

SUMMARY

Request for advice

In 2014, the Dutch Government published its *Vision for Science 2025* [*Wetenschapsvisie 2025*]. One of its aims is to link up Dutch scientific research with society more effectively and to ensure that it has an impact on society and the economy. Following on from the *Vision for Science*, the then State Secretary for Education, Culture and Science requested the Royal Netherlands Academy of Arts and Sciences ('the Academy') in 2017 to advise him on how best to determine the societal and economic impact of science. The present Advisory Report presents the Academy's recommendations.

Restriction to impact on society

The effects of scientific research are very broad, and how they manifest themselves differs from one discipline to another, as well as depending on the objectives of the research concerned. Basic research, for example, generates new knowledge and insights that are in turn utilised for the further development of other – more application-oriented – disciplines. That is in itself a type of impact. In the context of this Request for Advice, however, we are mainly interested in clarifying the way research results are utilised outside the field of science itself. This report therefore refers to 'societal impact' – i.e. the impact on society – which is taken to mean:

The contribution made by scientific research, in both the short and the long term, to changes in, or the development of, sectors of society and to challenges facing society. Such sectors of society include the economy, culture, public administration, and healthcare, while the challenges include such issues as climate change, immigration, quality of life, the environment, the rule of law, and security.

According to this definition, economic impact is explicitly part of societal impact. Contrary to the Request for Advice, this report does not therefore discuss societal and economic impact separately. It should be noted, however, that scientific quality and societal impact go hand in hand. Outstanding scientific research often also has a major impact on society.

Contribution of the education component to societal impact

An important task of our research universities and universities of applied sciences [*hogescholen*] is to educate young people. The tens of thousands of students who graduate annually will not only apply their state-of-the-art knowledge directly within businesses, government, or civil-society institutions but will also increase the capacity of society as a whole to absorb innovations. The education component is thus one of the most important means whereby higher education institutions have an impact on society.

In the Request for Advice to which this Advisory Report responds, however, the emphasis is on the societal impact of scientific research. The Committee has therefore focused mainly on the societal impact associated with scientific research, leaving aside the contribution made by education. As a result, a significant part of the societal impact of higher education institutions has been deliberately excluded.

Increasing attention to the societal impact of scientific research

The societal impact of scientific research is receiving a great deal of attention, both nationally and internationally, from politicians and from the bodies that fund research. This creates a growing need for ways to determine that impact. Various aims are often being pursued in that regard, such as:

- justifying investment in public research;
- increasing the impact of research;
- selecting research projects;
- communicating about the effects of research in the short and long term.

The Committee endorses the importance of the societal impact of scientific research, but cautions that that impact is by no means always clear, or cannot be clear, in advance. Research whose societal impact cannot (yet) be demonstrated can nevertheless still be extremely valuable. The increasing attention paid to societal impact must not lead to certain types of research being endangered.

The nature of societal impact

When looking for ways to determine the societal impact of research, it is essential to consider the nature of that impact. There is sometimes an erroneous perception that the process leading from research to societal impact is a linear pathway that starts from basic research and proceeds via more application-oriented research to – ultimately – applications. This ‘pipeline model’ is obsolete. In current research endeavours, new knowledge is generated within a dynamic and iterative process that is increasingly open and focuses on cooperation with partners in society. The impact on society is not only the result of research efforts but is achieved through a great deal of interaction between researchers and parties within society. One speaks in this context of ‘productive interactive networks’.

The impact that research has on society displays the following features:

- It is extremely diverse and certainly not always capable of being interpreted in economic terms. The impact in the technological sciences, for example, takes different forms to that in the humanities.
- It is often only apparent after a long or even very long period (more than 10 years).
- It is by no means always possible to link it directly to a particular research project. Successful changes within society are often based on numerous research projects, sometimes both domestic and foreign. Conversely, there are many factors that determine whether a research result in fact leads to an impact on society. Many of these factors lie outside the sphere of influence of researchers.
- It cannot always be objectively assessed at any one time. In some cases, the judgement as to whether a certain effect on society is positive or negative depends to a great extent on how it is perceived by the observer, while a certain development that initially seemed to be very positive may turn out to have unintended side effects and secondary effects.
- It is often also international, meaning that the results often only contribute to Dutch society indirectly.

Methods for determining impact

The methods for determining the impact of research need to be divided into two categories. The first comprises methods that assess the impact a certain time *after* the research has been carried out (ex-post assessment). The second category consists of methods that try to estimate *in advance* the impact that scientific research can have (ex-ante assessment).

There is often a considerable time lag between scientific research being carried out and society feeling its impact. In order to understand this process, most methods distinguish between different types of research results, with three levels being identified:

1. *Output*, i.e. the most direct results of a study, which are often apparent in the relatively short term. Examples include research publications, prototypes, and exhibitions.
2. *Outcome*, i.e. the medium-term results, which often have a clear relationship with the objective of the research project. The outcome of a research project might, for example, be an increase in the vaccination coverage of children in the Netherlands.
3. *Societal impact* means the effect in the long term. The outcome in the above example of vaccination coverage might be, for example, the societal impact of reduced infant mortality in the Netherlands.

Ex-post assessment of societal impact

There are a multitude of practices, systems, and criteria for assessing societal impact, both nationally and internationally. Broadly speaking, four categories can be distinguished:

1. Econometric studies. These attempt to determine the economic effects of, for example, research universities and universities of applied sciences as a whole.
2. The case-based approach. This method attempts to assess what the societal impact has been of individual research projects or programmes.
3. Societal impact or societal relevance as a component of research evaluation. Societal impact is increasingly one of the aspects assessed in the course of research evaluation, with a great deal of information being gathered about utilisation of the knowledge generated.
4. Process-oriented methods that attempt to clarify the course of the pathway leading from the research to its impact on society. These methods focus not on the nature and extent of the societal impact itself but on the process leading to it. This involves, for example, examining the extent to which potential users of the knowledge generated have been involved in the research process (the interactive productive network).

Many methods give a picture of output and outcome rather than of societal impact. The methods and tools are often still being developed, and there is no one method that is clearly the best. That is not to be expected in the short term either, given the multitude of methodological problems involved in measuring impact and the diverse nature of societal impact in the various scientific fields. Moreover, the question of the most appropriate methodological framework depends to a large extent on the aim of the assessment. One can say that in general that:

- The methods and indicators used must be chosen wisely, having regard to the objectives of the research, the stage that the study concerned has reached, and the specific research field or domain.
- Various aspects of 'impact' can be determined effectively by a 'mixed-methods'

approach, i.e. a combination of measurements, narratives, and other evidence at 'case level'.

- The most refined methods for estimating impact ex-post are extremely labour-intensive, costly, and far from always feasible.

Ex-post impact assessment can be carried out at the level of a project, research group, institute, or entire institution. The higher the aggregation level at which these assessments are performed, the greater the complexity but often the better the understanding of the societal contribution of the group, institute, or institution that emerges. Individual research projects are generally on too small a scale to bring about demonstrable changes in sectors of society or to provide solutions to major social issues. At the same time, however, one needs to realise that an assessment is only a 'snapshot' and a consequence of activities in the past. Such ex-post evaluations will provide a better picture of developments over the years if they are carried out with a certain frequency on the same unit. There is no unequivocal set of indicators at national level that can determine the societal impact of all the research in the Netherlands ex-post.

Internationally too, ex-post assessment of the societal impact of research is in the spotlight. In the United Kingdom, Australia, and New Zealand, societal impact is a criterion in the national research evaluation system. There are a number of lessons that can be learned from experience gained in other countries:

- Assessment of narratives by panels of experts combined with effective quantitative substantiation provides a good basis for the ex-post assessment of societal impact.
- It takes a long time for the impact on society to become apparent. This also varies greatly from one discipline to another and from one type of research to another. In many fields, the societal impact of research only becomes apparent later than the usual evaluation period of four to six years. This leads to the risk of a distorted picture being created of that impact.
- Constructing high-quality narratives and substantiating them is highly labour-intensive and therefore costly.
- Assessment panels must include experts who can offer a judgement on the use made of the knowledge generated.

Ex-ante assessment of societal impact

The expected societal impact of scientific research plays an increasing role in the assessment of research proposals or in the design of research funding programmes. This is understandable given the public nature of much research funding. However, relatively few methodologies have yet been developed for ex-ante assessment. This is also much more difficult, of course, because the societal impact has not yet made itself felt, and in practice there is rarely a simple chain of causality running from research to impact. Most of the approaches that have been developed are based on

constructing ‘impact pathways’ on the basis of a ‘theory of change’. Such a theory is a framework in which it is made clear in a specific context how and why a process of change will take place, what steps are required for that to occur, and how they relate to one another. Experience of constructing such pathways has been gained in various places and various sectors. For the British Research Councils, for example, specifying a ‘pathway to impact’ is a mandatory requirement when applying for research funding. Experience shows that this method can be useful, provided it is drawn up specifically for the project in question. Moreover, it is important that it is utilised as a dynamic tool and is updated and developed during the course of the project. If the pathway to impact document is only drawn up because it is a mandatory part of a grant application, then the impact will be minimal. Potential users or other stakeholders should also be involved in the activities. These activities, and organising them, cost time and money, for which provision must be made in the research budget.

Once impact has been determined, how should one then proceed?

In the final section, the Committee – all things considered – outlines the direction that can be taken within the Dutch knowledge landscape. Three directions for development are outlined and the Committee also makes a number of recommendations, which are explained in greater detail in the report.

DIRECTION OF DEVELOPMENT 1: DO MORE EX-POST WITH THE INFORMATION ALREADY COLLECTED

Methods for societal impact assessment can be highly labour-intensive. Any major increase in the administrative burden for researchers and institutions must be avoided. The Committee is therefore of the opinion that as much as possible should be done with the great volume of information that has already been collected for other purposes, for example in the framework of the periodic evaluations by means of the Standard Evaluation Protocol (SEP), the TO2 Evaluations, and the evaluations at universities of applied sciences (BKO). That information comprises a wealth of data that can be utilised to investigate the relationship between scientific research and its long-term impact on society.

RECOMMENDATION

The Association of Universities in the Netherlands (VSNU), the Academy, the Netherlands Organisation for Scientific Research (NWO), the TO2, and the Netherlands Association of Universities of Applied Sciences: Make the narratives produced within the framework of the SEP, the TO2 evaluations, and the BKO easily accessible to a wide audience. Consider whether the evaluation committees’ societal relevance assessment can also be linked to those narratives.

RECOMMENDATION

Minister of Education, Culture and Science: Commission one or more institutions to produce a comprehensive report on the societal impact of research in the Netherlands, and have it updated after a number of years. This report must be designed in such a way that it not only provides a snapshot but, specifically, can also identify changes over time. It can to a large extent make use of the information already available – although in fragmented form – such as narratives from evaluations, annual reports, and reports on programmes, projects, and institutes.

DIRECTION OF DEVELOPMENT 2: FOCUS EX-ANTE EVALUATION NOT ON DETERMINING THE SOCIETAL IMPACT ITSELF BUT ON THE FACTORS AND PROCESSES THAT INCREASE THE LIKELIHOOD OF SUCH AN IMPACT.

For most types of projects and programmes, it is not possible to reliably determine the societal impact of scientific research in advance because the time between the research and its actual impact is generally too long and there are too many unpredictable factors. This does not mean that the potential societal impact cannot and should not play any role in the ex-ante assessment of scientific research in the long term. The societal impact itself – and certainly its extent – cannot be predicted reliably, but it is nevertheless possible to estimate whether the research in question and the way it is organised will increase the *likelihood* of it's having an impact on society. Promoting productive interactive networks and actively involving potential users in drawing up the research question and implementing the research project play a central role in increasing the impact on society. Experimenting with mission-driven research programmes to tackle challenges facing society is an example of an approach in which the creation of such a network is taken into account from when the programme is first defined. In addition, greater appreciation for participation by researchers in productive interactive networks and the inclusion of a requirement for the presence of such a network in the explicit assessment of the research project or programme will increase the societal impact in the long term.

RECOMMENDATION

NWO: Continue along the planned path of requiring applicants for research funding to consider how their proposed research can have an impact on society, and what action is needed for that to be achieved. This can involve, for example, asking for impact pathways to be specified. Ensure that impact pathways do not become merely static documents but rather a means for promoting utilisation by society. This will also require enabling researchers to devote time and attention to the necessary activities.

RECOMMENDATION

Research universities, universities of applied sciences, and research institutions: When assessing and evaluating researchers, take explicit account of performance and efforts aimed at achieving an impact on society.

RECOMMENDATION

NWO and other research funding bodies: When setting the assessment criteria for research projects and programmes in which societal impact is one of the aims, include the requirement for there to be a potentially productive interactive network.

RECOMMENDATION

NWO: Continue along the planned path of, for example, experimenting with mission-driven programmes within the framework of the *National Research Agenda* (NRA) and investigate how this approach can lead to a faster and better impact on society.

DIRECTION OF DEVELOPMENT 3: UTILISE EX-POST EXPERIENCE TO INCREASE THE SOCIETAL IMPACT OF FUTURE PROJECTS.

The chain of causality running from research to effects in actual practice and on society is almost always long and diffuse. Relatively little is yet known about the different ‘pathways’ along which research has its influence and effect, and undergoes a transformation into an impact on society. In the Netherlands, hardly any research is being done on these mechanisms. A better understanding of how they operate can help to increase the societal impact of research in the long term and to develop better methods of evaluation.

RECOMMENDATION

Minister of Education, Culture and Science: Work with other ministries to set up a research programme to investigate the effects of research results and the development of better (or even better) narratives and indicators.

At the macro level, environmental factors, such as regional developments, often play a role in determining the degree of societal impact. A better understanding of the decisive environmental factors will be useful in designing policies to promote the societal impact of research. Many factors are already known from the literature that can determine that societal impact but it will be interesting to know which ones are specifically important in and for the regions in the Netherlands, and could be investigated more systematically.

RECOMMENDATION

Minister of Education, Culture and Science: Investigate what relationships and environmental factors encourage the societal impact of research, and utilise the understanding achieved to further improve policies for promoting societal impact.

In conclusion. The saying ‘the numbers tell the tale’ does not apply when one is attempting to determine the societal impact of research. A qualitative indication can be given, however, of how the likelihood of a societal impact can be increased. That indication will be considerably less reliable if *measuring* societal impact is linked to the allocation of (financial) resources (in which case ‘the numbers *do not* tell the tale’). Such a link will lead to undesirable incentives (‘gaming’), such as the encouragement of research with only a short-term perspective or the production of a too rosy picture of the societal impact. The results of an investigation of societal impact should therefore not be used in order to direct future research funding. This brings us to the Committee’s final recommendation:

RECOMMENDATION

Minister of Education, Culture and Science: Do not link measurement of the societal impact of research to research funding, given that doing so will create undesirable incentives to maximise the value of these indicators. Measuring these indicators will not, generally speaking, lead to an increase in the impact on society.