



WHAT TO EVALUATE

Foundations can evaluate the research they fund at various levels, at different times, as well as for different purposes. In what follows we will focus on ex-post evaluation (evaluation after the funding has been completed) rather than on evaluation before (ex-ante) or during (in itinere) the funding. However, it is always important at the beginning of any project or programme to establish a baseline for any future outcomes or impacts and put in place mechanisms for collecting information that will be needed to allow evaluation to be carried out 'ex-post'.

PAMPHLET 2: WHAT TO EVALUATE?

Deciding what to evaluate, when and with which methods largely depends on the answers to the following questions:

- > What do we want to achieve by funding this activity or piece of research?
- > What exactly do we want to know about the research we have funded?
- > Are grantees informed in advance of what kind of reporting the foundation expects, including format and volume?
- > Which resources are available for the evaluation – can it be done internally or is external expertise required?
- > Does the foundation have the required organisational structure and qualified staff available in order to be able to carry out this type of evaluation?
- > What time frame is available for the evaluation?
- > What are we going to do with the results of the evaluation?

This pamphlet aims at facilitating this decision by describing the relevant advantages and limitations of evaluating outputs and outcomes/ impacts of research.

OUTPUTS AND OUTCOMES/IMPACT

Outputs here refer to the direct, measurable results of a research project or programme. This is primarily concerned with evidence of new knowledge produced by the scientific community.

These are the often direct results of funding and can be measured by looking at:

- > Number of publications from the research;
- > Numbers of citations and other bibliometric data;
- > Patent data;
- > Information on how the knowledge is disseminated.

In addition, 'outputs' can refer to additional resources or research capacity that is a consequence of the funding. These can be measured by looking at:

- > Additional finance leveraged for follow-on or complementary studies;
- > Numbers of researchers trained and empowered through the research (e.g. higher degrees, professional promotions);
- > Evidence of new or improved research infrastructure (e.g. equipment, facilities).

'Outcomes' or 'Impacts', on the other hand, are concerned with:

- > Impacts on the structure and priorities of an academic field or discipline;
- > Impacts on policy and product development (e.g. citations in clinical/policy guidelines, patent citations, licensing revenues, spin-offs, start-ups);
- > Broader socioeconomic impacts, such as the impact on productivity or economic growth;
- > Health gains and quality of life gains, such as the reduction of the burden of disease and environmental impacts.

EVALUATING OUTPUTS

There are three main types of outputs from research projects or programmes.

Definitions used:

SCIENTIFIC OUTPUTS

The number and scientific impact of papers published within a project, programme or by an institution are most commonly used to evaluate research outputs. By just glancing at a publication list a foundation staff member is able to assess relatively quickly, whether the researchers in a particular project have produced results which their scientific peers consider valid and new. This form of assessment is quick and simple and may be particularly helpful when time and money are scarce. The trade-off for the simplicity and ease of this method is the accuracy of the results. *Pamphlet 3 (How to evaluate)* contains more detail about some of these problems and trade-offs.

ADDITIONAL FUNDING

Number and value of grants acquired from other sources or awards granted by prestigious donors are often included in an analysis of research output. It is important to consider issues of attribution (and contribution) when looking at additional funding acquired, i.e. the extent to which the additional funding was leveraged by the grant to be evaluated.

INTELLECTUAL PROPERTY OUTPUTS

In research evaluation, intellectual property outputs play a particularly important role when the funding objective aimed to produce results that can be applied outside of the academic research community. But even if such applicability was not part of the objective, licences, patents, and patent citations are just some of the indicators of research relevance that can be measured.

TABLE 1: **EVALUATING OUTPUTS: FACTORS TO CONSIDER**

OUTPUTS	FACTORS
<p>GENERAL</p>	<p>Time and Cost: Evaluating publication lists, number of patents and third-party grants is a fast and low-cost method of assessing scientific outputs and can be performed as soon as a report has been submitted.</p> <p>Accessibility: The required data (publication lists, publications, list of grants, patents) is easily accessible. This data is not just available for the duration of the project, but also long after the project has ended.</p>
<p>SCIENTIFIC OUTPUTS</p>	<p>Timing: If publication output is evaluated just after a project has ended, this often means that the scientific community has not yet had time to react fully to the research findings (via citations, opposing opinions, further developments etc.). The result being that the reaction of the scientific community may not be included in the evaluation, leading to an overestimation or underestimation of the scientific relevance of the findings.</p> <p>Use of existing expertise: Through the peer-review of journal publications you can include scientific expertise of specialists into your evaluation without having to ask them yourself. There is a risk, however, of the evaluator “importing” weaknesses of the peer-review process into the foundation’s own evaluation. Peer-review can be subject to bias, is time-consuming for the experts involved and there may be concerns over the objectivity and reliability of the findings.</p> <p>Comparability: Bibliometric data may be used to verify the reputation of the scientific journals in which the publications appear, helping to draw conclusions on the quality of the publication content.</p>
<p>ADDITIONAL FUNDING</p>	<p>Use of existing expertise: Assessing third-party grants draws on the expertise of selection committees and reviewers who have judged the work of the researchers in a different context.</p> <p>Potential Bias: Unless carefully calibrated against research experience, third-party funding and awards will often be seen to favour experienced researchers over newcomers when used to measure output. They may also inhibit new and radically innovative thinking and research if they perpetuate dominant approaches and schools of thought that are deemed lower risk.</p>
<p>INTELLECTUAL PROPERTY</p>	<p>Timing: Examining the number of patents acquired during the grant period shortly after the end of the project can also be misleading. It may take several years for the success or failure of an invention to be apparent, even when the design has been patented. Long-term effects of research funding on a discipline cannot be evaluated by using output measures alone.</p> <p>Significance of patents: A patent is used to protect the intellectual property rights of an inventor and the patent office only assesses whether the invention is new, subject to industrial application and constitutes an inventive step. Therefore a patent does not imply any information about the quality of the research that led to the invention nor does it confirm its usefulness or likely production. Counting the number of citations a patent receives (from other patents and scientific literature) is a better measure of patent quality, although some of the same caveats that apply to citation analysis more generally (see scientific outputs above) also apply here.</p>

EVALUATING OUTCOMES AND IMPACT

Research outcomes (impacts) have several different dimensions. This pamphlet focuses on academic, economic and social outcomes (impacts) of research.

Definitions used:

ACADEMIC IMPACT

Academic impact describes the effects research activities have within the different fields of research. When assessing academic impact it is important to ask the right questions. Relevant questions might be:

- > Do the research results constitute a major academic contribution or are they generally overlooked?
- > Are the research findings a stepping-stone for the development of a new field?
- > Are others carrying out further research in this area that is based on the results of the funded research?

The precise questions to be asked will depend very much on the vision, strategy and stakeholder interests of the foundation in question.

ECONOMIC IMPACT

By evaluating economic impact we attempt to calculate the return on research investments by taking a look at the effects on innovation and changes in technology that have directly resulted from investing in a certain research field. Changes in productivity as well as producer and consumer benefits as consequences of technological change are typical criteria that are taken into consideration when carrying out this kind of evaluation.

Some examples of economic benefits include:

- > Science commercialisation: profits resulting from the exploitation of intellectual property, spin-off companies and licences
- > Revenue gains and/or cost savings resulting from export and/or import substitution attributable to an innovation from the research
- > Human capital gains (e.g. reduction in productivity loss through illness or injury due to innovations from the research; new employment opportunities resulting from the exploitation of research findings)

SOCIAL IMPACT

In the context of this pamphlet social impact is used to describe the total social, environmental and/or cultural benefit the research yields for end users in a wider community.

Some examples of social benefits include:

- > Health benefits from new medical products and services, such as reduced mortality or improved patient care
- > Environmental benefits resulting from innovations attributable to research, such as less pollution or reduced carbon emissions
- > Improved policy formulation and implementation as a result of a better evidence-base

TABLE 2: **EVALUATING OUTPUTS: FACTORS TO CONSIDER**

OUTCOMES AND IMPACTS	FACTORS
GENERAL	<p>Resources: Impact evaluations - tracking outcomes - are generally more time consuming and costly than output evaluations. Attempts by governmental funding bodies to include social and/or economic impact in their evaluations have been heavily criticised by researchers for the extra workload it puts on them. When considering such an evaluation, one should minimise the additional burden placed on researchers to gather the required information, for example making use of data already in the public domain. As impacts can occur at any time after funding has been awarded, interim and final reports should be designed to capture this.</p> <p>Time: In an ex-post setting the impact of research may only be discernible years after a grant or programme has expired, requiring patience from both foundation staff and decision makers. For example, economic impact studies of agricultural research often cover observation periods of 20-25 years.¹</p>
ACADEMIC IMPACT	<p>Wider context: The reactions to published research findings can be taken into consideration. This puts individual projects into a larger context allowing a more accurate estimation of the relevance of the research findings. It can also provide an insight into the foundation's overall impact on the development of a certain field. When evaluating a funding programme, core funding area or institution it may be more appropriate to focus on the long term than just on the outcomes of individual projects.</p> <p>Limitations: There are limitations to such an approach however. Factors such as editorial politics and the questionable significance of journal impact-factors may impair the reliability of bibliometric evaluation results if not carefully handled. This is particularly true for high-risk research which sometimes leads to unexpected results which contradict current opinion at the time of publication. In such cases researchers may have problems getting their findings published in well known journals so that the results may see their first light in an obscure and little-known journal. The relevance and quality of the research results may however turn out to be much higher than that reflected by impact-factor analyses.²</p>
SOCIAL IMPACT	<p>Benefits: This enables funders to identify social priorities that could be included in their future funding programmes, thereby maximising the social impact of their activities. Public benefit is often cited as being a main criterion for a funding decision or the development of a new funding scheme, and it should therefore be possible to find measurements of social impact in the evaluation of such funding schemes.</p> <p>Attribution: It is very difficult, if not impossible, to attribute social or technological impact to a single project or funding initiative. Even when evaluating the social impact of a large funding programme, other initiatives in related fields must be taken into account as well as social trends and developments outside the foundation's own funding schemes.</p> <p>Methods: Currently there seems to be no generally accepted methodology on how to evaluate social impact, although governmental funding bodies and foundations in several countries are currently developing them and have recently introduced an assessment of impact into their funding programmes.³</p>

¹ See Maredia et al, Ex Post Evaluation of Economic Impacts of Agricultural Research Programs: A Tour of Good Practice

² Impact-factors - in their simplest form - are scores assigned to academic journals based on the average number of citations an article in that journal receives over a fixed period of time. Because impact-factor scores are readily available, they are sometimes used as a proxy for the citation scores of individual articles. However for a variety of reasons - lack of sensitivity to the composition of articles in the journal, lack of sensitivity to the scientific field of the journal, insufficiently long time-period within which citations are counted - impact factors may be misleading and a poor proxy for the impact of individual articles.

³ Higher Education Funding Council of England (HEFCE) Impact Pilot Exercises <http://www.hefce.ac.uk/research/ref/impact>

ECONOMIC IMPACT

Benefits: This can provide valuable information about the financial return of a philanthropic research investment. It provides funders of philanthropic research with an economic cost-benefit analysis which can then be used as a basis for further investment decisions. It is measurable and can be easily compared with other funding initiatives.

Resources: Such evaluations often require input from specialist personnel who are qualified to carry out impact studies. However, only few foundations have these specialists among their own staff and thus do not have to rely on experts from other organisations.

Attribution: As with social impact, long-term economic impact such as productivity gains may be difficult to attribute to a single source of funding or a single innovation.

CONCLUSION

Both output and outcome/impact evaluations offer valuable information on the results of a research project, programme or institution. Output measures can be applied to evaluate research on each of these levels. Outcome/impact assessment is most suitable for evaluating programmes as it is very difficult to attribute impact to a single project. Outcome/impact evaluation must include a long-term perspective and a foundation looking for the impacts of its research funding might consider performing this type of evaluation repeatedly, in order to gain the full picture - of course this is only possible if the necessary resources are available and the exercise is considered worthwhile. Evaluation of research outcomes and impacts remains a subject open to methodological discussions.



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