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Knowledge as a common good: the societal relevance of scientific research

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Universities are, to a large extent, publicly funded. It is reasonable to expect that society should benefit as a result. This means that scientific research should at least have a potential societal impact. Universities and individual researchers should therefore give serious thought to the societal relevance of their research activities and report on them widely. Core questions they should be asking are: "Do we do the right things?" and "Do we do them right?". This implies that as well as indicators of scientific quality, attention should be given to indicators of societal relevance. These two considerations are examined in the context of current evaluation practices of academic research. Twelve indicators of societal relevance are proposed, focusing on both their socio-cultural and economic value. The examples given mainly concern the health and life sciences. This paper concludes with a discussion of the key challenges in evaluating the societal relevance of scientific research.

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La connaissance comme « bien commun » : la pertinence sociétale de la recherche scientifique

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Les universités sont, en grande partie, financées par l'État. Il est légitime de penser que la société puisse en bénéficier. Cela signifie que la recherche scientifique devrait au moins avoir un impact sociétal. Les universités et les chercheurs indépendants devraient, par conséquent, sérieusement considérer la pertinence sociétale de leurs activités de recherche et en tirer les conséquences à grande échelle. Les questions fondamentales qu'ils devraient se poser sont : « Faisons-nous les choses comme il faut ? » et « Les faisons-nous correctement ? ». Ceci implique qu'outre les indicateurs de qualité scientifique, l'attention devrait être portée sur les indicateurs de pertinence sociétale. Ces deux considérations sont analysées dans le contexte des pratiques actuelles d'évaluation de la recherche universitaire. Douze indicateurs de pertinence sociétale sont proposés, et l'attention est portée à la fois sur leur valeur socioculturelle et économique. Les exemples fournis concernent essentiellement les sciences de la santé et de la vie. Cet article s'achève sur une discussion portant sur les défis majeurs en matière d'évaluation de la pertinence sociétale de la recherche scientifique.

One of my champions is the British statistician Austin Bradford Hill (Bouter, 1993; Hill, 1952, 1965). In 1948 he introduced the randomised clinical trial to determine the effectiveness of medical treatments through randomised treatment allocation and arbitrary outcome assessment. At the time, this approach gave rise to heated debate and was criticised as unscientific and unethical. Sixty years later, Hill's position is no longer controversial. Today there is a consensus that, in cases where there is reasonable doubt, it is actually unethical not to conduct a clinical trial. The doctrine of evidence-based medicine is founded on this very principle. It centres on the notion that, while theory and fundamental research are essential, they nevertheless provide an insufficient basis for the application of scientific knowledge. This requires applied research in the relevant field. Hill formulated four questions that authors and readers of scientific articles should ask themselves:

- Why did you start?
- What did you do?
- What answer did you get?
- And what does it mean anyway?

I would like to discuss the last question in particular, and there are two key elements to my stance. The first is that researchers should reflect on the societal relevance of their work. The second is that universities should report on the work of their researchers and formulate concrete indicators of societal relevance.

This paper will begin by considering the relationship between scientific quality and relevance to society. It will then demonstrate the importance of focusing on societal relevance and its place within the traditions of VU University Amsterdam. Subsequently, it will identify a number of indicators of societal relevance and will propose ways for working with them. Lastly, it flags the challenges that lie ahead.

Quality and relevance

The dream of every modern-day university manager is a cockpit with a dashboard full of performance indicators. To be honest, didn't we all want to be pilots when we were growing up? I am such a manager and I know that my steering ability depends on the quality of those indicators. I also know that vision and wisdom are important when it comes to interpreting the readings on those displays and dials. With this in mind, we can make two demands of

research: that it is of high scientific quality and that it is relevant to society. The first demand is non-negotiable and is central both to the assessment of research proposals and the evaluation of academic research. The demand for societal relevance is less self-evident and gives rise to a great deal of discussion.

To begin with, relevance often depends to a large extent on the outcomes of a body of research, in addition to all kinds of circumstances beyond the control of researchers and universities. A good example of external circumstances benefitting favourably is a study on the use of back support belts to prevent injuries among the baggage handlers who load aircraft at Amsterdam's Schiphol Airport (Van Poppel *et al.*, 1998). This kind of work can cause back problems, but our study showed that back support belts were not effective in preventing these problems. "Negative" findings like this often make a study difficult to publish, but in this case we were fortunate. Our findings came out just as legislation in the United States to make back support belts compulsory was being drawn up. In record time, our study was printed in a leading journal and became the topic of heated debate in the media and during sessions at the US House of Representatives.

It would not be reasonable to expect every research project to have such a clearly identifiable social impact. But this example does show how scientific quality and societal relevance can go hand in hand. On the whole, I think there is at least a moderately positive correlation between quality and relevance. Of course, it should also be noted that bad research is never relevant. There should be no misunderstandings about that. In my view, quality and relevance are not interchangeable. I have no sympathy for attempts to boost societal relevance by making concessions on scientific quality.

Since universities are publicly funded, it is reasonable for society to expect something in return for this investment. First and foremost, this means that universities should train professionals who can make a difference. This is surely the best way to make our societal relevance clear to all. But it is research, not education, that I want to discuss here. At the very least, we should be entitled to demand that research has the potential to be relevant and lead to results which can be implemented. While this can be seen most clearly in applied research, I believe it applies also to fundamental research, although the relevance of the latter is much more difficult to predict and can sometimes take decades to emerge. In many cases it may not even materialise, but this should not undermine the researchers' good intentions in the first place.

Universities have to become transparent when it comes to the scientific quality and societal relevance of their research. In other words, are we doing the right things and are we doing them right? (Bensing *et al.*, 2003) The first question relates to taking up the challenge of society's problems. The second concerns both the quality of research and the relevance of its findings. Society

has the right to receive a clear answer to these questions. Besides, it is becoming increasingly difficult to make an impression by simply referring to the intrinsic importance of fundamental research.

Scientific quality

In many countries, the quality of scientific research is evaluated at fixed intervals and often the primary significance of such an evaluation concerns the policy of the university in question (Meta Evaluatie Commissie, 2007; Standard Evaluation Protocol, 2003). This is certainly true of the Netherlands. But there are cases where this evaluation process has far-reaching consequences for the budget allocated by the government. The United Kingdom's Research Assessment Exercise (RAE), which is held every four years, is a good example of this (HEFCE, 2008). This approach is still subject of much discussion, since the method used appears to work to the distinct disadvantage of interdisciplinary and applied research (Banatvala *et al.*, 2005; Shewan and Coats, 2006).

The RAE also gives rise to strategic effects such as the temporary transfer of foreign colleagues who have an impressive list of publications to their credit. This is not the right way forward. However, I do believe that it is important to reward good behaviour and therefore I agree with those who advocate more dynamism in the funding of research (Commissie Dynamisering, 2006a, 2006b; Raad voor Medische Wetenschappen, 2005; Zuijdam, 2006). I also think that, within universities, there are good reasons for linking budget allocation to performance, at least to some extent. But any such allocation needs to be based on performance indicators which are simple to measure and difficult to manipulate.

Publications and citations are measurable aspects of scientific quality. The financial support obtained also makes a statement about the quality of the researcher and the research group. However, there are important cultural differences between disciplines as regards funding, publication and citations (Wouters, 1999). Citations are interesting because they show how great a contribution a specific publication has made to the acquisition of knowledge in a given field. The indicator which reflects the relative impact in comparison with the rest of the field is particularly informative (Moed, 2005; Van Raan, 1996; Moed *et al.*, 1995). It is obtained by dividing a research group's average number of citations per article by the average number of citations of an article in the same field.

Table 1 shows a bibliometric analysis of the eight university medical centres in the Netherlands (CWTS, 2006). Apart from the VU University Medical Center, the identities of the various institutes have been concealed, but actually VUmc comes a close third behind Rotterdam and Utrecht. The final column shows that the Netherlands' university medical centres are cited 40% more often than the international average.

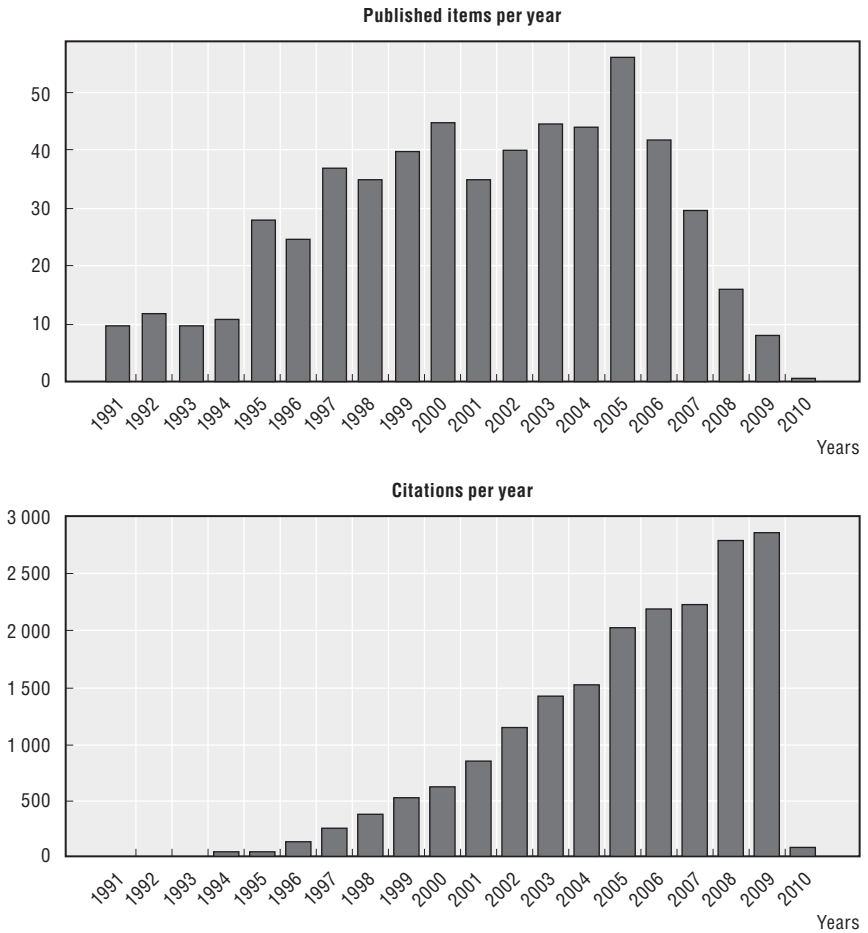
Table 1. **Output of eight University Medical Centres (UMCs) in the Netherlands, 1998-2005**

UMC	Publications	Citations per publication	CPP/FCSm
UMC a	9 034	15	1.59
UMC b	11 886	15	1.59
VUmc	7 711	14	1.52
UMC c	8 600	12	1.46
UMC d	8 937	15	1.44
UMC e	8 893	14	1.43
UMC f	9 023	12	1.27
UMC g	6 431	10	1.21
Total	**59 664**	**13**	**1.40**

The recently published Leiden Ranking shows that VU University Amsterdam and the VU University Medical Centre combined rate 35% above the world average when it comes to citation scores (CWTS, 2008; Council for the Humanities and Social Sciences Council, 2005). This puts us in 15th place in the European rankings and in fourth place among Dutch universities. While this is not bad, it also indicates that there is room for improvement. But even as we consider such matters, we must not lose sight of the limitations of this one-dimensional approach. As I see it, there are three.

First of all, this approach is largely dominated by the pure sciences. It does not work effectively for the arts and social sciences, where a different publication culture applies (Council for the Humanities and Social Sciences Council, 2005). Secondly, citation analyses rely heavily on past achievements. In most cases, between four and eight years pass between the start of a report and its publication. It then takes at least another year before the first citations start to appear. Third, only absolute citation scores are available for individual researchers, with all the disadvantages this entails. Nevertheless, the information in Figure 1 is increasingly being used when deciding on staff promotions to associate or full professor. It gives the number of publications and citations per year, the average number of citations per publication and the h-index. The significance of this last criterion is rising dramatically. The h-index is the number of articles which received h or more citations (Hirsch, 2005). In other words, if a researcher's articles are ranked in descending order on the number of citations, an h-index of 76 means that the 76 articles will have 76 citations or more. A singular index such as this is appealing in its simplicity but the strong influence of age and discipline means it is also potentially misleading. Researchers with the same h-index may also vary widely in terms of the number of publications to their credit.

Figure 1. **Publications and citations**



Notes: Results found: 581.
Sum of the times cited: 19 356.
Average citations per item: 33.31.
H-index: 76.

Source: ISI Web of Knowledge, *www.isiwebofknowledge.com*.

The discussion above makes it clear that finding good indicators of scientific quality is no easy task. Operationalising societal relevance is far more difficult still. But this does not strike me as grounds for giving up all attempts to achieve it.

The position of research

Research is becoming less and less the exclusive province of the universities (Wissema, 2005; Van Vught, 2004). Indeed, in both research and education,

there has been a dramatic rise in the level of international competition. Such developments call for decisive co-operation in a variety of changing contexts, and lead to the creation of new interdisciplinary scientific fields. In addition, governments are placing ever greater demands on quality, transparency and innovative ability. This requires a flexible, dynamic and entrepreneurial organisational structure. And all of this has to be combined with a greater, more readily demonstrable commitment to society.

Progressively, society has become more and more interested in science and academic endeavour, as evidenced by the 25th anniversary edition of the science section of leading Dutch newspaper *NRC Handelsblad* (NRC, 2007). It argues that innovation and new insights often occur unexpectedly and spontaneously. This suggests that there is good reason for having freedom and room for manoeuvre in scientific practice. I wholeheartedly concur with this position. Societal relevance is a difficult thing to predict. It is far simpler to assess impact in retrospect but even then, it can seldom be demonstrated beyond a reasonable doubt that a specific research project provided the missing piece of the puzzle (Oortwijn *et al*., 2007; AWT, 2005, 2007). The time frame also varies enormously: sometimes the societal impact of a study is readily apparent, but it often takes many years to make itself felt.

VU University Amsterdam has enjoyed a reputation for strong societal commitment since its foundation (Deursen, 2005). One manifestation of this commitment is the large number of political leaders among the university's former students. It can also be seen in the inspiring plans for a new campus in Zuidas, Amsterdam's dynamic new business district, in which the university's academic functions are interwoven with living, working and cultural activities. Academic citizenship and academic entrepreneurship are central to VU University Amsterdam's educational vision and its institutional development plan (Vrije Universiteit, 2007; Onderwijscentrum VU, 2006). This means that, in addition to excelling in scientific quality, it is also important to be outstanding in terms of societal relevance. It is therefore high time to make societal relevance a tangible entity, expressed in concrete terms. This is something we need to do for the outside world in the interests of accountability. But more importantly we need to do it for ourselves, to serve as a compass for our choices in the world of science.

Indicators of societal relevance

As I go on to discuss how indicators of societal relevance have been taking shape, I will make reference to health research, the sector with which I am most familiar. This familiarity stems partly from my involvement in commissions at the Royal Netherlands Academy for Arts and Sciences and the Council for Health Research, which focused on selecting indicators for this field of research

(Council for Medical Sciences, 2002; Raad voor Gezondheidsonderzoek, 2007). However, it is possible to imagine how my observations might be translated in terms of the arts, the exact sciences and the social sciences. Indeed, such translations are already available to some extent (Council for the Humanities and Social Sciences Council, 2005; AWT, 2007).

Clearly, the aims of health research ultimately lie in improving public health and healthcare. These should manifest themselves as improvements in people's life expectancy and quality of life. These are the outcomes that really matter. But, as we have already seen, their relationship with the research whose social relevance we want to evaluate is a complex one. It would therefore be unreasonable to come down too heavily on the researcher and his research for not fully realising the potential impact of the new knowledge obtained. Bearing this in mind, it is better to choose indicators at the product or process level, as shown in Table 2.

Table 2. **Indicators of societal relevance of scientific research**

Indicators of social value
Products:
• Specialised publications.
• Lay publications.
• Guideline or policy document.
• Service, method, technology.
Processes:
• Committees in professional or public domain.
• Public information services.
• Continuing education.
• Public opinion or political decision making.
Indicators of economic value
Products:
• Patents.
• Intellectual property.
• Start-up company.
Process:
• Committees in commercial domain.

Across the world, there have been many efforts to identify indicators of societal relevance (Bensing *et al.*, 2003; Council for the Humanities and Social Sciences Council, 2005; Council for Medical Sciences, 2002; Bensing and Oortwijn, 2006; Bouter and Knottnerus, 2000; Buxton *et al.*, 2000; Hanney *et al.*, 2004; Hicks, 2005; Kingwell *et al.*, 2006; Oortwijn *et al.*, 1998; Roper *et al.*, 2004; Spaapen *et al.*, 2007; UK Evaluation Forum, 2006; Wooding *et al.*, 2005). These efforts vary from very simple, expedient attempts to all-encompassing systems which turn the process of evaluation into a field of research in its own right. We have now acquired a considerable amount of experience in this area. Sometimes people

look almost exclusively at the economic value of the research (Ranga *et al.*, 2003; Blakemore and Davidson, 2006; Clairborne Johnston *et al.*, 2006). But many others consider this too limited (Van Oostrom, 2007). A number of institutes, including the NIVEL Institute for Health Services Research in Utrecht, the Netherlands, and our very own EMGO Institute, incorporate indicators of societal relevance in their annual reports (EMGO Institute, 2007; NIVEL, 2007).

As mentioned above, I distinguish between indicators that relate either to a product or a process (Table 2). Products are concrete and countable, and do not generally present too much of a problem when it comes to establishing the plausibility of the relationship between the research results and the unit evaluated. To establish indicators for processes is much harder.

As concerns products, it is a known fact that only 10% of Dutch doctors regularly read international scientific journals (Bouter and Knottnerus, 2000). For other professional groups, the situation is probably no different. If research results are to reach a group of professionals here in the Netherlands, **specialised publications** in Dutch, either in article or book form, will be an important channel of communication. Books and articles are also an effective way of spreading knowledge among the general public. Academics also find out more about areas related to their own field mainly by reading the science sections of the newspapers (Willems and Woudstra, 1993). But more and more, Internet is becoming their favourite medium.

Public relations and science communication are not part of the scientific researcher's core activities. But to ensure the quality of the **lay publications** provided, it is important that researchers are involved. Ideally, professional conduct should be based on weighing up all of the relevant and available scientific knowledge in a clear and balanced manner. This means that authoritative **guidelines and policy documents** constitute a suitable indicator. Sometimes scientific research leads to a new **service, method or technology**.

As concerns process indicators, I believe that researchers should also play an active role in the process of distributing and applying research results, although theirs will certainly not always be a leading role. The extent to which research groups fulfil this important role of distributing and applying scientific knowledge can be seen by looking at the membership of **committees in the professional or public domain**. Exactly which committees should be included in such a survey would have to be established for each discipline separately. Other concrete process indicators are the research-based contributions to **public information services** or the retraining and **continuing education** of professionals.

Sometimes research results make a noticeable contribution to **public opinion or political decision-making**. One illustration of this is the research that followed an outcry in the Dutch media and among Dutch MPs about the

fact that nursing home staff in Groningen had left elderly patients with dementia to die if they were no longer able to drink for themselves. The press was outraged. But after the case was researched, the headlines took a very different tone. It turned out that allowing patients to die by no longer administering fluids only took place after a painstaking decision-making process and led to a relatively peaceful death. The impact of a study will not always be this clear. Yet I still believe it is worthwhile to chart the media attention devoted to a given department or institute.

It is also important to know what the economic value of a scientific research project is, mostly in macroeconomic terms. In other words, we want to see how research contributes to the knowledge economy. In this domain too, a distinction can be made between indicators at product level and at process level. First of all we can assess the amount of **patents**, as well as the sale of **intellectual property**. However, it is also important to remember that, as a rule, universities tend to make their research results public and therefore accessible to all. As far as I am concerned, that should definitely remain so. Knowledge is a common good. Sometimes research can lead to a **start-up company**, and in its early years it is usually closely associated with the university. A prime example of this construction is the company that developed a new improved voting aid – the Electoral Compass – together with the Dutch national daily *Trouw*, winning a national journalism prize in the process. Recently the Electoral Compass was used for the US presidential elections. In such circumstances, the researchers are often part-time entrepreneurs. Business initiatives of this kind provide very tangible evidence of the economic value of research. However, there are also risks attached to this dual role of researcher and entrepreneur. Independence can become compromised, the conclusions can become distorted, and public resources can be appropriated for private gain. I believe we should be more forthright in debating this darker side of academic entrepreneurship. A suitable process indicator of economic value may be membership of relevant **committees in the commercial domain**.

Challenges

The evaluation of the societal relevance of scientific research is still in its infancy. There is still plenty of room for discussion about the validity of the indicators, the optimum level of detail and weighing up the relative importance of its various aspects. Indeed, it is essential that such discussion takes place. However, it is clearly still too early to adopt a strong quantitative approach.

Societal relevance should be the focus of attention at both the start and the end of the empirical cycle (Groot, 1961). The primary motivation of many academics is intellectual curiosity and of course there is nothing at all wrong with that. However, the process of selecting a research topic and formulating

a research question should always be accompanied by a reflection on the expectations in terms of relevance to society. This reflection may serve as a compass, guiding the choices yet to be made. At an early stage in their work, researchers should take into account the burning questions being asked by stakeholders, whether they be citizens, patients, companies or politicians. Of course, their freedom will be restricted by the available expertise and the resources available for research. But I am nevertheless convinced that researchers in this phase should have a clear ambition to carry out research that has real societal relevance. Once the project has been completed, it is the responsibility of the researchers to disseminate the results across the various scientific forums and, where relevant, among professionals, politicians and the general public.

Universities have to take the societal relevance of research seriously and report on it in terms of concrete performance indicators. Before this can be achieved, the indicators need to be developed in greater detail. I would therefore like to take this opportunity to invite the academic community to take up this challenge in a creative and constructive manner. A clearly identifiable focus on societal relevance also gives a powerful signal to students and young researchers. It shows that the academic process is not simply about chalking up publications and collecting citations. This message can be reinforced by rewarding researchers who have made a special contribution in this regard.

To resume, we should think more carefully about how we articulate societal issues in research that can provide useful answers. I believe that every researcher should not only ask himself "Am I doing things right?", but also "Am I doing the right things?". And above all, we should be asking "What does it mean anyway?".

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