertise to trigger new growth in Norwegian industry'.

- '*Strategic basis and importance*', including, among others the project's role in relation to partners' strategic objectives, plans and research challenges.

- *'User participation'*, including 'whether those who will be utilising the R&D results have demonstrated an adequate degree of binding commitment regarding their involvement in the management and implementation of the project'.

- *'Other socio-economic benefits',* addressing potential impacts 'on society outside of the utility value/commercial benefits for the partners in the target group'. This may include: 'Value creation in industry; Useful applications for the public sector; Useful applications for civil society; Dissemination of knowledge, diffusion of technology and knowledge-building within R&D institutions; Enhancement of the external environment.'[9]

Each criterion is rated individually. For the overall rating, the various impact criteria, scientific merit and other criteria are combined into a single score based on the discretion of the reviewers; that is, there are no rules for the relative weighting of the criteria. The demands for user involvement in these projects are, however, definitive. At least one industry partner is required and partners needs to prove their dedication to the project by contributing with at least 20 per cent of the total project costs at the R&D institutions, as well as a statement confirming their interest in the project. Moreover, the application need to contain a section describing the project relevance to industry and the potential socio-economic benefits.

The expert panels reviewing the applications are in most cases peers in research organisations abroad[10]. On the other hand, the programme boards making the final ranking and funding decisions always consist of both researchers and users (except for independent projects/responsive mode funding). There are no general rules for the relative weight on researcher and user expertise, and it varies which group is in the majority in the programme board. The programme boards are composed to be 'relevance experts', and to make judgements and decisions to fulfil the aims of the programme. Hence, they may select a proposal that has received a second best score from the expert panel, rather than one with the best score, if they think that proposal better addresses the aims of the programme. Still, according to RCN, different programme boards assess relevance differently, and it may vary from person to person whether he/she is willing to set own expertise/relevance assessments above the expertise of the expert panel. Notably, the reviewers and the programme board have separate tasks: The programme boards are to assess relevance and cannot alter the quality rate or review given by the reviewers/expert panels, but may give it *higher priority* based on relevance assessments. Overall, the experiences with this practice are positive, and involving users in assessing relevance is seen as very valuable.

Notably, for RCN independent researcher-initiated projects, all reviewers and programme board members are peers, and broader impact is not a review/selection criterion. Norway has one research council responsible for funding all different kinds of research[11] – from basic responsive mode grants to innovation grants to industry. Independent researcher-initiated projects are considered a separate funding-stream free of demands for non-scientific relevance.

Horizon 2020

Turning to the proposal review in Horizon 2020, we find a clear emphasis on non-academic impacts throughout the programme (except ERC grants). Both the review criteria, rating/ranking and the recruiting of reviewers are set up to ensure that expected impacts are taken into account. Impact is one of the three overall 'award criteria': 'Excellence', 'Impact' and 'Quality and efficiency of the implementation'. These three criteria have the same minimum threshold for funding (3 on a scale from 1 to 5), and in general they are given equal weights in the overall assessment. In some cases, as for 'Innovation actions' and the 'SME instrument', impact is given extra weight in the overall assessment (weight 1.5).

Under the impact criterion for 'Research and innovation actions' within Horizon 2020, the reviewers are asked to assess the extent to which outputs should contribute to (at European and/or international level):

- ‘Enhancing innovation capacity and integration of new knowledge;
- Strengthening the competitiveness and growth of companies by developing innovations meeting the needs of European and global markets; and, where relevant, by delivering such innovations to the markets;
- Any other environmental and socially important impacts (not already covered above);
- Effectiveness of the proposed measures to exploit and disseminate the project results (including management of IPR), to communicate the project, and to manage research data where relevant.’[12]

In addition comes the expected impacts listed in the specific work programme/call. In their assessments, reviewers are told to look at any framework conditions, barriers or obstacles (as described in the proposal) important for achieving the expected impacts, as well at the plan for dissemination and exploitation of results.[13]

When selecting experts for assessing the proposals, expertise is widely defined, and includes experts in innovation, exploitation and communication, in addition to experts in the field of research. Moreover, experts are recruited both from research organisations and private sector. DG RTD is concerned with getting a good mix of experts across disciplines, geographical backgrounds and types of organisations, and sees that special efforts are needed to attract expertise in innovation. There are also particular concerns regarding the interpretation of the impact criterion, to ensure that the experts understand the concepts in the guidelines.

As for the other funding agencies, applicants are required to describe expected impacts from the project. For ‘Research and innovation actions’, they are asked to describe how the project will contribute to expected impacts of the specific call for proposals/work programme, as well as environmental and socially important impacts and the needs of European and global markets. Horizon 2020 furthermore addresses non-academic needs for research and innovation by including private companies, public bodies and NGOs as project participants. The specific calls for proposals may also demand inclusion of ‘user’ participants. For ‘Research and innovation actions’, the general requirement is a minimum of three organisations in three different countries, but there is no general demand to include non-academic organisations.

The practices of the various agencies are summarised in Table 2.1.

Table 2.1 Overview project selection

Agency	Evaluators/panel composition	Review criteria	Demands for user support/ involvement/impact description
NERC	Responsive mode: Peers (users might participate) Programmes: Peers and users	Excellence: Including, among others, scientific impact and appropriateness of methods. Fit to scheme: Assessment against programme objectives and requirements. May include scientific objectives with particular user relevance/co-designed with users. Scale: 0-6 by individual reviewers and 0-10 by moderating panel. Pathways to impact: Commented on by reviewers and assessed by moderating panel, but not scored/part of funding decision.	Pathways to impact statements: 'Applicants are required to identify the potential societal and economic impact of their work and to outline the steps they can sensibly make to facilitate the realisation of this impact.' The application needs to contain an acceptable 'Pathways to Impact" description before a grant may start.
NSF	The large majority are peers. Some reviewers from industry or public agencies where this is relevant.	A) Intellectual merit: potential to advance knowledge and understanding within its own field or across different fields **B) Broader impacts**: potential to benefit society and contribute to the achievement of specific, desired societal outcomes. The be considered in the review for both criteria: To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts? Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success? How well qualified is the individual, team, or organization to conduct the proposed activities? Are there adequate resources available to the PI to carry out the proposed activities? **Rating and ranking**: Proposals are given an overall assessment (often on a 5-point scale from 'Poor' to 'Excellent'. Both criteria need to be considered, but no general rules for relative emphases or thresholds for funding.	Impact description required: 'The Project Description must contain, as a separate section within the narrative, a section labeled "Broader Impacts of the Proposed Work". This section should provide a discussion of the broader impacts of the proposed activities.'[14]
RCN	Independent projects (responsive mode): Peers only Programmes: Peers and users	**Researcher projects:**[15] No general criteria on broader impact/relevance, but for strategic programmes, criterion G often includes such concerns: A) Scientific merit B) Project management and the Project group C) Implementation plan and resource parameters D) National cooperation E) International cooperation F) Dissemination and communication of results **G) Relevance relative to the call for proposals** H) Overall rate of the referee/panel. **Rating and ranking**: Each criterion is rated individually, no fixed rules for relative weighting of the criteria into the overall rate. **Threshold**: applications with overall below score 4-5 (of 7) will normally not be funded. **Knowledge-building Project for Industry:**[16] Several broader impact/relevance criteria: **F) Relevance and benefit to trade and industry** **G) Strategic basis and importance** **H) User participation** **J) Other socio-economic benefits** **Rating and ranking**: Same as for researchers projects.	Researcher projects: No general demands, except that all applications to the RCN should contain 'adequate consideration to any potential impacts (positive or negative) on the natural environment (external environment), when this is relevant. This applies both to the performance of the projects and to the utilisation of the results.' Knowledge-building Project for Industry: Industry partners and industry contribution required. Industrial partners (Norwegian) must provide cash financing to cover a minimum of 20 per cent of the total project costs at the R&D institutions. 'Each of the companies that is expected to contribute funding must provide a statement confirming the company's interest in participating in the project.'[17] *Applicants are asked to describe:* • 'underlying knowledge challenges and needs that provide the justification for initiating the project.' • 'Relevance for Norwegian industry' • 'Other socio-economic benefits'[18]
H2020	'Experts' are broadly defined as 'a high level of skill, experience and knowledge in the relevant areas (e.g. project management, innovation, exploitation, dissemination and communication)' and recruited both from private and public sectors.[19]	A) Excellence: Clarity and pertinence of the objectives; Credibility of the proposed approach (additional criteria under the specific actions). **B) Impact**: The extent to which the outputs of the project should contribute at the European and/or International level (ref. to the expected impacts listed in the work programme under the relevant topic). A) Quality and efficiency of the implementation: Work plan; participants; management structures and procedures. **Thresholds:** Minimum score 3 (max=5) on all three criteria. Minimum overall score 10. (thresholds may vary according to the work programme) **Weighting**: In Innovation actions and the SME instrument 'Impact' is given higher weight (1.5).	Requirements differ by call. General requirements for Research & innovation actions: At least three legal entities in different member states/ associated countries. Legal entities include research organisations, private companies, public bodies and non-profit organisations. Impact description required: Applicants are asked to describe how the project will contribute to expected impacts set out in the work programme/call, knowledge meeting the needs of European and global markets and 'other environmental and socially important impacts'.[20]

Main findings

In all the four organisations studied above, the potential future relevance and benefits are part of the ex ante assessments of research grants. In some organisations it is compulsory for all funding schemes (NSF and NERC), whereas others also have schemes aiming at scientific excellence where wider impacts are not part of the review criteria (ERC under Horizon 2020, and responsive mode

funding in RCN). The RCN focuses particularly on relevance and impact in the selection processes for grants when this is an important objective (such as 'Knowledge-building Projects for Industry'), Horizon 2020 has impact as an important criterion in all schemes except ERC grants, whereas in NSF and NERC broader impacts are addressed in all funding schemes.

The extent to which broader impact is a selection/rating criterion also differs. In Horizon 2020 and the RCN, the impact criteria are rated separately, NSF proposals are only given overall ratings (intellectual merit and broader impacts summarised in one assessment), whereas in NERC impact is commented (and needs approval), but is not part of the rating or ranking of proposals. Furthermore, Horizon 2020 is the only one of the four with a minimum impact score threshold for funding, and fixed weights for aggregating scores on various criteria to one overall score. In NSF and RCN, the emphasis on expected broader impacts in the overall rating of the proposals relies on the discretion of the reviewers. Hence, it is only the Horizon 2020 which has a 'measurable' impact criterion and in this way ensures that it is given weight in the final conclusions.

All the organisations to some extent involve non-academic experts in the review, whereas none of them use lay juries to assess the wider impacts or let potential users outside academia give separate assessments of proposals. Notably, non-academic experts are not used to assess researcher initiated/independent research. To what extent non-academic experts participate vary by type and content of the funding schemes. In NERC and RCN non-academic experts are only used for strategic/thematic programmes (not for responsive mode funding/independent projects), and non-academic experts are not used for assessing ERC grants (under Horizon 2020). When non-academic experts/users are involved in project assessments/selection, they seem to participate on equal terms with academic experts, and are not assigned separate/different evaluation tasks. Still, in some cases there are committees with separate tasks, as for the expert panels (assessing scientific quality) and the programme boards (assessing programme relevance) of the RCN.

In sum, there is a variety of practices for prospective assessments of broader impacts. At the one end, we find *soft* approaches applied to all funding schemes and incentivising impacts, but leaving much to the discretion of the experts and impact is not necessarily a selection criterion. At the other end, we find *firm* approaches with separate impact criteria, minimum thresholds and fixed weighting of impact, leaving less to the discretion of experts and review panels. The approaches have different advantage and are adopted for different reasons. The soft approaches are more open to the initiatives of the research community and the expertise of the reviewers, and are in this way adaptable to all kinds of research and may open up for 'blue sky' (and potentially very valuable) research without prospectively identifiable impacts. The firm approaches, on the other hand, ensure that impact is given weight in the selection process, and more firmly incentivise research with broader impacts. Whereas the firm approaches indicate greater confidence in the possibility of separating the impacts of individual projects and comparing the value of such impacts ex ante, the soft approaches indicates greater confidence in (or at least reliance on) impact incentives and the integrity of reviewers.

3 Relevance monitoring during projects

Funding agencies may have different ways of following up and monitoring their research projects in order to enhance societal relevance. Societal relevance may be a separate issue in required progress reports from projects, and there may be specific demands/incentives/reporting for user interaction and involvement, and the wider dissemination of results. Moreover, funding agencies may organise workshops and conferences disseminating preliminary results and discussing implications, in order to enhance impact. Such practices may vary substantially between an agency's funding schemes. In the academic literature we find little discussion or studies of such monitoring. There are, however, some approaches and methodological studies that may be useful when following up on research projects in order to enhance societal relevance. One of these is the 'productive interaction' approach (Spaapen and van Drooge 2011). Based on studies on the various contextual conditions for societal impacts of research, this approach addresses the interactions between researchers and stakeholders throughout the research process as the 'small but necessary steps in the process of achieving social impact' (Spaapen and van Drooge 2011:216). The approach include three major categories of interactions that should be mapped when assessing the potential for impact: (1) direct interactions (personal interactions, professional networks), (2) indirect interactions (publications/media/artefacts), and (3) financial interactions (research contracts/financial contribution). The authors also emphasise that the approach may serve as an 'enlightenment tool' for the researchers, in that focusing on these issues may increase their awareness of relations to various stakeholders and the value of their research to social impact.

Below we look at how selected funding agencies follow up on their funded research projects.

Practices in selected agencies

Natural Environment Research Council

Projects funded by Research Councils UK (RCUK) report outputs and outcomes annually through a common system for the UK ('Researchfish'[21]). Examples of output types reported from NERC projects include:

- Collaborations/partnerships;
- Further funding;
- Staff member mobility (including other sectors);
- Engagement activities/audiences;
- Influence on Policy, Practice, Patients & the Public;
- Products;
- Spin Outs;
- Narrative Impact (brief summary).

Hence, a broad range of information is collected during projects. On NERC's web pages it is emphasised that the information is 'valuable for NERC's strategic planning and essential in reporting to government on the return from its investment in research base, ie in creating a competitive advantage for the UK economy and in improving wellbeing for the public'.[22] The information is not used for monitoring individual project. Monitoring the progress of 'Pathways to Impact' for each grant is said to be too resource-demanding,[23] and would not be considered useful or fair: Research takes time and substantial output, outcomes or impacts during projects cannot be expect. Still, the submission of progress information is monitored, and from 2015 grant holders who do not report, will be unable to apply for further grants and payments will be withheld. Notably, these sanctions relate to the submission only, not the content of it. There are no sanctions on lack of outcomes or impacts. The need to report such project results, as well as the need for writing pathways to impacts to obtain grants, still incentivises impact activities in ongoing projects. A further motivation may be that a selection of top achievements is used in the NERC Annual Report, and may lead to: 'Impact case studies sent direct to government to demonstrate the impact of NERC's environmental research', or features (online/NERC magazine) or impact case studies to demonstrate the impact of research to stakeholders, including industry, policymakers and the general public.[24]

Generally, engaging with the public is encouraged and supported by NERC, and some additional funding is offered for knowledge exchange activities/interaction. In a few cases they also give additional funding to projects with an excellent pathway to impact (without an extra proposal). The grant handbook explains why knowledge exchange activities/interaction are important and how the NERC communications team can contribute. NERC offers a course on 'Engaging the public with your Research', free to grant holders and the project staff/students.[25] Moreover, NERC's programme-level activities may include conferences for stakeholders and knowledge exchange during projects (in addition to programmes end-activities). Another priority is to make information about all funded research available in an online database to enable businesses/user stakeholders to identify potential research partners, and 'maximise the impact of publicly funded research'.[26]

The National Science Foundation

The NSF approach to 'monitoring' projects and enhancing impact, is fairly similar to the one found in the UK. There are annual progress reporting from projects, no general demands – but encouragement – for interaction with users[27], and no monitoring/mid-term assessment of individual projects. Impact is a separate category in the annual project reports, where PIs are asked to report 'any activities intended to address the broader impact criterion'[28]. NSF here comply with a uniform format for reporting performance progress on Federally-funded research projects (RPPR) where PIs are asked to describe how the project has made an impact on human resource development, commercial technology or public use, improving social economic, civic or environmental conditions etc. Whereas there are no specific requirements for user interaction, the annual project reports include a section for describing the partner organizations of the project, including 'academic institutions, other nonprofits, industrial or commercial firms, state or local governments, schools or school systems, or other organizations (foreign or domestic)'.[29] Further/continuing grants may be delayed or stopped if the annual report is not submitted and approved by the programme officer. Projects may be terminated because of poor progress, but it is unlikely that an annual report is not approved because of lack of fulfilling the broader impact criterion.

As in the UK, engaging with the public and interacting with users is encouraged, and there may be various programme level activities for facilitating it.

The Research Council of Norway

As noted in Chapter 2, the RCN has different sets of review criteria for different kinds of grants. But whereas societal/broader impacts is not a review criterion in responsive-mode funding, all projects use a progress report template including non-scientific outputs and impacts, regardless of whether it is responsive mode funding, strategic or innovation oriented research. The template covers all kinds of activities and results from the projects, including dissemination to users; to the general public;

industry-oriented R&D results; commercial results (and of course academic activities and results).[30] Knowledge-building Projects for Industry need to submit progress reports twice a year, other projects once a year.

Possible sanctions related to the progress reports are somewhat more pronounced compared to NSF and NERC. Progress reports need to be submitted and approved before funding for the following year/period is allocated. If progress is not according to the millstones defined in the application (this is a separate yes/no question in the online form), there is a risk that the progress report is not approved.[31] As explained in Chapter 2, some RCN schemes/project types require industry/user partners. If the progress report reveal that such requirements are not fulfilled, the grant may be renegotiated/ended. By and large, the progress report is a non-conformity report, and deviation from the contract (including the progress plan of the project), may induce adjustment in payments or ending of the contract. Hence, if the companies do not contribute (financially) to the project according to contract, if PhD/students are not recruited as planned, or the conditions for carrying out the project in other ways dissipates, the projected may be ended. It is still unlikely that a grant will be stopped because of below planned impact related *output* during project (according to our knowledge, it has never happened).

For each research programme, RCN produces an annual report, including aggregated data from progress and final report from projects. In addition to metrics from the project reports, the programme reports may give examples of results and their relevance/how they are used – taken from the free-text part of the project reports elaborating on findings and results.[32] There are no ordinary follow-up/midterm assessments on impact/relevance. Exceptions are larger/long-term grants, such as midterm-assessments of Centres for Research-based Innovation (SFI). For all centre grants, there are midterm assessments which may have implications for further funding. These evaluations incentivise a high emphasis on producing results in the first 4-year grant-period, including relevance for users/wider impacts, but so far no centre-grant has been stopped half way through the grant.

Like NSF and NERC, RCN organises workshops and conferences at programme-level, communicating projects results to relevant target groups, including preliminary results from projects in progress. Furthermore, RCN emphasises the importance of matching research agendas and user arenas at an early stage of the research, and as noted above user involvement is required in some projects (knowledge-building projects for industry).[33] It should be added that there are mixed experiences concerning industry participation in knowledge-building projects. Overall, the projects have high additionality and every fourth project had commercialised results within four years of project completion. Still, most often the projects are initiated by the researchers, in most cases the projects do not entail an increase in R&D investments in the companies, and there are indications that the companies' involvement and interest in some of the projects is limited (due to too many partners and/or too general research topics).[34]

Horizon 2020

As for all agencies studied above, Horizon 2020 (and previous Framework Programmes) demand progress reports from funded projects. Horizon 2020 progress reports are to be submitted according to 'reporting periods' of the project, which means that reports are not necessarily required on annual basis. Information demanded in the periodic reports include:

- explanation of work carried out,
- overview of progress,
- a publishable summary and
- a questionnaire on the performance indicators Horizon 2020 Specific Programme (vary according to the specific programme's objectives, e.g. patent, innovations new to the company or the market, number of joint public-private publications).[35]

Compared to the practices in the agencies above, the monitoring of Horizon 2020 projects are more encompassing and formal. The Commission uses experts in their monitoring of projects, and the monitoring may cover project progress according to initial work plans, as well as quality of deliverables and 'the expected potential impact in scientific, technological, economic, competitive and social terms, and the plans for the use and dissemination of results'.[36] According to our information, the periodic monitoring of projects is generally less encompassing, whereas ad hoc monitoring – requested where the Commission find it necessary – may be extensive. The researchers are informed that the Commission will check the implementation of the project, compliance with the grant agreement, including assessing deliverables and reports, as well as the 'continued scientific or technological relevance' of the project.[37] Possible sanctions if periodic reports are not accepted include modification or termination of the grant – based on project assessments by the Commission and taking experts formal recommendations into account.[38]

The information collected in (interim and final) project reports will be used to assess the impact at programme-level (Horizon 2020 as such), in the Annual Horizon 2020 Monitoring Reports and in interim and final evaluations of Horizon 2020.

Like the agencies above, Horizon 2020 work to communicating project results to relevant target groups and enhancing impacts[39], but compared to those agencies, the general emphasis seems somewhat more on formal monitoring of grants than on incentivising user interaction and wider impacts of the research.[40]

Table 3.1 Overview project monitoring

Agency	**Progress reporting** (annual reports)	**Demands/incentives for user interaction**	**Follow-up/midterm assessments**
NERC	All outputs and outcomes are reported annually through a common system for UK 'Researchfish'. Examples of output types reported: Collaborations/partnerships; Further funding; Staff member mobility (including other sectors); Engagement activities/audiences; Influence on Policy, Practice, Patients & the Public; Products; Spin Outs; Narrative Impact (brief summary). Sanctions (from 2015): Grant holders who do not report, will be unable to apply for further grants and payments will be withheld (no plans for sanctions on lack of outcomes/impacts).	Engaging with the public is encouraged and supported by NERC (but no general demands). The grant handbook explains why this is important and how the NERC communications team can contribute. Programme-level activities: Conferences for stakeholders/knowledge exchange.	'It would be too resource intensive to invest in monitoring the progress of Pathways to Impact statements within each and every grant'[41] The emphasis is on motivating impact activities/user interaction.
NSF	Impact is a separate category in the annual project reports. PIs are asked to report 'any activities intended to address the broader impact criterion', that is, how the project has made an impact on human resource development, commercial technology or public use, improving social economic, civic or environmental conditions etc. Sanctions if report is not delivered or not approved by the programme officer: Further/continuing grants may be delayed or terminated.	No general demands for user interaction. The annual project reports include a section for describing partner organisations involved with the project. Programme-level activities: Meetings/events for facilitating engaging with the public/users where relevant.	Annual progress reports need to be approved. No particular focus on follow-up on broader impacts during projects.
RCN	Annual (or twice a year) reporting from projects includes a variety of metrics on dissemination/ use/impact. Sanctions if progress report is not delivered and approved: Contracts may be renegotiated/ended if progress is not according to milestones defined in the proposal. Unlikely that a grant will be postponed/stopped because of below expected output/impact.	For some schemes/project types industry/user partners are required (e.g. see Chapter 2). If users are not contributing according to contract the project may be terminated. Programme-level activities: Conferences for stakeholders/ knowledge exchange.	Apart from annual reports, there is no general follow up/midterm assessments. In some cases, there are midterm assessments of larger/long-term grants which may have implications for further funding, including assessment of user involvement/potential impact (e.g. midterm-assessments of Centres for Research-based Innovation/SFI).
H2020	Periodic report (for each reporting period of the project) and a final report are demanded: Periodic report: Explanation of work carried out, overview of progress, a publishable summary and a questionnaire on the performance indicators Horizon 2020 Specific Programme (vary according to the specific programme's objectives, e.g. patent, innovations new to the company or the market, number of joint public-private publications).[42] Sanctions if report is not delivered and accepted: Modification or termination of the grant – based on project assessments by the Commission, taking experts formal recommendations into account.[43]	No general demands/vary by call/type of action. Programme-level activities: workshops and conferences.	Periodic and ad hoc reviews/monitoring of funded projects/actions.

Main findings

Regular monitoring of impact activities during projects seems rare. The studied organisations demand annual/periodic progress reports from the project they fund, including information on impact-related activities and outputs, still these are not (regularly) used for monitoring such aspects in the individual projects. Sanctions apply if progress reports are not delivered (payments/further proposals are

withheld), but there are no defined sanctions related to lack of preliminary outputs or outcomes of projects.

The funding agencies' 'during project policies' seem focused on incentivising and facilitating impact, through conferences for stakeholders/knowledge exchange, or training researchers in user interaction and handling of the media.

Funding agencies perceive that project progress is foremost the responsibility of the researchers and their host institution/employer, and furthermore that such monitoring would not be fair: Research takes time and the agencies do not expect much output, outcomes or impacts during projects. Another concern may be that monitoring non-academic impacts may be seen as restricting academic autonomy, and perceived as detrimental to the integrity of science. Moreover, the funding agencies have limited resources for project monitoring. Still, some funding schemes demand user contribution/co-funding, and if such requirements are not fulfilled, projects may be terminated.

When the (overall/programme level) project portfolio is monitored, the purpose is programme management and accountability. Aggregated information from the progress reports is used for overviews and annual reports, and informing decision-making more generally. This provides information on how taxpayers' money is spent, an aggregated picture of ongoing activities and preliminary results, and the possibility to understand trends and adjust the balance between different funding streams. Moreover, requiring progress reports on user interaction, and other impact-related activities and outputs from all projects, may incentivise such activities and outputs.

4 Retrospective evaluation of broader impacts of research

There is no straightforward way of assessing the wider/societal impact of research. Impact is in itself complex, and hard to both capture and measure. In addition to normative issues, such as the relative value of potential impacts of research and value/impact for whom, measuring the wider impact of research projects suffer substantial attribution problems and is furthermore complicated by the time-lag between research and impact (Brewer 2011; Fagerberg et al. 2011:76-78; Foss Hansen 2009; Martin 2011). Results from research projects may have extended and combined effects far beyond the individual projects, and there may be substantial national and sectorial spillovers that are hard to capture. The transfer mechanisms of knowledge may be hard to map and users may have very little or no knowledge of the origin of the research result they profit from, and most likely the identifiable 'impacts' result from a combination of research projects and funding sources. In sum, impacts of research are part of complex processes, and it may be difficult to locate the research enabling an 'identified impact' to one project, research group, funding scheme or funding source or country, and vice versa. In addition comes the time-lag problem. The time-lag between research and impact may be ten years or more. Most often ex post evaluations of research projects and programmes take place shortly after the completion of the projects/programme, and before impacts can be substantially identified. Hence, the focus of evaluation is often the potential, not attained, impacts – even for 'retrospective' evaluations. The dilemma is that if programme evaluation is postponed to several years after the completion of the programme/project, it is likely to be much harder to track the relevant informants and data sources. Moreover, the evaluation may no longer be a relevant basis for decision-making.

In this context, a variety of methods coexist and are often combined when assessing the resulting social, economic and broader impacts of research:

- *Surveys* to customer/users benefiting from the research may be one key information source for assessing impacts. To what extent is the research used and perceived useful among relevant stakeholders, and to what extent have they benefitted, or expect to benefit, from the research? Such surveys are foremost applicable for the direct users/commissioners of applied research, whereas harder to apply when evaluating long-term basic research without defined user groups. A general challenge is to identify the potential users, as well as the end users' ability to identify the research they are (potentially) benefitting from. Hence, surveys are often limited to a group of easily identifiable direct users, and do not cover the broader group of potential users. Furthermore, as indicated above, timing is a problem, and within a timeframe for which users may be identified and evaluation is still relevant for decision-making, users may only be able to account for *potential and expected* impacts. Another concern is that direct

users may have vested interests in the outcome of the evaluation, and may overestimate impacts in order to ensure further funding for the research area. User surveys, at least when it comes to direct users and applied research, are still important for measuring users' satisfaction and the non-academic relevance of research.

- Various *quantitative methods* are used for analysing output and impact data from project reporting and survey data, as well as available registry data. In general, performing solid statistical analysis measuring impacts, demands valid indicators, reliable data, control groups and long-time series (Christensen et al. 2014). For instance, with Difference-in-Difference analysis, the effect of a programme on its beneficiaries/users may be compared with a group of non-users, concerning economic returns, market shares, health/living conditions or other measurable aspects. Measuring the effect includes comparing the situation before and after the programme between the beneficiaries and the control group (quasi-experimental design), which often imply challenges concerning available data. The demands for valid indicators and control groups for such analysis are often difficult to fulfil when evaluating research impacts. Especially for broader impacts, both valid indicators and control groups may be difficult to identify. According to OECD (2014:108), recent trends in the efforts to assess impacts of STI policies include more emphasis on using registry data (administrative data) and the use of control groups and experimental designs, but also more emphasis on the softer dimensions of impacts. There are concerns to develop impact indicators beyond the economic dimensions (Godin and Doré 2005; Bornmann 2013). An additional concern when developing metrics and methodology for assessing impacts is that the relative importance of different forms of benefits varies between fields of research and industrial sectors, complicating such efforts (Salter and Martin 2001).

- *Case studies* may be used in the evaluation of impacts in a variety of ways. They are often used as one of multiple inputs to impact evaluations: the evaluators collect in-depth data on the outcome and impacts of a smaller sample of projects or research groups. The 'Payback Framework' is an example of a comprehensive tool for data collection and cross-case analyses of the 'payback' of research to society (Donovan and Hanney 2011; Klautzer et al 2011). Recently, impact case studies has also been introduced as part of the review process for performance-based funding in the UK. Here, the evaluated units select cases themselves and write impact narratives/case studies and submit to review panels, which then assess and rate the case studies (Research Excellence Framework, http://www.ref.ac.uk). Case studies are adaptable to the large variety of possible impacts of research, and may for instance include comprehensive mapping of links from research to public policy, or from research to benefits for specific stakeholders/users.

The choice of methods for assessing impacts has implications for what impacts, and whose benefits, are measured. The scope of impacts addressed, the definition of indicators and the selection of cases to be studied or stakeholders to be surveyed/included, may be defined in a set methodology, vary between programmes, or it may be up to the discretion of the consultancies or expert panels performing the evaluations. Below we map practices and experiences on retrospective impact assessments in the selected funding agencies.

Practices in selected agencies

Natural Environment Research Council

NERC do not (regularly) assess impact on programme or project level. Final reports on completed programmes are in most cases summary descriptions of activities, key findings/highlights based on the projects' case studies, and not impact evaluations. Most impact evaluations are concentrated at more general levels, as well as on specific research units, than on projects and programmes. There are for example, evaluations of strategic funding areas and research themes.[44] Such higher level evaluations

are used to compare NERC funding streams and perceived more useful than programme evaluations, given limited resources.

Moreover, there have been evaluations of NERC centres where panels rate research excellence, broader impacts as well as the research and impact environment. Here the assessments of broader impacts has been done based on methods similar to what is used in the UK Research Excellence Framework: The centres submit impact case studies which are rated by expert panels[45] (referred to as 'REF-methodology', http://www.ref.ac.uk). Using panels for rating is found both to give helpful benchmarking and an insurance about quality of the case studies.

Case studies or narratives are also widely used in the NERC annual impact reports, and in final reports on programmes to illustrate impact, and multiple impact case studies in a field may be analysed as a group to get the broader picture. NERC have a small team who looks for examples of impact and write stories. As the researchers have learnt writing about impact through REF, NERC now also receive better texts directly from the research communities.

NERC does not commonly perform surveys to user stakeholders, but such surveys may form part of singular evaluations[46], and it is perceived difficult to link benefits for end users to individual research projects.

The emphasis on *programme* impact evaluations has been reduced later years, because of limited resources for carrying out evaluations, and because programme evaluations give limited information (it is hard to assess project and programme impacts). The need to wait several years after completion of a programme before measuring impacts, also makes such evaluations less relevant.

More generally, the high emphasis on 'pathways to impacts' and illustrating impacts in narratives, seem to imply relatively less emphasis on impact metrics.[47] Still, all projects are required to report outcomes and impacts in a common UK online database, which gives a basis for metrics as well as incentivising impact activities.[48] For NERC this is a helpful basket of different measures, but in using the data on reported outputs and impacts from projects, there is more emphasis on bibliometrics for studying the scientific impacts, than on studying societal/broader impacts. The latter type of impacts happens in very many different ways, and metrics on e.g. patents and spinouts, even if important, only give a small part of the story. Most broader impacts are perceived not measurable.

There are still some metrics in the NERC annual impact reports, including patents, income from IP activity, PhDs leaving to private/wider public/third sector, instances of influence on public policy. There are also some examples of evaluation of economic impacts of NERC funded labs/centres, performed by independent consultancies and used in cases with measurable economic impacts.[49] In general econometrics, is found less useful for evaluations at agency level, as data mainly gives basis for studying correlations between input and output at system level, and not for the particular funding agencies.

In contrast, case studies are found to provide a link between funding, outputs, outcomes and impacts, by telling the story and also including testimony from users and on tangible benefits. The NERC impact report explains that there are yet 'no robust and widely accepted metrics for impact' and argues for emphasis on cases:

> 'The economic and societal benefits of science investment are notoriously challenging to evaluate and quantify. It is often easier to demonstrate the process of generating impact, and the kinds of impact we achieve, than to measure the impact itself.' (NERC Impact Report 2014:30)[50]

The National Science Foundation

NSF has a panel system of regular review of project portfolio and programmes. This includes Committees of Visitors (COVs) to evaluate review procedures and balance in project portfolio every 3 to 5 years, but does not cover impact of projects.[51] The CoVs report to the Advisory Committee of the

relevant NSF directorate, which 'review and advise on the impact of the support program' on a broader basis.[52] Both the CoVs and the Advisory Committees comprise researchers as well as stakeholders outside academia.[53]

NSF also undertakes external evaluations of research initiatives and programmes.[54] The methods differ by programme and needs and between NSF directorates; in general both metrics and case studies are used. There are no regular surveys to user stakeholders or econometric analysis, and the extent to which programme evaluations address broader impacts varies.[55]

As in the UK, there is a general emphasis on illustrating impacts by narratives. The annual project reports provide descriptions of impacts, and NSF projects and their impacts are presented to the public under 'Discoveries' at the NSF website.

The final reports from projects provide information that may be aggregated into metrics. Notably, the annual NSF performance report for 2013 reports on the strategic goal to 'innovate for society' without using metrics,[56] and in general, the emphasis on impact metrics on project level seem to have been limited. It should be added that a few years ago, a report on the NSF merit review criteria suggested that retrospective assessments of impact should be on a more aggregated level than the individual projects[57], and that due to the variety in impacts, there is more emphasis on the impact narratives than on quantifying the broader impacts of individual projects.

However, there is an ongoing (2014-2018) initiative to strengthen NSF's evaluation capacity. The ambition is to enable 'consistent evaluation of the impact of NSF investments with a high degree of rigor and independence'. The agenda includes better access to post-award outcome data, stronger data analytics, evaluation designs and visualization tools.[58] At the moment, the initiative includes three cross-cutting programme evaluations and guidelines for evaluation of different types of programmes are being written. Moreover, 'Star Metrics' is an ambitious federal level initiative, led by the National Institutes of Health (NIH) and NSF, where research institutions are invited to participate and deliver data, in order to enable assessments of impacts.[59]

The Research Council of Norway

There are no standard methods for evaluating RCN programmes. At programme end, the programme board is required to write an 'end report' summarising results and experiences/further challenges to the relevant Division board of RCN.[60] Often there is also an evaluation, performed by external experts/consultancies. The methods and approaches of these evaluations vary, and so does the extent to which broader societal impacts of the research are addressed. It is up to the external evaluators to select appropriate methods, and most often a variety of qualitative and quantitative methods are applied. A general challenge in evaluating impact of programmes is the timing. The evaluations are needed at the end of the programme, as the general purpose of the evaluation is learning in order to designing the future initiatives; more specifically, often the follow-up to the ended programme. The end report from the programme board, as well as the external evaluation, are presented to the Division Board, and future initiatives/adjustments are discussed.

Hence, the programmes are evaluated too early to capture broader and long-term impacts of the research. Moreover, RCN is concerned that the programmes interact with other funding schemes in a broader national and international context, and that impact of one particular programme is very hard, or even meaningless, to measure. Partly as a result of this, RCN is concerned with formulating programme specific aims that are measurable – so that whether or not they are fulfilled can be addressed in retrospective evaluations. This implies more focus on specific research aims and activities to be promoted and less on overall impact on society. There are also more emphasis on broader evaluations, covering the whole research area, rather than the impact of singular programmes. Aims of the RCN evaluation policy include contributing to the development of methods for impact evaluation, initiating impact evaluations with broad perspectives and to a larger extent emphasising impacts of RCN's contributions in all types of evaluations.[61]

The general knowledge and data available for monitoring and evaluation is also a high priority. The requirements for quantitative reporting from RCN-projects encompass a wide range of non-academic dissemination, use and impacts. The overall categories (apart from academic outputs, each with several subcategories) reported are:

- dissemination measures for users;
- dissemination measures for the general public;
- industry-oriented R&D results;
- commercial results to which the project has contributed;
- new business activities;

Introduction of new/improved methods/models/technology to enhance value creation.
A perceived challenge concerning data on use and impact is underreporting: that the universities does not have overview of use and impact of their research. Normally, the reporting ends at the project termination.

Moreover, RCN regularly follows up their innovation projects with surveys at start-up, termination and *four years after* termination.[62] A sample of companies that have received funding for 'Innovation Projects for the Industrial Sector' are surveyed, and an annual report measuring the socio-economic impacts and additionality of the RCN-funding is produced. 'Innovation Projects for the Industrial Sector' are projects run by industry, and the company needs to cover at least 50 per cent of project costs, whereas the RCN funding may cover procurement of external R&D services and fellowships, payroll expenses and direct project expenses. The company is responsible for the project and also the main user of its results, while it typically includes research provided by research institutes and universities. In this context, user surveys assessing impact are easier to conduct as the users are both known to the Research Council and – as project owners – should feel responsible to respond to the surveys (even if the surveys are anonymous and carried out by an independent research institute). A key finding in the surveys is that projects run by small, new and R&D-intensive companies more often tend to be successful in socioeconomic terms. And there are substantial differences in measured impacts between fields of technology (much higher in for example ICT than in energy/environment). Moreover, the commercial returns/expected net value for the companies, are highly skewed: The top nine per cent of the sample accounts for 90 per cent of the expected returns (Hervik et al. 2014:8-12). In sum, the surveys indicate both a general skewness in economic impacts[63] and that more general impacts are hard to compare between sectors. In addition, the economic returns are based on estimates for future earnings and the companies may have problems separating the impact of singular projects (Hervik et al. 2014:42). Figure B in the appendix shows the analysis model and some overview results from the surveys.

Horizon 2020/earlier FPs

In DG RTD the evaluation of impacts is perceived to require a combination of methods, and a multitude of methods are used to evaluate the EU Framework Programmes. The ex post evaluation of FP6[64] was performed by an expert panel and based on a number of evaluation and impact studies of various aspects of FP6, interviews, self-assessments, as well as background reports by independent experts. Concerning effects on beneficiaries it was concluded that FP6 had a positive influence on industrial competitiveness. Wider societal impacts were not assessed. The external evaluation of FP7 is scheduled to be completed by the end of 2015.[65]

Case studies and narratives are increasingly used in evaluations commissioned by DG RTD, and there are aims to develop new methodologies based on case studies and narratives. Case studies are particularly emphasised for the evaluation of the long-term and non-academic impacts of the Framework Programmes, and in combination with quantitative analysis. Concerning past evaluation efforts, the DG RTD annual report on programme evaluation activities 2013 lists 32 evaluations, of which 15 used case studies. However, many of these do not relate to wider impacts of FP projects.[66]

Stakeholder surveys are another important source of information regarding impacts of the FPs. The survey for the FP7 Interim Evaluation asked stakeholders about the extent to which the research activities were 'likely to produce enduring impacts'.[67] A main challenge has been to identify the beneficiaries several years after the completion of a project.

As mentioned in Chapter 3, data from Horizon 2020 project reporting will be used to assess the impact at programme-level, not the individual projects. FP7 Monitoring Reports present metrics on reported results, such as publications, patents, and use/exploitation of results.[68] Notably, the final reporting from Horizon 2020 projects demands a publishable summary describing results and their exploitation and dissemination, and conclusions of the projects and its socio-economic impact[69], and may provide bases for extensive analysis.

DG RTD aims to develop tools and methodologies beyond standard metrics (as publications and patents), including the combination of qualitative and quantitative data. Especially when it comes to assessing the wider societal and economic impacts of research, there is perceived room for improvement. The experience is that assessing impacts requires a long-term perspective, as most impacts can only be observed many years after the completion of a research project. There are furthermore challenges concerning the interoperability and comparability between existing datasets at international level and across national databases.

Table 4.1 Overview post project impact assessments

Agency	User surveys	Quantitative data	Case studies	Impact (programme) evaluation (combined methods)
NERC	Not commonly performed[70]. Reason: Hard to link benefits for end users to individual research projects.	In general low emphasis on metrics.[71] Some metrics in the NERC annual impact reports: patents, income from IP activity, PhDs leaving to private/wider public/third sector, instances of influence on public policy. Some economic impact evaluations (independent consultancies), on NERC funded labs/centres,[72] but not on project level.	Emphasise on examples/narratives in the NERC annual impact reports, and in final reports on programmes. In some cases groups of impact case studies in one field is analysed together to get the broader picture. Used 'REF-methodology' to rate impact case studies of NERC centres.	Impact is not (regularly) assessed on programme or project level. Final reports on completed programmes in most cases are summary descriptions of activities, key findings/highlights based on the projects' case studies, and not impact evaluations.[73] Evaluations are still performed at other levels: Including evaluations of NERC centres using panels to rate research excellence, as well as impact case studies, and the research and impact environment [74], and evaluation of strategic funding areas, themes.[75]
NSF	Not commonly performed. Evaluation methods vary between NSF directorates.	Evaluation methods vary between NSF directorates. Metrics may be aggregated from annual project reports. In the annual NSF performance report for 2013: 'innovate for society' is one of the strategic goals reported on. No metrics used.[76]	Description of impact in annual project reports. Projects and their impacts are presented to the public under 'Discoveries' at the NSF website. (No use of panels to rate impact case studies.)	Panels: Committees of Visitors (COVs) evaluate review procedures and balance in project portfolio, but not impact of projects.[77] CoVs report to the Advisory committee of the relevant NSF directorate, which 'review and advise on the impact of the support program' on a broader basis.[78] Evaluations: External evaluations are contracted and the methods differs by programme. In general both metrics and cases studies are used.
RCN	Routinely only for 'Innovation Projects for the Industrial Sector': Surveys at start-up, termination and four years after termination (anonymous survey to the companies which are the 'project owners').[79]	Aggregated figures based on metrics in Projects' progress and final reports are presented in programmes annual reports.	PIs write about results and impact of the projects in their final report to the RCN (free text). Various kinds of case studies are used in evaluations. (No use of panels to rate impact case studies.)	At programme end the programme board is required to write an 'end report' summarising results and experiences/further challenges. Often there is also an evaluation, performed by external experts/consultancies. No standard methods for these evaluations. Most often a combination of methods are used. Example: The evaluation of PETROMAX and RENERGI (2012) was based on metrics (from projects' progress/final reports), and interviews with stakeholders. There were also case studies performed by the evaluators (not impact case studies from the involved researchers), including interviews with researchers and stakeholders.[80]
FPs/ H2020	User surveys are considered important when evaluating impacts.	FP7 Monitoring Reports present metrics on reported results (publications, patents, use/ exploitation of results).[81]	Increasingly used. There are aims to develop new methods based on case studies/narratives.	Impact evaluation is said to require a combination of methods. Ex post evaluation of FP6[82]: Expert panel evaluation was based on a number of evaluation and impact studies of various aspects of FP6, interviews, self-assessments, background reports by independent experts. Wider societal impacts were not assessed. DG RTD aims to develop new methodologies for assessing impacts.

Main findings

None of the studied organisations have established methods and routines for evaluating the broader impacts of research projects and programmes. In general, a variety of methods are combined, and the focus of evaluation is often on the level above the individual research programme. The need to wait several year after the completion of projects before impact can be assessed, makes programme evaluations less useful as basis for policy-making. Moreover, the long-term impacts of research are likely to derive from multiple programmes and funding sources, and to evaluate the impacts of individual programmes is seen as less relevant.

There is an increasing emphasis on case studies in the evaluation of broader impacts. These are used both for general information about the impacts of research, communicated to the public and used as illustrations in evaluation reports. New methodologies combining case studies and e.g. expert panels are also developed and tested. Case studies including narratives linking research projects, the interaction with users and other 'impact activities' with a broad range of possible benefits and impacts,

are found helpful by the funding organisations, for learning about impacts, incentivising broader impacts of research, as well as for ensuring that the taxpayers money is wisely spent.

In general, the emphasis on metrics for assessing project impacts seems limited. The final reports from projects provide information that may be, and often are, used for metrics, but this reporting is not used for evaluating impacts on project-level, and there are many concerns pointing against the use of quantitative evaluations on programme-level as well. Broader impacts are hard to capture, are perceived to be underreported, and the available metrics such as patents and spinouts only give a small part of it. Hence, there seems to be somewhat limited belief in metrics and the possibility to measure the broader impacts of research. It is moreover emphasised that relevant impacts vary much between research questions and projects, and that metrics need to be adaptable and adjusted to the specific evaluation tasks. There are still general ambitions, as well as specific initiatives, to improve data bases and develop methodology for retrospective evaluation of impact. In most cases, these initiatives seem pointed at higher levels than individual research programmes and their funded projects, e.g. at research areas, research centres, types of funding instruments, or as in the case of DG RTD, the Framework Programme as such. Due to challenges – and the costs – in measuring impacts of individual programmes, regular evaluations of individual programmes seem to be given reduced priority.

In sum, there seem to be some common experiences limiting impact evaluations of individual programmes. Still, there is much ongoing work to develop methodology and improve databases, and there is clear emphases on impact evaluations more generally (though less for individual projects and programmes) and a variety of methods are employed. The next chapter include a discussion of strengths and weaknesses of quantitative methods and case studies for impact evaluations.

5 Discussion

As shown in the preceding chapters, funding agencies meet challenges both in prospective and retrospective assessments of societal relevance and impacts. Below, we summarise and discuss the challenges at the three stages of impact assessment, and furthermore the possible interconnections between the stages.

Prospective assessments

The potential non-academic relevance and impacts are considered in the review of research grants in all the four organisations. Still, it is only the Horizon 2020 which has a 'measurable' impact criterion and in this way ensures that impact is given weight in the final conclusions (minimum threshold for each criterion and fixed weighting into an overall score). Other organisations have chosen a more open approach: In NERC impact is commented on (and needs approval), but is not part of the rating or ranking of proposals, in NSF proposals are given one overall assessment (including both intellectual merit and broader impacts), whereas in RCN there are some funding schemes where impact is *not* considered in the review process, and other schemes where it is a selection criterion, but still without fixed weighting.

In the later years, we have seen increasing emphasis on broader impact in prospective assessments of research. At the same time, there is also increased emphasis on academic excellence. Funding agencies have parallel concerns in ensuring that they fund research important to society, and that they sponsor the best research groups and bring science forward. They need to be accountable both to society and to the academic community. Whereas the RCUK 'Pathways to Impact' were introduced in 2009, the NSF broader impact criterion was introduced already in 1997. According to Holbrook and Frodeman, NSF has increasingly emphasised that reviewers should assess broader impacts, and broader impacts have become more central in the review process since its introduction (Holbrook and Frodeman 2011: 244). At the same time EU FPs have introduced separate funding schemes selecting projects solely based on scientific excellence (under the European Research Council), and several national funding agencies in Europe have followed up with national schemes to match ERC. Hence, the trends in prospective assessments includes more emphasis both on academic excellence and on broader impacts – both are considered increasingly important.

Both NSF and RCUK are concerned about an open encompassing approach to assessing impacts. The relevant aspects and scope of impacts to assess vary by project and it is much up to the individual applicant to define the relevant impacts of the projects. In a general overview of relevant aspects for 'Pathways to impact', RCUK has set up overall direct objectives such as 'Wealth creation, economic prosperity and regeneration' as well as less direct objectives such as 'Attracting R&D investment' and 'Increasing public engagement with research and related societal issues' (see Figure A in Appendix). In this way impact is broadly defined and may be adapted to most fields of research.

There are still challenges relating to different perspectives on the value of impacts – and the conditions for success – in prospective assessments of research. Different peers and other experts may have different assessments/opinions about:

- The societal importance of the research topic/questions
- The importance/advantages of the potential impact
- The likeliness/conditions for impact

These kinds of divergences do not appear to be addressed in studies of review processes, and are not a reported problem in the organisations studied above. Still, there are obvious differences in the perceived value of research, as Rymer (2011:6) point out and illustrate by environmental research that may have negative economic impacts, or by research on biodiversity that may receive very different response from ecologists, conservationists and animal rights activists. Another example is the potential impacts of health research:

> A program to reduce obesity in children might be expensive to implement, not have any serious economic benefits for 30 or 40 years, pose complex issues for the food industry and add to the cost of food (Rymer 2011:6).

Such conflicting interests and divergent political concerns may entail very different prospective assessments of impacts. Hence, 'conflicting stakeholder groups' may be an important concern when selecting the experts for prospective assessments, as well as concerns for responsible research and innovation and research ethics.

When it is hard to compare the *value* of expected impacts between projects or to separate the impacts of specific projects, estimates and assessments of (extra-scientific) impacts of proposed research becomes both complicated and less meaningful. Among the studied organisations some have solved this by not including impact as a separate review criterion (NERC: the pathway to impact statements need approval, but is not part of the rating of the proposal). Other alternatives are to limit impact assessments to specific objectives defined in the call for proposals/the research programme[83] (as often is the case for applied research), or that the relative emphasis to be put on impact is up to the discretion of the reviewers (as in NSF).

Monitoring projects

The funding agencies are concerned to facilitate and incentivise impact. There are conferences and knowledge exchange with stakeholders, and researchers are trained in user interaction and handling the media. The funding agencies are less concerned with monitoring project-level 'impact activities'. Impact-related activities and outputs are reported in the progress reports from projects, but are not (regularly) used for monitoring the individual projects. Sanctions apply if progress reports are not delivered (payments/further proposals are withheld), but there are no defined sanctions[84] related to lack of preliminary outputs or outcomes of projects. The funding agencies consider that research is complicated and takes time, and do not expect much output, outcomes or impacts during projects. Hence, impact monitoring is not a priority.

When the project portfolio is monitored, the purpose is programme management and accountability. The aggregated information from the progress reports is used for overviews and annual reports (on programme or agency level), and informing decision-making more generally, but not for monitoring the projects.

Retrospective assessments

The studied organisations have no set methodology for retrospective evaluation of the broader impacts of research projects and programmes. Notably, the projects and programmes are often *not* regular objects of retrospective assessments. More often, the evaluations address research areas, research centres, or types of funding instruments/groups of programmes. Programme evaluations are less useful as basis for policy-making, as impacts do not appear until several years after the

completion of projects, and long-term impacts of research are likely to derive from multiple programmes and funding sources. Consequently, evaluations of the impacts of *individual programmes* are less relevant for policy-making.

For impact evaluations in general, a variety of methods are combined, and adjusted to the evaluation objectives and field of research. There is an increasing emphasis on case studies, which are used for general information about the impacts of research, communicated to the public and used as illustrations in evaluation reports. Furthermore, methodologies combining case studies and e.g. expert panels are developed and tested. On the other hand, we find somewhat limited belief in metrics in order to capture and measure the broader impacts of research. Broader impacts are perceived to be hard to capture, vary extensively between projects and be underreported. Hence, available metrics such as patents and spinouts only give a small part of it. There are however, general ambitions, as well as specific initiatives, to improve databases and develop methodology for retrospective evaluation of impact. Informants also emphasise that quantitative methods/econometrics are valuable – and are applied – in contexts where economic impacts and benefits for identified stakeholders can be measured.

Table 5.1 summarises the strengths and weaknesses of quantitative methods and case studies in assessing broader impact. A general challenge for all methods (not listed in the table), is the time-lag between research and impacts. This is in particular a problem when trying to find 'short-term indicators' predicting long-term impacts (Buxton 2011:259) at programme end, and when there is no further reporting from projects after the grant period. Case studies give flexibility in adapting assessments to the individual projects, but it is still hard to assess impact until several years after project end. Another general challenge is the mismatch between grants and the research lines and projects of the researchers awarded. In many fields of science, research lines are typically longer than the normal grant periods, and researchers often hold multiple grants for the same lines of research (both in parallel and successively, Langfeldt et al. 2014). Hence, measuring impact of the particular grants may be difficult.

Apart from these general challenges, we see that the strengths and weaknesses of quantitative methods and case studies match each other. What is a weakness of case studies is a strength of quantitative methods and vice versa (Table 5.1). Comparability and costs are strengths in quantitative methods and weaknesses in case studies. Narrow indicators and attribution problems are weaknesses in quantitative methods, whereas contextuality, flexibility and the possibility of linking research and impacts are the strengths of case studies. Hence, the methods are often combined in order to combine the strengths and limit the weaknesses. Notably, a special issue of Research Evaluation on the assessment of research impact concluded that 'state of the art evaluations of research impact combine narratives with relevant qualitative and quantitative indicators' (Donovan 2011:176).

Incentives are an additional argument for impact case studies, as well as a reason for avoiding impact metrics as basis for further funding. Rewarding research based on metrics implies incentivising what is measurable (such as number of contributions in mass media or number of patent applications), rather than enhancing the impacts of the specific projects. Impact case studies allow for more general incentivising; the researchers may themselves define the kind of impact they aim at, and they may be rewarded based on a broad range of achievements relevant for their particular project. Most often the 'reward' is in form of a published narrative describing their achievements and positive feedback from stakeholders, further incentivising doing research with potential broader impacts.

Another issue is that when impact case studies are assessed by expert panels, the evaluations are likely to be subject to reviewer biases in the same way as peer review in general. Experts/juries may come to divergent conclusions on the relative value of different benefits to society. Hence, the selection of expertise to the panels may be decisive.

Table 5.1 Overview of strengths and weaknesses of methods for assessing broader impact

Approach	Strengths	Weaknesses
Quantitative methods/ metrics	• **Comparability**: Same indicators used across projects, enables comparisons. • **Lower costs**/less resources needed for performing (provided data is available)	• **Narrow indicators**/do not cover the complexity of impacts. • Possible **negative incentives** (researchers focus on activities that counts in evaluations). • **Attribution problems**: multiple projects may contribute to the same impact – hard to compare their impacts. • **Data demands:** High quality and longitudinal data, and control groups are needed to perform solid statistical impact analysis.
Case studies	• **Contextual and flexible:** Possibility of mapping and linking all kinds of impacts in all kinds of contexts and in different stages, including complex and interrelated impacts. • **Wide-ranging expertise:** Juries/panels to assess the case studies may be composed to reflect a variety of expertise and stakeholders.	• **Comparability**: Impact/value is hard to compare across cases. • **Craft intensive/costly** methodology (for external evaluators doing impact case studies, or for evaluees selecting, writing and submitting them). When mass production of case studies (as in REF), methods will necessarily be cruder/less sophisticated (Martin 2011). • **Possible biases** in reviewers/juries' assessments of impact case studies.

A systematic approach across all three stages?

A final question in our study is the extent to which the three stages of impact assessments are linked. In the studied organisations such links exist at overall levels, but not at project level.

According to our informants, for basic research such linking would not be much useful for following up individual projects. The reason is mainly the same as for not monitoring impact at project level: research is complex, takes time, have extended and combined effects beyond the individual projects, and basic research may prove to be valuable to society decades after it was performed. In such a context, strict follow-up and evaluation of impacts according to project plans/statements in the proposal may be contra productive.

There are still links between prospective assessments, project monitoring and final reports from projects. In many cases, no further grants are awarded if progress report for ongoing projects, or final report is not submitted. Notably, these decisions derive from formal award requirements, not to the assessment of the impact of projects. In the UK, prospective peer review and impact evaluations are clearly defined as separate exercises.

On the other hand, the agencies try to link the stages in their evaluation policy and to build up databases that enable overall analysis, monitoring and evaluation of the project portfolio. Good databases should contain data from all three stages, and are perceived as important building blocks facilitating monitoring and evaluation, and for getting an overview of activities as input to policy-making. A general challenge is to include data with a longer time-line than provided by the final project reports.

In addition to such linkages in the organisations' overall policy, there may be more overall linkages at national/system level. In the UK, the Research Councils are responsible for the prospective assessments, the higher education institutions are responsible for carrying out the research and for researcher career systems, whereas the Higher Education Funding Councils are responsible for retrospective assessments. Together they are intended to complement each other, balance different concerns, as well as strengthening the incentives for impact. The underlying idea is that an overall coordinated policy may be effective without any top-down micro level coordination.

Figure 5.1 indicates some general links between the stages. *At the project-level,* such links may derive from an overall policy to make researchers responsible for enhancing impact, by including descriptions of the potential impacts in the proposals, and reporting on it in progress and final project reports. As far

as the required impact statements and reporting categories are fairly open and amendable, they may give incentives for 'thinking' impact across all fields of science. *At the programme-level,* links may derive from overall aims and measures to enhance impact, ensuring that criteria and requirements at all stages, as well as programme-level impact related activities, support programme objectives. Apart from incentivising impacts, such overall links at programme-level may enhance the basis for learning and policy-making. Taken together, such systematic approaches across all three stages may include coordinated/complimentary aims and measures at programme level and strengthened incentives for broader impacts at project level.

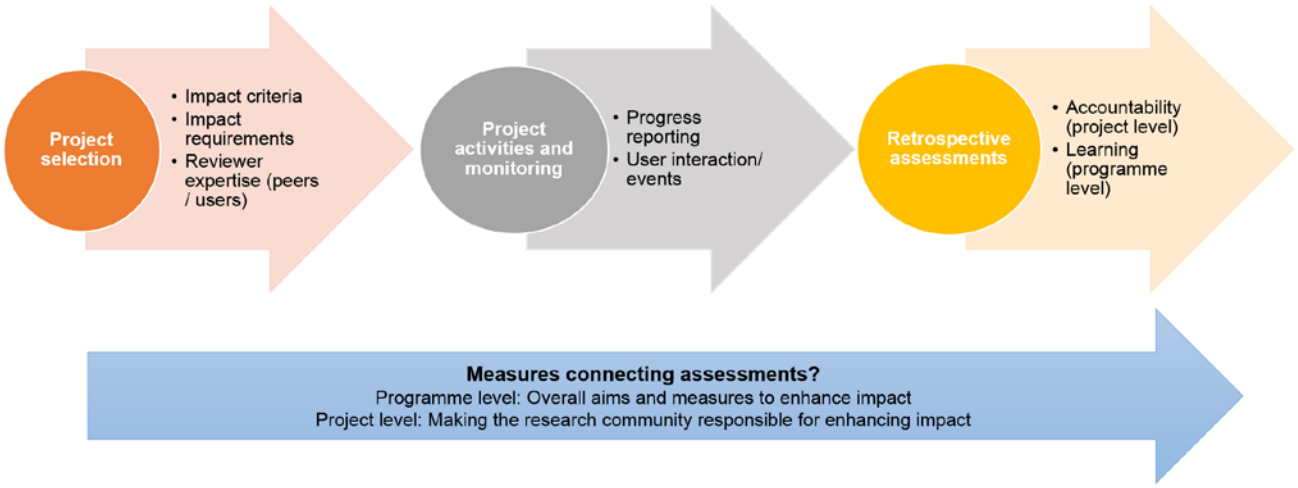


Figure 5.1 Interconnected impact assessments

It should be added that systematic follow-up of projects in terms of checking to what extent the expected impacts are obtained, may seriously narrow the perspective of retrospective impact assessments. The most important impacts obtained may be others than those planned/predicted in the proposal, and they may appear many years after the evaluation. It may moreover turn project follow-up into an accountability exercise with negative impact on the research process, in terms of lower impact ambitions in the proposals and less risk-taking during projects – because some may fear scoring low if setting ambitious goals that are not reached.

Comparing data on the different stages may still prove useful for other purposes. For example, analyses of correlations between prospective and retrospective impact assessments may provide new knowledge on the working and challenges of impact assessment, and possibly provide input to developing methodology adequate for more encompassing evaluation of the broader impacts of research.

Finally, it should be added that conditions for linking the three stages relate to overall policy aims. If the aim is (a) to improve the general understanding of the impacts of research and informing the public authorities and the public about the broader importance and value of research, no particular linking of the three stages may be needed. If the aim is (b) policy development and a knowledgebase for improving funding schemes, i.e. designing funding schemes that can help enhancing broader impacts, there will be a general need for harmonised longitudinal data across the three stages and across funding schemes. If the aim is to (c) reallocate resources to the research groups with the best scores on impacts, sensitive approaches to avoid negative incentive effects should be a prime concern, and there may be a need for linking the stages to monitor potential negative incentive effects.

References

Bhattacharya, Ananyo (2012). Science Funding: Duel to the Death, *Nature* 488: 20-22. http://www.nature.com/polopoly_fs/1.11073!/menu/main/topColumns/topLeftColumn/pdf/488020a.pdf

Bornmann, Lutz (2013). What is societal impact of research and how can it be assessed? A literature survey. *Journal of the American Society of Information Science and Technology*, 64(2): 217-233. http://onlinelibrary.wiley.com/doi/10.1002/asi.22803/pdf

Brewer, John D. (2014). The impact of impact. *Research Evaluation* 20(3):255–256.

Buxton, Martin (2011). The payback of 'Payback': challenges in assessing research impact. *Research Evaluation,* 20(3): 259–260.

Cicchetti, D. V. (1991). The reliability of peer review for manuscript and grant submissions: A cross-disciplinary investigation. *The Behavioral and Brain Sciences* **14**(1): 119-186.

Christensen, Thomas Alslev, Hanne Frosch and David Boysen-Jensen (2014). *Central Innovation Manual on Excellent Econometric Evaluation of the Impact of Public R&D Investments.* Copenhagen: Danish Ministry of Science, Innovation and Higher Education. http://ufm.dk/en/publications/2014/files-2014-1/cim-2-0_may_2014.pdf

Chubin, D. E. and E. J. Hackett (1990). *Peerless Science. Peer Review and U.S. Science Policy*. New York, State University of New York Press.

Cole, S., et al. (1981). Chance and Consensus in Peer Review. *Science*. 214: 881-886.

Demicheli, Vittorio and Carlo Di Pietrantonj (*2007).* Peer review for improving the quality of grant applications. *Cochrane Database of Systematic Reviews* 2007, Issue 2. Art. No.: MR000003. DOI: 10.1002/14651858.MR000003.pub2.

Donovan, Claire (2011). State of the art in assessing research impact: introduction to a special issue. *Research Evaluation,* 20(3): 175–179.

Donovan, Claire and Stephen Hanney (2011). The 'Payback Framework' explained. *Research Evaluation,* 20(3): 181–183.

Fagerberg et al. (2011). Et åpnere forskningssystem. *Norges offentlige utredninger, NOU 2011:6*. Oslo: Kunnskapsdepartementet. https://www.regjeringen.no/nb/dokumenter/nou-2011-6/id641690/

Foss Hansen, Hanne (2009). Forskningsevaluering: Metoder, praksis og erfaringer. Copenhagen: Forsknings- og Innovationsstyrelsen. http://ufm.dk/publikationer/2009/forskningsevaluering-metoder-praksis-og-erfaringer

Frodeman, Robert and Adam Briggle (2012): The dedisciplining of Peer Review. *Minerva*, 50(3): 3-19.

Godin B. and C. Doré (2005). *Measuring the Impacts of Science: Beyond the Economic Dimension,* INRS Urbanisation, Culture et Société. http://www.csiic.ca/PDF/Godin_Dore_Impacts.pdf

Hervik, A., B. G. Berem and L. Brein (2014). *Resultatmåling av brukerstyrt forskning 2012.* Molde: Møreforsking Molde AS, Rapport 1404. http://www.moreforsk.no/publikasjoner/rapporter/naringsokonomi/resultatmaling-av-brukerstyrt-forskning-2012/1077/2679/

Holbrook, J Britt and Robert Frodeman (2011): Peer review and the ex ante assessment of societal impacts. *Research Evaluation*, 20(3): 239–246.

Klautzer, Lisa, Stephen Hanney, Edward Nason, Jennifer Rubin, Jonathan Grant and Steven Wooding (2011). Assessing policy and practice impacts of social science research: the application of the Payback Framework to assess the Future of Work programme. *Research Evaluation,* 20(3): 201–209.

Langfeldt, Liv, Inge Ramberg and Hebe Gunnes (2014). *Swiss Research Funding. Researcher Survey for the Swiss National Science Foundation (SNSF)*. Oslo: NIFU-report 5/2014.

Langfeldt, Liv and Svein Kyvik (2011). Researchers as evaluators: tasks, tensions and politics. *Higher Education, 62(2): 199-212.*

Langfeldt, Liv (2006). The policy challenges of peer review: Managing bias, conflict of interests and interdisciplinary assessments. *Research Evaluation,* 15(1):31-41.

Langfeldt, Liv (2004). Expert panels evaluating research: decision-making and sources of bias. *Research Evaluation,* 13(1):51–62.

Langfeldt, Liv (2001). The Decision-Making Constraints and Processes of Grant Peer Review, and Their Effects on the Review Outcome. *Social Studies of Science 31(6):820-841.*

Langfeldt, Liv (1998). Fagfellevurdering som forskningspolitisk virkemiddel. En studie av fordelingen av frie midler i Norges forskningsråd. Oslo: NIFU-rapport 12/98.

Martin, Ben R. (2011). The Research Excellence Framework and the 'impact agenda': are we creating a Frankenstein monster. *Research Evaluation* 20(3):247-254.

Nightingale, Paul and Alister Scott (2007). Peer review and the relevance gap: ten suggestions for policy-makers. *Science and Public Policy*, 34(8): 543–553.

OECD (2014). *OECD Science, Technology and Industry Outlook 2014.* OECD Publishing. http://dx.doi.org/10.1787/sti_outlook-2014-en

Rip, Arie (2000). Higher forms of nonsense. *European Review* 8(4):467-486. http://doc.utwente.nl/35756/1/A083191593.pdf

Rymer, Les (2011). Measuring the impact of research - the context for metric development. Australia: The Group of Eight. https://go8.edu.au/sites/default/files/docs/go8backgrounder23_measimpactresearch.pdf

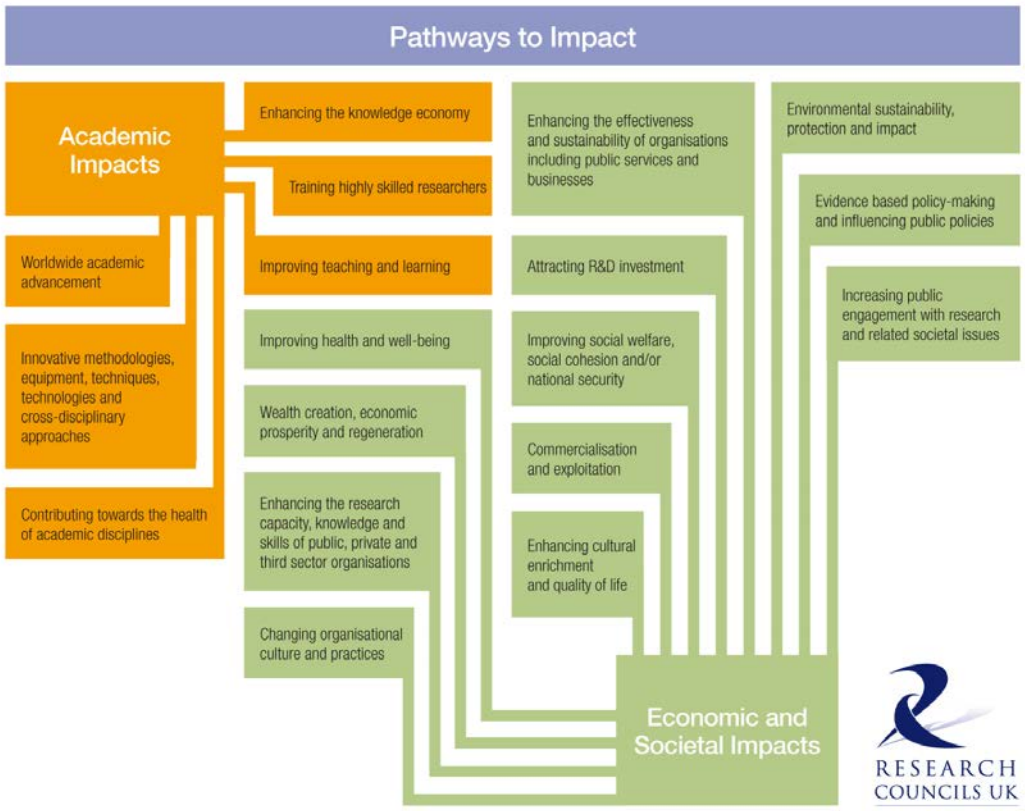
Salter, Ammon J. and Ben R. Martin (2001).The economic benefits of publicly funded basic research: a critical review. *Research Policy* 30: 509–532.

Spaapen, Jack and Leonie van Drooge (2011). Introducing 'productive interactions' in social impact assessment. *Research Evaluation*, 20(3): 211–218.

Travis, G. D. L. and H. M. Collins (1991). New Light on Old Boys: Cognitive and Institutional Particularism in the Peer Review System. *Science, Technology & Human Values* 16(3): 322-341.

Appendix

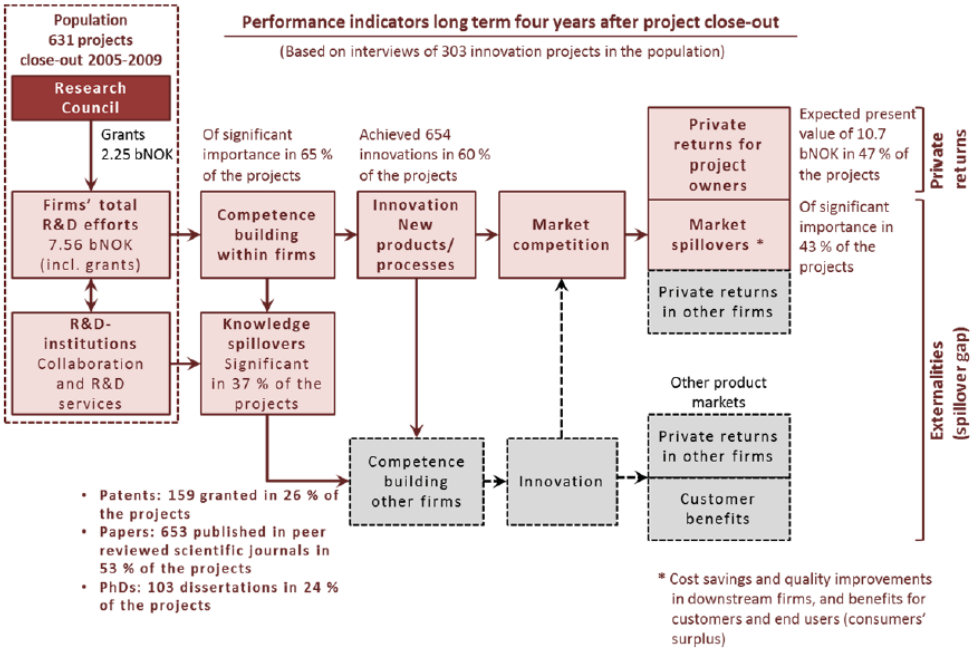
A) Example of different aspects of impacts of research. Overview set up by Research Councils UK.



Source: RUCK; http://www.rcuk.ac.uk/RCUK-prod/assets/documents/impacts/RCUKtypologydiagram.pdf

B) User survey on outcomes and benefits of research: Example of analysis model and results concerning RCN projects.

Figure 1 Overview of long-term R&D input and outputs measured four years after close-out for Innovation Projects in the Industrial Sector finished 2005-2009.



Source: Hervik, et al. 2014:6.
http://www.moreforsk.no/publikasjoner/rapporter/naringsokonomi/resultatmaling-av-brukerstyrt-forskning-2012/1077/2679/

Notes

[1] The definition 'peer competence' varies. In some cases wide multi-disciplinary panels of researchers rank proposals from all fields of science, and 'peer' simply denote researcher.
[2] http://www.rcuk.ac.uk/RCUK-prod/assets/documents/impacts/RCUKPathwayspresentation.pdf
[3] In some cases, there may be users among panel members, but in general it is hard to find users willing to spend time on panels for responsive mode funding.
[4] An 'excellence' rating gives the application an advantage over similarly scored proposals without an excellence rating, and an 'unsatisfactory' rating is 'a negative factor when rank ordering the proposal with others.'
http://www.nerc.ac.uk/funding/application/howtoapply/forms/standardandniguidance.pdf
[5] http://www.bbsrc.ac.uk/funding/apply/impact/pathways-to-impact.aspx
[6] The large majority of these are peers, but may also include reviewers outside academia (industry and other public agencies) in programmes where this is relevant.
[7] Present definition, cf. http://www.nsf.gov/nsb/publications/2011/meritreviewcriteria.pdf
[8] Examples: The strategic programme KLIMAFORSK aims to: Expand expertise and applicable knowledge in trade and industry and the public administration; Facilitate dynamic, targeted communication activities.
http://www.forskningsradet.no/servlet/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition%3A&blobheadervalue1=+attachment%3B+filename%3DWorkprogramme2014-2023LargescaleprogrammeonClimateResearchKLIMAFORSK%2C0.pdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1274506261910&ssbinary=true. The Oceans and Coastal Areas Programme (HAVKYST) aims to provide a research-based foundation for integrated, long-term management of and value creation based on marine resources.
http://www.forskningsradet.no/servlet/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition%3A&blobheadervalue1=+attachment%3B+filename%3D%22HAVKYSTProgramplanrev2010engweb.pdf%22&blobkey=id&blobtable=MungoBlobs&blobwhere=1274469548767&ssbinary=true
[9] http://www.forskningsradet.no/en/Knowledgebuilding_project_for_industry/1253963988225
[10] For the review of 'Innovations projects' the panels may also contain experts in other sectors. This RCN project type is describe in Chapter 4 below (see also http://www.forskningsradet.no/en/Innovation_project_for_the_industrial_sector/1253963988186).
[11] http://www.forskningsradet.no/en/Vision_and_mandate/1138785841810
[12] http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-h-esacrit_en.pdf. Same criteria apply for Research and innovation actions, Innovation Actions and SME instrument.
[13] http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/pse/h2020-evaluation-faq_en.pdf
[14] http://www.nsf.gov/pubs/policydocs/pappguide/nsf15001/nsf15_1.pdf
[15] http://www.forskningsradet.no/en/Researcher_project/1195592882768
[16] http://www.forskningsradet.no/en/Knowledgebuilding_project_for_industry/1253963988225
[17] http://www.forskningsradet.no/en/Knowledgebuilding_project_for_industry/1253963988225
[18] Template for project descriptions for Knowledge-building Projects for Industry
[19] http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/pse/h2020-guide-pse_en.pdf
[20] Research & innovation actions, proposal template:
http://ec.europa.eu/research/participants/data/ref/h2020/call_ptef/pt/h2020-call-pt-ria-ia_en.pdf
[21] https://www.researchfish.com/
[22] http://www.nerc.ac.uk/funding/next/finalreporting/
[23] http://www.rcuk.ac.uk/RCUK-prod/assets/documents/documents/PtoIExecSummary.pdf, page 4. RCUK argue that 'It would be too resource intensive to invest in monitoring the progress of Pathways to Impact statements within each and every grant' and that they already monitor and evaluate by output and outcome via 'ResearchFish', develop impact case studies and publishing annual impact reports.
[24] NERC Research Grants and Fellowships Handbook, NERC January 2015, page 59.
[25] http://www.nerc.ac.uk/funding/application/howtoapply/forms/grantshandbook.pdf. This is similarly emphasised by the other UK research councils. The Economic and Social Research Council (ESRC)

has a separate web page with advise on 'How to maximise impact' http://www.esrc.ac.uk/funding-and-guidance/impact-toolkit/what-how-and-why/how-to.aspx. ESCR also provide block awards to research organisations to accelerate the impact of research (Impact Acceleration Accounts, IAA). The funding is based on the size of the institutions' ESRC research funding and the strength of their 'IAA business plan', and is to be spent on knowledge exchange activities such as user networks, staff mobility/secondment between research organisations and user stakeholders, and improving engagement with the public sector, civil society and industry (not for research actives). http://www.esrc.ac.uk/collaboration/knowledge-exchange/opportunities/ImpactAccelerationAccounts.aspx

[26] 'Gateway to Research': http://www.nerc.ac.uk/funding/next/finalreporting.

[27] In projects where this is relevant.

[28] http://www.nsf.gov/pubs/policydocs/gc1/dec14.pdf

[29] https://www.nsf.gov/bfa/dias/policy/rppr/format_ombostp.pdf

[30] The categories are same as in the final projects report, listed in Chapter 4. Knowledge-building Projects for Industry and Innovation Projects need to submit project accounting reports, in addition to the progress reports.

[31] 'An approved progress report is a prerequisite for the disbursement of the funding pledged for the coming year.' http://www.forskningsradet.no/en/Article/About_project_reports/1253979444039

[32] Such reporting is more substantial for longer-term/centre grants than for regular grants. Annual reporting from the Centres for Research-based Innovation include academic merits, as well as activates towards users and the public and examples on how results are used by participating companies/partners.

[33] In addition comes projects run by industry (Innovation Project for the Industrial Sector) or by public sector (Innovation Project for the Public Sector). http://www.forskningsradet.no/en/Application_types/1138882215869

[34] http://www.damvad.com/media/82769/kpn-rapport-endelig-.pdf

[35] http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf. Moreover, final reports demand a publishable summary describing results and their exploitation and dissemination, and conclusions on the action and its socio-economic impact.

[36] http://ec.europa.eu/research/participants/docs/h2020-funding-guide/experts/expert-roles-and-tasks_en.htm

[37] http://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/grant-management/checks-audits-reviews-investigations_en.htm

[38] http://ec.europa.eu/research/participants/docs/h2020-funding-guide/experts/expert-roles-and-tasks_en.htm

[39] For example, by organising workshops and conferences and new projects and achievements are presented on the H2020 web site http://ec.europa.eu/programmes/horizon2020/en/newsroom/551/.

[40] As noted in Chapter 2, there is no general demands for user interaction, in H2020, this vary by call/type of action.

[41] http://www.rcuk.ac.uk/RCUK-prod/assets/documents/documents/PtoIExecSummary.pdf

[42] http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf. As the first H2020 projects have recently started, this is not yet implemented. The the first reporting should come 18 months after start-up.

[43] http://ec.europa.eu/research/participants/docs/h2020-funding-guide/experts/expert-roles-and-tasks_en.htm

[44] http://www.nerc.ac.uk/about/perform/evaluation/evaluationreports/

[45] http://www.nerc.ac.uk/about/perform/evaluation/evaluationreports/centrereports/

[46] The evaluation of Relu in 2012 provide an example of programme evaluation including survey to stakeholders http://www.nerc.ac.uk/research/funded/programmes/relu/relu-final-report-part2.pdf

[47] http://www.nerc.ac.uk/about/perform/reporting/reports/impactreport2013.pdf; http://www.nerc.ac.uk/about/perform/reporting/reports/impactreport2014.pdf

[48] The database, called 'Researchfish' is an 'online facility that enables research funders and Research Organisations to track the impacts of their investments, and researchers to log the outputs, outcomes and impacts of their work.' http://www.rcuk.ac.uk/research/researchoutcomes ; https://www.researchfish.com/about_wwd . Researchfish is used by more than 90 funders to gather information from researchers about outcomes.

[49] E.g.: Storm Surge Prediction and its Impact on the UK Economy. DTZ (undated).

[50] http://www.nerc.ac.uk/about/perform/reporting/reports/impactreport2014.pdf

[51] P 74 http://www.nsf.gov/pubs/2014/nsb1432/nsb1432.pdf
[52] http://www.nsf.gov/eng/adcom/charter.pdf
[53] See NSF Merit Review Report Fiscal Year 2013, page 74: 'To ensure the highest quality in processing and recommending proposals for awards, NSF convenes external groups of experts, called Committees of Visitors (COVs), to review each major program approximately every three to five years. This includes disciplinary programs in the various directorates and offices, and the cross-disciplinary programs managed across directorates. The COVs (comprised of scientists, engineers and educators from academia, industry, and government) convene at NSF for a two to three-day assessment. These experts evaluate the integrity and efficiency of the processes used for proposal review and program decision-making. In addition, the COVs examine program management and portfolio balance. The COV reports, written as answers and commentary to specific questions, are reviewed by Advisory Committees and then submitted to the directorates and the NSF Director. Questions include aspects of the program portfolio, such as the balance of highrisk, multidisciplinary, and innovative projects.' http://www.nsf.gov/pubs/2014/nsb1432/nsb1432.pdf.
[54] The NSF performance report for 2013 lists 12 external evaluations undertaken in 2012. http://www.nsf.gov/about/budget/fy2014/pdf/50_fy2014.pdf
[55] 'Evaluations at NSF are currently performed at the discretion of the individual directorate, office, or program being evaluated.' (Page 49 in NSF performance report for 2013, http://www.nsf.gov/about/budget/fy2014/pdf/50_fy2014.pdf)
[56] http://www.nsf.gov/about/performance/annual.jsp
[57] http://www.nsf.gov/nsb/publications/2011/meritreviewcriteria.pdf
[58] See 'NSF evaluation and assessment capability' (2014-2018) at http://www.nsf.gov/about/budget/fy2016/pdf/47_fy2016.pdf
[59] 'The goal of the STAR METRICS® project is to utilize existing administrative data from federal agencies and their grantee institutions, and match them with existing research databases on economic, scientific and social outcomes.' (https://www.starmetrics.nih.gov/Star/About). A common (and partly open) database of research grants/project and results (such as publications and patents) are being build up to enable assessments of impacts. Another focus is in the project is employment impact and job creation.
[60] For an example, see 'Sluttrapport DEMOSREG 2005-2014' http://www.forskningsradet.no/servlet/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition%3A&blobheadervalue1=+attachment%3B+filename%3D%22DEMOSREGsluttrapportWEBNY.pdf%22&blobkey=id&blobtable=MungoBlobs&blobwhere=1274506191219&ssbinary=true
[61] Evaluering – Policy for Norges forskningsråd 2013-2017. http://www.forskningsradet.no/servlet/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition%3A&blobheadervalue1=+attachment%3B+filename%3D%22EvalueringspolicyeksternFINALweb.pdf%22&blobkey=id&blobtable=MungoBlobs&blobwhere=1274505118862&ssbinary=true
[62] «Resultatmåling av brukerstyrt forskning». Annual reports from 2006 to 2014 are available: http://www.forskningsradet.no/no/Aktivitetsevalueringer/1182736860818.
[63] Similar to the skewness in scientific impacts as measured in citation rates.
[64] http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/fp6_ex-post_evaluation_expert_group_report.pdf#view=fit&pagemode=none
[65] The FP7 Interim Evaluation concluded that it was too early to assess outcomes and impacts, see http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/fp7_interim_evaluation_expert_group_report.pdf#view=fit&pagemode=none
[66] http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/rtd_annual_report_evaluation_activities_2013.pdf#view=fit&pagemode=none See also EPEC 2011: Understanding the Long Term Impact of the Framework Programme http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/long_term_impact_of_the_fp.pdf
[67] http://ec.europa.eu/research/evaluations/pdf/archive/fp7-evidence-base/surveys,_self-assessments/stakeholder_consultation_on_fp7.pdf#view=fit&pagemode=none
[68] http://ec.europa.eu/research/evaluations/index_en.cfm?pg=home

[69] http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf

[70] Have been performed for specific evaluations, e.g. evaluation of Relu in 2012: http://www.nerc.ac.uk/research/funded/programmes/relu/relu-final-report-part2.pdf
[71] http://www.nerc.ac.uk/about/perform/reporting/reports/impactreport2013.pdf; http://www.nerc.ac.uk/about/perform/reporting/reports/impactreport2014.pdf
[72] E.g.: Storm Surge Prediction and its Impact on the UK Economy. DTZ (undated).
[73] Still one example of external evaluation of impact: Evaluation of 'Rural economy and Land Use programme' 2012: Impact evaluation based on case studies, interviews, surveys to project leaders/researchers, stakeholders at project level and stakeholders at programme level. The programme was a joint investment of three research councils (ESRC; NERC; BBSRC) and the evaluation do not representative for NERC programme evaluations. http://www.nerc.ac.uk/research/funded/programmes/relu/relu-final-report-part2.pdf
[74] http://www.nerc.ac.uk/about/perform/evaluation/evaluationreports/centrereports/
[75] http://www.nerc.ac.uk/about/perform/evaluation/evaluationreports/
[76] http://www.nsf.gov/about/performance/annual.jsp
[77] P 74 http://www.nsf.gov/pubs/2014/nsb1432/nsb1432.pdf
[78] http://www.nsf.gov/eng/adcom/charter.pdf
[79] 'Resultatmåling av brukerstyrt forskning' http://www.forskningsradet.no/no/Aktivitetsevalueringer/1182736860818
[80] http://www.forskningsradet.no/servlet/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition%3A&blobheadervalue1=+attachment%3B+filename%3D%22RevidertrapportPetromaksogRenergiendelig.pdf%22&blobkey=id&blobtable=MungoBlobs&blobwhere=1274505221211&ssbinary=true
[81] http://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/6th_fp7_monitoring_report.pdf#view=fit&pagemode=none
[82] http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/fp6_ex-post_evaluation_expert_group_report.pdf#view=fit&pagemode=none
[83] In addition to the concerns for responsible research and innovation.
[84] The exceptions are schemes with demands for user contribution where projects may be terminated when such requirements are not fulfilled.

Nordisk institutt for studier av
innovasjon, forskning og utdanning

Nordic Instititute for Studies in
Innovation, Research and Education

www.nifu.no