vetenskap & allmänhet

To
The Academic Career Inquiry *(Befattningsutredningen)*
Ministry of Education and Research
103 33 Stockholm

The Resources Inquiry *(Resursutredningen)*
Ministry of Education and Research
103 33 Stockholm

Measuring societal engagement – proposed indicators for resource allocation and academic merit rating

Summary

Engagement with society at large is an important mission of universities, but one that is unfortunately often regarded as a "third," less prioritised mission instead of an integrated aspect of education and research. One way to change attitudes is to clearly emphasise the value of societal engagement when allocating resources by formalising the measurement of the universities' efforts in this area. It also benefits individual scientists and researchers when collaborative activities are valued and rewarded, for example, when appointments are being made. Clear indicators need to be defined in order for this to become a reality.

In this report the association Vetenskap & Allmänhet, VA, (Public & Science), presents a number of initiatives and projects in Sweden and other countries, a discussion about possible indicators and a set of proposals to the Academic Career Inquiry *(Befattningsutredningen)* and the Resources Inquiry *(Resursutredningen)*.

Our hope is that the ongoing commissions of inquiry will take the proposals into consideration so that engagement activities will be recognised and rewarded to a greater extent in the future, both for individual scientists and for universities in general.

Stockholm, June 8, 2007

Camilla Modéer — *Secretary General*

Karin Hermansson — *Research Manager*

Contents

1. Societal engagement is important and must be valued!

Science is affecting people's everyday lives more and more. New technologies, discoveries and innovations are having a major impact on our health, welfare and security, while also becoming a cause for concern. Citizens are expected to take a stance on numerous issues and need knowledge to be able to make informed decisions. There is also democratic value in people knowing what their tax money is being spent on and being given the opportunity to express an opinion about it.

People's questions and knowledge of their needs and values are very useful for scientists and for research. Without dialogue with the rest of society, the scientific community runs the risk of losing public support and thereby also, over time, missing out on grant money and having less academic freedom. Dialogue between universities and society at large is therefore of great importance. Cooperation between universities and industry is also a crucial factor in ensuring Sweden's welfare and growth in a climate of growing global competition.

People in Sweden have a high level of trust in scientists and research, some believe it to be too high and that people are not critical enough of what scientists are doing. But trust is vulnerable and can easily be destroyed.

In VA's studies there are signs that the public's faith in researchers is declining. There may be many reasons for this, but one hypothesis is that it is linked partly to an increase in "individualisation" in society, and partly to events of a negative nature that more directly impact people's opinions of scientists. Research fraud, academic conflicts that have degenerated and resulted in legal consequences as well as numerous media scares have caught people's attention.

People pay attention to media reports and absorb negative messages and this can easily give them a skewed image of science and its significance. Also, people lack a full understanding of research conditions and methods – this is true of journalists and the general public. Many do not understand that scientific results need to be tested and re-tested; that this is the very basis for progress in science and research. The scientific community should therefore take a more active interest in these issues and discuss ways to deal with them.

Researchers communicate too little with the society, in particular the general public. This is the opinion of both the public and politicians. School teachers also experience the gap between themselves and the academic world as very wide and desire more contact with scientists. Researchers bear a major responsibility to try to improve dialogue with society – with respect to both methods and models for communication as well as content and wording. Information must be easy to obtain and comprehensible for the recipient. But it is also important to create forums for meetings with teachers and school children to discuss what we want to achieve in the future, why we need knowledge about the world around us and how we can obtain and utilise this knowledge.

Schools need to have a scientific basis for their work. Teacher training – the quality of which is the topic of lively debate – is naturally a crucial factor in the effectiveness of our schools in the long term. VA's study of teachers' opinions of research and researchers revealed that students of education were less likely than teaching professionals to have contact with researchers, despite the fact that they themselves were attending a university!

VA's studies show that scientists believe it is important to have a dialogue with the public, but feel that it takes too much of their time and is not considered as a merit. Also, the academic culture does not promote engagement and there is still a tendency to believe that scientists who spend their time on such things are less serious.

Change is therefore needed in the academic system and in the appointment structure. It must be worth a scientist's while to communicate with society at large, to be engaged in the public debate

and to work with school teachers and industry. If engegement with society is worth their while in terms of actual "merit points" and in the allocation of funds, the academic culture can change.

Based on the results of VA's studies, we can draw three overall conclusions:

- There is a wide gap between the scientific world and the public.
- All groups that were studied – scientists as well as the public, journalists, politicians and teachers – are interested in having more contact with each other. The obstacles are many, however, and are complex – both in terms of systems and attitudes.
- People are interested in research and new knowledge and can see the benefits, particularly if they feel that the issues relate to them and their lives.

Thus, change is needed on several levels in the academic system and the academic culture.

Researchers need to take responsibility for making contact with the society – schools, the media, businesses and others. Increased knowledge about how research works is crucial in raising the level of trust among the general public as well as among journalists and politicians. To stimulate more contact, the academic merit rating and financing systems need to be reformed so that societal engagement is rewarded. A change in attitudes in academia is also needed.

External research funding bodies must also demand knowledge transfer and public engagement. It is important, however, not to merely require that engagement activities be listed in applications but also assess and evaluate such activities. Failing to do so would send a message that dissemination and communication plans are merely in the applications for appearances' sake and that the actual engagement is not all that important.

Societal engagement is still unfortunately seen as "the least important" mission after education and research. Many use the term "the third mission," which tends to confirm this view, instead of regarding it as an integrated aspect of education and research. Although engagement is actually of value for research, many scientists see it as a burden rather than an opportunity. One way to change attitudes is to place a clear value on societal engagement when resources are to be allocated by formalising the measurement of the efforts and initiatives of universities and by measuring such things as the number of papers published. Clear-cut indicators must be established to make this a reality.

In this report, Vetenskap & Allmänhet will propose ways to construct such indicators. In Chapter 2 a number of initiatives in Sweden and other countries are described. In Chapter 3 possible indicators for different target groups are described. Chapter 4 addresses documentation and weighting. In Chapter 5 Vetenskap & Allmänhet's recommendations are presented.

2. Measuring engagement in Sweden and other countries

2.1 International perspectives

Many countries are developing indicators for interaction between academia and society. Most agree that it is an important but difficult task and many would like to receive help or to discuss how best to go about this task.

The British Science and Technology Policy Research at the University of Sussex, SPRU, recently published a report that discusses in detail measurement of so-called "third stream activities" [1]. The authors state that it is important to start this work as soon as possible, since the indicator development is time consuming and to avoid a situation where innovation and commercialisation are the only things that count. One important point made in the report is that a variety of indicators is needed to avoid an interpretation of the engagement mission that is too narrow. They also point out that indicators, which in the beginning are perceived as "soft", often become "hard" over time because "the hardness" is related to its degree of acceptability. Several existing indicators of quality in research are actually relatively "soft," for example innovation indicators.

The British Association for the Advancement of Science, the BA, has joined the Royal Society in recommending that eight universities in Great Britain be designated as role models with respect to public engagement and that they pass their experiences on to others. The establishment of such role models was recommended by the Royal Society in a report 2006 [2]. 60 universities have applied to be such *Beacons for Public Engagement* and the selection process is currently under way[1]. The funding, a total of eight million pounds, comes from Research Councils UK and the Wellcome Trust. A portion of the funds will be used to establish a coordination centre to promote best practice, build networks and provide an overview of the activities that are being carried out [18].

In Norway a commission of inquiry in two parts was published in 2005 and 2006 of how societal engagement can be measured and evaluated for the allocation of grants [3, 4] . The authors of the study recommend a set of indicators based on important arguments regarding quality assurance, documentation and keeping the additional workload for universities at a reasonable level. They emphasize the importance of increasing the level of *dialogue* – two-way communication – particularly with respect to user-focused contacts, i.e. targeted at customers/users of research results. Unfortunately the study's recommendations were not fully acknowledged in the political arena and the proposed indicators are not yet part of the Norwegian system.

In 2003 the Danish Government published an action plan based on a report conducted within the industrial sector [5] in which a number of initiatives were proposed to strengthen interaction between primarily universities and industry [6]. One of the incentives mentioned in the report was the importance of increasing knowledge in society as a whole. The Ministry of Science, Technology and Innovation in Denmark has prepared an index (described in the action plan) to reflect the OECD nations' research collaboration. This benchmarking includes: quality and relevance in research, commercialisation, R&D collaboration and opportunities for disseminating technical knowledge and sharing human resources. Of the 21 OECD nations studied, Denmark is in ninth place, while Sweden is fourth after Finland, the US and Switzerland. According to the report, Denmark is among the best in the quality and relevance category, but is placed somewhere in the middle in the other categories. From this, the Danish Government has drawn the conclusion that there is still room for improvement.

[1] The six Beacons were announced in November 2007. For more information, see for instance: http://www.rcuk.ac.uk/sis/beacons.htm

In the new Danish university financing system[2] basic financing is to be allocated according to quality and based on four criteria: productivity, quality of teaching, quality of research and quality of the dissemination of research knowledge [7]. The final criterion should take into account collaboration with industry, patents, start-up companies, media attention and other means of conveying information. In the current system, not all of these parameters have been included as yet, but a committee recently (April 2007) presented an analysis of possible indicators for knowledge dissemination, their benefits, how they can be measured, which problems they may involve and when they could be put into effect, taking into account data collection etc. [8]. The indicators are divided into financial and non-financial and most relate to collaboration with industry and/or commercialisation. The proposed non-financial indicators also include "visibility," which in turn includes participation in the public debate and lectures for external target groups. The plan involves a first stage in which a financial indicator for knowledge dissemination (that measures the economic value of collaboration agreements) is introduced in 2008. The process will be gradually expanded [26].

A brand new report from the EU Commission reviews projects aimed at increasing young people's interest in natural science and technology (so-called science mentoring and science ambassador schemes) [9]. The report points out that this is part of the EU Lisbon Agenda as an important aspect of ensuring an adequate supply of competent scientists in the future. In the report, direct contact between children/young people and "real" scientists is one of the fundamental criteria. One of the report's conclusions is that it is important for scientists who act as mentors, ambassadors and leaders in such programmes to be recognised and rewarded for their efforts.

Societal engagement also includes communicating with new students and providing information to potential students. In this context, a report from the US Institute of Higher Education Policy, (IHEP), on the increasingly popular ranking system is of interest [10]. The authors of the report believe that a university's ranking has an impact on the ability of graduates to get a job and on their potential average salary etc. The results show that ranking systems vary greatly and that quality is defined in entirely different ways by different people and players. The authors therefore believe that it would be better to create a uniform model or perhaps even a model where the user – the student applicant – defines what "quality" is and which criteria are the most important. They can then compare the universities based on these choices.

Also in Australia, attention has been drawn to the ranking system, in particular the need for a common approach to rewarding high quality teaching. The Australian Government initiated a project to identify indicators to measure the quality of teaching at universities. The project is being carried out at the Carrick Institute for Learning and Teaching in Higher Education and is expected to continue for 3–4 years [20].

A Belgian scientist has proposed a *Science Communication Escalator, (SCE),* as a way of grading and evaluating communication [11]. The steps are based on a model for risk management called the Risk Management Escalator that is used, among other things, for pension planning and within the US Homeland Security programme [12]. The model's premise is that there are different types of knowledge and they require different types of communication. The lowest and simplest level on the Communication Escalator is Public Understanding of Science, (PUS), which means one-way information, books, articles etc. The next step is Public Awareness of Science, (PAS), which involves a more interactive form of communication, e.g. science fairs, science cafés etc. Step three is called Public Engagement of Science, (PES), which refers to processes that involve consulting the public – e.g. a citizen's jury or focus group activities. The highest level on the Escalator is Public Participation in Science, (PPS), which means processes where science alone

[2] The system is a result of the work of the Danish Goverment's Globalisation Council (www.globalisering.dk). The government's globalisation strategy (adopted on 20 April 2006) states, among other things, that the allocation of basic funding of the universities should be based on quality.

does not have all the answers, but where ethical, moral and financial aspects need to be included in the equation and where the public participates in this discussion. One example is consensus conferences and here Denmark is a pioneer. Based on these levels in scientific communication, it should be possible to evaluate activities and to weight them in different ways.

At a workshop held in March 2007 with a group of representatives from the Belgian universities, set up at the request of the Flemish Government, the universities' science communication efforts were discussed [27]. The participants agreed that while clear directives and work descriptions exist for the universities' other two missions – research and education – there were no such clear directives for engagement with society. This is the case despite the fact that both the Belgian Government and the EU want to encourage the dissemination of science and research results. They identified three steps towards a merit system: increasing awareness of the importance of science communication, creating tools for researchers, and forming rewards. According to the participants, it is possible to increase awareness by incorporating an obligation to communicate research results in the academic structures. At the University of Antwerp a method is already being used whereby research communication is one of three criteria that are taken into consideration when positions are to be filled. For step 2 a database was identified and for step 3 different types of rewards were discussed, such as financial incentives, public recognition and awards. The group is at present working on a definition and description of science communication to be presented to Belgium's Minister of Science.

2.2 What is the situation in Sweden?

Engagement efforts are included in the guidelines for filling positions and is referred to in professorship profiles and other vacant position announcements at several Swedish universities and university colleges. It is unclear exactly how much weight is actually placed on these factors compared to the applicant's other merits. The impression given by both policy documents and the profiles is that the wording is vaguer when it comes to societal engagement compared to other merits, which may result in much being left to individual discretion when such merits are being judged.

The Karolinska Institute (KI) was, to the best of our knowledge, the first to include engagement as an item in its so-called qualification portfolios. Other universities have followed suit and several of them have policy documents, web information for applicants etc. that strongly resemble KI's portfolio model. In some places similar models are currently being developed.

Engagement activities is included in the assessment of both pedagogical and scientific expertise when teaching positions are to be filled at KI, i.e. in the pedagogical and the scientific "portfolios." The documentation required is information on the target group, scope, who assigned the activity, the date and the degree of "autonomy in planning and implementation." Activities relevant to the pedagogical portfolio could, for example, include providing written or oral information for the purpose of disseminating knowledge of pedagogical development work in society. In the scientific portfolio, examples would more likely be cooperation with industry, government agencies and patient associations, as well as contacts with the media [21]. Engagement is also included in policy documents for the appointment of docents[3] at KI in which qualification requirements are outlined, although here the requirements are less precise.

The guidelines for engagement merit rating differ among the universities that use this as a criterion. Cooperation with industry is always included, while guidelines regarding engagement activities aimed at society at large are often more vaguely formulated; they are more an expression of a desire and are sometimes not included at all.

[3] Academic title. To be approved as a docent, a PhD or equivalent is required as well as scientific and pedagogic skills. A docent has a higher scientific competence than a PhD.

The Swedish National Agency for Higher Education (Högskoleverket, HSV) in 2007 conducted a survey of the efforts and initiatives of institutions of higher education with respect to the societal engagement mission. The universities were asked to answer a series of questions based on an earlier review conducted by HSV in 2004 [13, 14]. The questions addressed areas such as merit rating, cooperation between universities, academic integrity, the role of the library, impact on political decisions and which indicators the universities themselves want to emphasise. The results of the study are expected to be published in spring 2008.

One important aspect of engagement is that it is significant in helping students enter the job market after graduating. Interaction for this purpose could include thesis work, projects, career days, guest speakers etc. In spring 2007 the Confederation of Swedish Enterprise (Svenskt Näringsliv) ranked a number of Swedish university programmes with regards to cooperation with industry and found that there are major differences in the level of interaction, both between various programmes and different universities [15].

The three forms of interaction graded in the Confederation's ranking were practical training, company sponsorship and project/thesis work. A category "other" included activities such as career days and business incubators. In each category, the programme's efforts were ranked based on the number of accessible forms of cooperation, the number of students involved in them, their duration and to what extent the university was involved. The ranking was entirely quantitative, i.e. it focused on how *much* interaction took place. Quality was not assessed.

The Swedish Foundation for Strategic Research (Stiftelsen Strategisk Forskning, SSF) decided in April 2007 to grant funds for exchanges between academia and industry by enabling a university researcher to work as a guest researcher for a period of time in industry, or for a researcher in industry take a guest position at a university [16, 17]. The purpose of the programme is to increase the mobility of people between academia and industry and thereby increase knowledge and awareness of the different conditions prevailing in both of these "worlds." Mobility is limited today and according to SSF this is partly due to differences in opinions as to what is considered worthy of merit. Increased mobility between sectors is important in the promotion of Sweden's and Europe's scientific "excellence," capacity for innovation and competitiveness.

More initiatives are needed for measuring and rewarding societal engagement – both at the university level and for individual scientists. Good efforts are being made in many places, but cultures cannot be changed without strong signals. Through a clear and evidence-based system for measurement and rating, attitudes to the engagement mission can be changed. Sweden can, over time, strengthen its position as a knowledge nation and R&D intensive companies can improve their competitiveness.

A complete list of references can be found at the end of this document. Additional information about the various sources and initiatives can be obtained from VA.

3. Engagement indicators

We can divide societal engagement into three general categories of possible criteria/indicators: one that measures activities aimed at the *public*, one that measures interaction with *users* of research results etc and one that measures engagement with *schools*. A fourth possible indicator is revenue from sales to both the public and users.

3.1 The public as a target group

The public as a target group can be reached partly through popular science articles or books and the media, and partly through various events where scientists meet the public and dialogue between them occurs. Communication can also take place in the "virtual world" through blogs, chat forums etc.

These types of activities can be measured fairly easily by being documented in the same systems as scientific publications. It may be difficult, however, both to ensure the quality of the documentation of participation in events with and for the general public and to fix boundaries when it comes to exposure in the media. What types of events and media exposure should be counted?

3.2 Users as a target group

Activities aimed at the user target group involve innovations, start-up companies and various types of conferences and projects or assignments for and in cooperation with the users of the research results. The first two activities may appear easy to measure, but there are issues. Patents are not necessarily a measure of quality since it is not possible to know whether or not a patent will ever be used. It would be better, according to the Norwegian commission of inquiry, to count licensing agreements, since they take into account actual demand for the knowledge in question. Royalty revenues are another step towards the required knowledge actually being rewarded. Regulations vary between countries, influencing how this can be measured. In Sweden researchers own their innovations, and therefore they usually have no obligation to report licensing agreements to the university.

Start-up companies are easy to count and "prove" since they are registered with the Patent and Registration Office (PRV) or an equivalent body. The Norwegian study points out, however, that sole proprietorships should be excluded because this model would tend to encourage scientists or researchers to start one-man businesses that do not actually do anything. Another model is to only count companies with a certain turnover, although this would probably be much more complicated from an administrative point of view.

Activities aimed at the user target group include participation in conferences aimed at various categories of customers, commissioned research, collaborative projects with industry or other users, and industry PhD students. Commissions and various types of collaboration can be documented through signed agreements. Collaborative projects may, however, vary greatly in nature and quality assurance should be discussed further. Conference participation can be documented in the same way as described above, but the same problems exist when it comes to quality assurance as with participation in other kinds of events.

Another model for engagement with users is for scientists to spend time in industry or for employees of non-academic organisations to teach or do research at universities. In the British SPRU report the authors point out that such exchanges are a sign of a high degree of engagement and collaboration between academia and organisations outside the academic world, and are therefore a good indicator. Drawing the line with respect to the minimum length of a guest posting may be problematic, as might the quality aspect. Work carried out within a scientist's own company should, for example, not qualify for merit.

3.3 Engagement with schools

Collaborative projects with schools and producing teaching materials for schools fall outside both of the categories described above – or they could be included in both. Cooperation projects can take different forms and it is therefore not always easy to find a way to ensure quality and document them so that they can be included as engagement indicators. Projects that are clearly a one-time event should be excluded to avoid an overabundance of field trips and similar one-time events being arranged merely to "earn points." On the other hand, participation in long-term projects that aim to increase interest among children and young people in knowledge and science should absolutely be encouraged.[4] Scientists that agree to act as mentors or leaders for such projects should be given points for this. Projects can be documented in the form of agreements that clearly outline timeframes and who is responsible.

It should be possible to document teaching materials in the same way as other written works. Again, the issue of quality assurance needs to be discussed in more detail.

3.4 Turnover/revenues

A pure financial indicator measures primarily user-focused engagement through revenues generated by patents, licensing agreements and royalties. Some public-targeted engagement can also be measured using a financial indicator.

Universities may have revenues in the form of payments for services provided (e.g. surveys, calibration, taking specimens), for commissioned education or research, for the sale of publications or for arranging conferences, etc.

The advantage of a financial indicator is that it is relatively easy to produce from the university's existing financial system. One drawback is that all of the important outreach activities that take place free of charge are not rewarded at all.

[4] Examples of such projects in Sweden are given in reference 18.

4. Documenting and weighting

The additional documentation requirements will involve some extra work for the universities. For this reason, as much documentation as possible should be kept within existing systems which would then only need to be expanded to include new types of publications, activities etc. Weighting between the different indicators and between parameters (activities or other types of contributions) within each indicator can be a more difficult issue. These issues are discussed in more detail below.

4.1 Documenting

Assuming that publications, collaborative projects, licensing agreements, industry PhD students etc. can be documented in a satisfactory and reliable way, the number of such parameters is a good basis for measurement. The universities often have some type of system for assembling documentation on publications. They need this, if nothing else, for the preparation of annual reports etc.

Most universities have some form of database system for documenting publications [22]. Some use them for internal resource allocation. Some have purchased the same database system, while others have developed their own. A process is under way to coordinate all databases of the Swedish universities, to make it possible for researchers and others to search through all Swedish scientific publications. In spring 2007 the National Library of Sweden's National Co-operation Department provided funding for this type of coordination [23].

It should be possible to include the most important engagement activities in these databases. Most of them register popular science as a certain publication category in their databases, but not all of them use it. Patents are also often registered. As a rule the databases focus on published works, which means that lectures, events, project agreements etc. are rarely included. Minor modifications may therefore be needed to enable new categories of publications to be registered.

Registering activities that have not been registered previously adds to a university's administrative burden, but the workload should be relatively limited as long as it relates to popular science publications, partnership agreements etc. The workload will increase if participation in conferences, science fairs, TV/radio reports etc. are also to be registered, because an evaluation needs to be made of scope and quality in order to assess whether the activity should be counted or not.

The documentation of financial income already takes place within existing accounting systems. However, some extra work will be needed to produce the relevant figures and register them in the indicator system.

4.2 Weighting

Different activities have different effects when it comes to things like how many people will be reached, how effective the communication will be and how long the impact will last on the target group. Also, different activities involve different amounts of work on the part of the scientists. Hence, it is necessary to weight the different interaction activities when they are combined into measurement data/indicators. Since the long-term effects are almost impossible to assess, there are two main principles for weighting:

1. Dissemination, i.e. how many are reached by the activity
2. How much time is spent by the scientists on participating in the activity (or how much in term of resources does the university need to invest in the activity)

Other considerations can also be taken into account, such as a desire to encourage cooperation between universities or to single out and reward activities that result in direct contact with the target group (as opposed to one-way communication in the form of books and articles). Each time weighting is done it adds complexity to the system and it is therefore necessary to carefully consider which type of weighting is reasonable.

The Norwegian committee chooses the number of hours of work as the determining parameter in weighting different activities/contributions within one and the same indicator. This means, for example, that an article is given less weight than a book, and an in-depth popular science essay in a professional journal is given more weight than a newspaper article, chronicle or similar material. In the same way, the study points out that licensing agreements and start-ups require much more effort than, for example, student projects within the same indicator, and that these should be given significantly more weight [4].

Weighting the different indicators was not part of the Norwegian study's assignment. In spite of this, the authors write that through the way they have structured the indicators, the innovation, customer-focused communication and publication indicators are given extra weight. They also believe that the demands should be higher with respect to documentation and evidence for these indicators than for indicators that cover media and direct communication with the public. The latter gives less weight per contribution, but does not have the same requirements with respect to evidence and documentation. The committee also points out, that user-focused interaction in particular is given great weight. This also has an impact on the pure financial indicators, i.e. revenues from the sale of services, books etc. In the report from the Danish team [8] the emphasis is also placed on users and commercialisation. Weighting does not, however, seem to be dealt with by the Danish team. The report does however mention that since patenting often involves high cost, weighting of revenues from patents and licenses must be balanced so as not to have a detrimental impact on the national economy.

We suggest a similar weighting as in the Norwegian proposal between parameters (i.e. different activities or other contributions) and indicators. Below we discuss in more detail measurement, documentation and weighting for each considered indicator and parameter.

4.3 Measuring engagement with the public as a target group

a. Publications, mass media, one-way communication

- Popular science articles (including Web publications)
- Popular science books
- Research publications in (scientific) open-access journals, i.e. fully open to the public and users
- Debate articles, chronicles, feature articles etc. in daily newspapers
- Participation in popular science TV and radio programmes, including those streamed on the Web
- Participation in the production of museum exhibitions
- Participation in Expertanswer (Expertsvar)
- University websites
- Individual websites

Comments and discussion:

Written articles etc. should be published and assessed for quality by an independent editor outside the university's own organisation.

Electronic articles should be treated, for example, as printed works, i.e. they should be published by independent editors (outside the university).

Articles, books etc. can be documented by the university in the same way as scientific articles and are already included in many of the existing database systems. The Danish review of possible indicators (2007) suggests using commercial media monitoring services, such as Cision[5], for the documentation of articles and books [8]. Perhaps this could also be done in Sweden, particularly for the type of media participation that cannot be easily included in university databases – e.g. radio and TV.

Articles in daily newspapers could be handled differently depending on the type of article. The Norwegian study suggests that pure debate articles be excluded and that only the more thematic and factual articles [4] be included. Swedish examples include essays in Dagens Nyheter's cultural section or feature articles in Svenska Dagbladet[6]. Since it is important for scientists to participate in public debate, we believe that it is a mistake to exclude debate articles in the daily press and we propose that these be included.

An interesting question is how articles with *several authors* should be handled. Should each author receive points, or should each article be given points which will then be shared among the authors? A similar question arises when several universities collaborate in the publication of an article. Our suggestion is for each author to receive points for the article, without weighting for the number of authors, in order to reduce the administrative burden. In this way, collaboration between scientists and between universities will be rewarded, which may be a positive thing in itself.

TV and radio appearances. It is not clear how the quality of this type of mass media participation can be assured and how it should be weighted. It could range from a brief comment in a news broadcast to a lengthy appearance on a science programme – each requiring different amounts of effort by the scientist in question.

We suggest that a mere mention or an isolated statement in a newspaper article or on the TV/radio, i.e. a scientist commenting on a current event, should not be included. It would be difficult from a pure administrative point of view to process all of these types of media participation and it may also be unfair because often "celebrity scientists" are the ones asked to speak. Another argument for excluding these types of statements is that provocative or even erroneous statements and comments on exposed "business" (e.g. fraud or academic conflicts) tend to attract a lot of coverage, which would give a disproportionate result in a merit system.

Articles and features are documented in media archives etc. Documenting them within university publication databases involves extra work for the universities and a new database registering category is needed for this type of media participation. One alternative of interest, as mentioned above, is to use commercial media monitoring services.

Museums sometimes enlist the help of scientists to prepare exhibitions. Participation in this kind of work could be documented through partnership agreements between the museum and the university, but must be registered, for example, in the above-mentioned database system to be counted in an interaction indicator. Such registration involves extra work for the university and they fall into a different category to published works. One model is to log them with other types of activities and collaborative projects, see below.

University websites vary significantly in terms of quality and are therefore difficult to manage in a system such as this. It may, however, be worth encouraging an improvement in services and information on university websites because they reach a wide audience and have the potential to make a significant contribution in educating people. It is, however, difficult to evaluate and to measure quality and important initiatives in this area. Our proposal is therefore not to include websites in the indicator system at this time. This is in line with the proposal of the Norwegian

[5] www.cision.com
[6] Dagens Nyheter and Svenska Dagbladet are the two major Swedish daily newspapers.

study. The same reasoning can be used regarding the websites of individual scientists, and we therefore offer the same recommendation for these sites.

Open access, i.e. making articles and reports freely available in electronic formats, is a hot topic within the academic world today. Up to now, mainly scientific publications aimed at an academic readership – and not at the general public – are being made available in this way. These works are counted elsewhere in the university funding system and should not therefore be counted as an engagement activity. On the other hand, open access-published articles have the potential to reach a wide audience, which is worth encouraging. But as long as the process of developing open access is under way, we suggest postponing the evaluation of these types of publications.

Expertsvar (Expertanswer) is a Swedish service for journalists that want to make contact with scientists[7]. When a request is received by Expertsvar, information officers at the universities search for one or more suitable scientists at their particular university and send their contact details to the journalist who then contacts the scientist or scientists directly. Whether or not they actually come into contact or whether this contact results in an article or media appearance in the end is not registered (although these articles/appearances are of course registered in another way when they are published/broadcast). Therefore we suggest that participation in Expertsvar not be included among the indicators for engagement.

B. Activities that involve direct contact and make dialogue possible

- Open house events at universities/colleges lasting one or several days
- Open lectures
- Participation in activities where dialogue and/or hands-on experiences take place, e.g. science cafés, science festivals etc.
- Scientists engaging in blogging
- Participation in chat and discussion forums on the Web

It should be possible to document *activities involving dialogue with the public* (lectures, discussions, other activities) in publication databases in the same way as published papers. Here the problem is quality assurance and weighting. Should, for example, participation in the university's own open house days be weighted differently to participation in events organised by external players (e.g. the International Science Festival, Researchers' Night, Science Café etc.)? Our suggestion is for open houses organised by the universities themselves to be counted as a single activity for which the university is given credit and that the individual scientists that participate be rewarded in the same way as for participation in another activity. Open houses at universities, regardless of the target group, usually only mainly reach interested members of the public and not the public at large, at which external events in general are targeted. Therefore a lower weighting would be preferable, although this may be difficult to implement from an administrative point of view.

Participation by scientists in *chat forums, blogs* etc. is a way to achieve dialogue with the general public and is also a model that suits young people, which should be encouraged. Online chat rooms are being set up by TV news programmes, daily newspapers, children's TV programmes and various interest groups. LunarStorm[8] offers opportunities for chatting with various types of people. It is becoming more and more common for scientists, university rectors etc. to have their own blogs, which is also a way to open up the academic world to a wider audience and to enable people to ask questions directly. However, quality assurance of these types of activities is a problem and for this reason, there may be some doubt as to whether they should be included as indicators of engagement. If included, this activity should be possible to document in the same way as published papers in a database and should have its own heading/category.

[7] www.expertsvar.se. A similar service on the European level is offered by Alpha Galileo www.alphagalileo.org
[8] LunarStorm is a "community," i.e. a virtual meeting place, for young people on the Web www.lunarstorm.se

4.4 Measuring engagement with users as the target group

a. Innovation and industry cooperation

- Start-up companies, spin-offs
- Patents, licensing agreements
- Commissioned research, commissioned education
- Collaborative projects involving industry and universities
- Student projects in cooperation with industry, industry PhD students

b. Activities with players who use/convert research results

- Participation in activities aimed at users of research results (e.g. companies or other organisations); lectures, items on the agenda at professional conferences etc.
- Guest positions for scientists in other sectors of society

Comments and discussion:

Patents are, of course, a measure of innovation at universities. Their use as indicators can, however, be called into question, partly because "bad" innovations may also be patented and partly because patents are not always used or may even hinder further development. The British SPRU report also points out that another drawback with patents is that we do not know if they will have any economic or social value [1]. Also, universities may be tempted to file more patents than appropriate from a commercial point of view. The Norwegian committee suggests for similar reasons that patents should not be used as indicators [4]. Furthermore, the Danish review states that the patent processes involve considerable cost for the university and thus for society, and supporting such processes therefore runs the risk of having a detrimental impact on the national economy [8].

Patents can, on the other hand, be easily documented in the same publication database systems as other written works. For instance, in the database used by Uppsala University patents are already being registered, which means no extra work is involved. Patents must also be registered with the Swedish Patent and Registration Office or other patent authority.

Licences would be better indicators since they reflect a demand. But the British report warns that they are entirely market-driven and that different licensing agreements involve entirely different income levels. When counting the number of agreements, no distinction is made at all between a very valuable and a less important innovation. Licensing is documented in the form of written contracts that can probably be documented in databases in the same way as patents, see above.

Royalties are a third way of measuring innovation. More on this in section 4.6 below.

New companies are registered with the Patent and Registration Office or similar authority. Sole proprietorships (e.g. consultants) should, according to the Norwegian study, not be counted to avoid "strategic" start-ups [4]. In Sweden it is entirely possible to have a registered company with several partners (e.g. a general partnership) that has no financial activity. A better model may therefore be to only count limited companies (not sole proprietorships or general partnerships) with more than one employee. Limited companies must also have share capital, which should put them in a better position for having a real turnover. Another possibility is to only count companies that have a turnover above a certain level. This may, however, involve more administrative work. Also, it can often take many years before a new company generates positive results – a fact that is also emphasised in the British SPRU report [1].

Industry participation, commissioned research, commissioned courses etc. are documented through agreements between the parties involved. It may be best to deal with EU financed projects in a particular order. If they are rewarded elsewhere they should not be "counted twice." Likewise, we may question whether participation in collaborative projects of the type that are financed by VINNOVA (Swedish Government Agency for Innovation Systems), for example, should be counted. These have undergone a selection process and the university has been allocated external

funds for the project. Giving the university credit for these projects also because they constitute an engagement with industry means they would be "counted twice". On the other hand, the individual scientist running the project should be recognised for his/her efforts. Recognising this type of engagement may, as the Danish review (2007) also points out, benefit certain areas and certain regions in particular [8].

Guest scientist postings, i.e. scientists spending a certain period of time within industry (or with another organisation), or a researcher from a non-academic organisation teaching or doing research at a university, should be encouraged. These postings can be documented through agreements where the scope and the company's/organisation's and the scientist's names are stated. Only continuous postings lasting more than a few months should be counted and engagement points should only be awarded when the scientist has returned to his original position. If exchange occurs within a programme financed by an external benefactor, the university should not be rewarded twice by receiving points for engagement as well. On the other hand, the individual scientist should be credited for the time spent as a guest researcher.

Industry PhD students are a good way for both companies and academia to make useful contacts and to promote the exchange of knowledge. They should be documented in the form of agreements with the company, indicating that collaboration will continue throughout the PhD study period, the person responsible at the company and the examiner at the university.

Student projects, thesis work etc. are documented in written agreements with the company in question, stating the participating student's name, and that the university, the student and the company have participated throughout the duration of the project. A quality assurance threshold may be set in the form of an assurance that the work must amount to a certain number of university college credits or that the project must be either at the Bachelor's or Master's degree level. The student must also have received at least a passing grade for the university to be allowed to count the project.

Documentation and registration of companies, collaboration projects, student and PhD projects must be prepared by the respective university and this will probably involve extra administrative work.

4.5 Measuring engagement with schools as the target group

- Authoring (or co-authoring) of text books or teaching materials
- Long-term collaborative projects with schools or at the upper secondary level

Teaching materials should be possible to document in the same way as other written works. They should have their own heading/category in the documentation system (database), but when they exist in the system the work involved in registration should not be too substantial. Teaching materials can take different forms: text books, work books, Internet-based services, etc. It is therefore important to discuss further how to handle quality assurance or if there should be limits to the types of teaching materials that can be counted.

Collaborative projects with schools and at the upper secondary level may take different forms and it may therefore be difficult to determine their quality. Projects that are obviously of a one-time nature should be excluded to avoid an overabundance of field trips and similar one-off events being arranged merely to "earn points." On the other hand, participation in long-term cooperation and projects with the aim of increasing interest among children and young people in science should be encouraged. Scientists acting, for example, as mentors or leaders should receive credit for this in the merit rating system.

The project should be documented with some form of agreement, where the timeframe and persons responsible at the university or college and at the school/schools are clearly stated.

4.6 Financial measurement

- The sale of publications, revenues from conference arrangements etc.
- Revenues from commissioned research, commissioned courses, services provided, etc.
- Revenues from licence sales or royalties

Sales revenues are a measure of quality since they are a measure of demand. Producing the figures requires a degree of extra work for the universities, but since they are already in the financial systems that undergo the usual quality-assurance audits, the extra administrative work should be relatively limited.

The Danish review (2007) points out, however, that it may be difficult to draw the line, i.e. to determine within existing accounting systems which revenues are relevant [8].

Sales of publications are a sign of interest from the external environment and may originate from customers as well as the general public. However, close attention should be paid to weighting to avoid the risk of a universities charging for access to research results to a greater extent than necessary. Possible revenues from conferences, e.g. those aimed at particular customer groups, should also be included – these too are a sign of interest and demand. On the other hand, arranging pure scientific conferences should not, of course, be included as an engagement activity, which would cause a problem if the university records the revenues from such events on the same account.

Selling licences and royalty revenues. The British report points out that royalty revenues reflect a real demand and therefore constitute a better indicator than both the number of patents and the number of licences – particularly in the long term since this is likely to be a fairly stable revenue source. But since revenues may differ greatly between different licences, the report states that it may be best to use a *median value* for royalty revenues. This would prevent distorted effects from extreme cases. Royalties are, however, influenced by market conditions in different areas at any given time, which means that temporarily "hot" sectors will have an advantage.

Furthermore, the Danish review states that patents may involve high costs for the universities (and for society). It is therefore important to create a balance so that innovation indicators do not have a detrimental impact on the national economy.

5. Recommendations

Appropriate indicators for the universities as a basis for resource allocation are somewhat different from the indicators that should apply at the individual level, i.e. for the individual scientist's merit rating. Vetenskap & Allmänhet proposes indicators at both of these levels, as listed below.

5.1 Indicators at the university level (Resources Inquiry)

Our suggestion is to introduce four indicators at the university level, each consisting of a number of different parameters in order to achieve a system where diversity in engagement activities is rewarded and to avoid bias towards a one-sided concentration on, for example, commercialisation. Each parameter would be given points and weighted according to clear principles. The points would then be added to arrive at a sum for each of the four indicators. Weighting is a difficult issue and further preparation work would therefore be needed.

Within each of the four indicators the university would receive a total number of points. The points system should naturally be constructed in such a way that it fits into the resource allocation system as a whole.

I. Public engagement

Within this indicator we suggest including the following parameters:

a. Open houses at universities, i.e. major events aimed at the general public
b. Open lectures (not linked to major events at the university)
c. Popular science books and articles
d. Participation in events that provide a forum for dialogue with the public
e. Participation in the production of museum exhibitions
f. Participation in TV/radio/newspaper reports – excluding isolated statements
g. Scientists engaging in blogging, scientists taking part in chat forums etc.

VA suggests giving every parameter the same weight. If authors from several universities have worked together on a book or an article, each university should be given points for the publication to minimise administrative work. Books could possibly be given more weight than other parameters taking into account the amount of work involved. It should also be noted that the amount of work involved in a publication/lecture or similar is significantly less than, for example, starting a company, and these should clearly be given less weight than the user oriented indicators below.

II. Engagement with industry and other users of research

Within this indicator we suggest including the following parameters:

a. Licensing agreements or patents
b. Start-up companies (spin-offs) with more than one employee
c. Collaborative projects with industry/customers
d. Industry PhD student agreements (each PhD student can only be counted once)
e. Thesis/project work within industry
f. Participation in conferences aimed at customers
g. Individuals from non-academic organisations being guests at universities as teachers/researchers for a prolonged, continuous period
h. Scientists working as guest scientists in a non-academic organisation for a prolonged, continuous period and then returning to their university

VA suggests that parameters e, g and h should be given less weight than a–d, and parameter f should be given even less weight. These parameters should all, however, with the exception of f, which can be compared to participation in conferences or lectures aimed at the public, be given more weight than the public parameters above.

III. Engagement with schools

Within this indicator we suggest including the following parameters:

a. Authoring (or co-authoring) teaching materials
b. Long-term collaborative projects with schools or at the upper secondary level

Here, all types of teaching materials or projects should be given the same weight.

IV. Revenues

Within this indicator we suggest including the following:

a. Revenues from the sale of publications, conference arrangements, etc.
b. Revenues from commissioned research, commissioned courses, services, etc.
c. The sale of licences and possibly royalty revenues

The revenues are added to arrive at a figure that can be used as an indicator.

5.2 Indicators at the individual level (Academic Career Inquiry)

Our proposal is to introduce two engagement indicators for individual scientists. Each indicator consists of a number of different parameters, in order to achieve a system where diversity in engagement activities is rewarded and to avoid bias towards a one-sided concentration on, for example, commercialisation. The idea is that each parameter is given points and weighted according to clear principles. The points are then added to arrive at a sum for each of the indicators.

Within the two indicators the scientists can receive a total number of points or credits. This system should of course be constructed in a way that fits into the merit rating system as a whole.

I. Public engagement

Within this indication we suggest including the following parameters:

a. Popular science books/articles
b. Open lectures
c. Participation in events that provide a forum for dialogue with the public
d. Participation in the production of museum exhibitions
e. Participation in TV, radio and newspaper reports
f. Blogs, participation in chat forums, etc.
g. Authoring (or helping to produce) teaching materials for schools

VA suggests weighting parameters a and g somewhat higher than b, c and d, which in turn are weighted higher than e. Currently it is difficult to ensure the quality of electronic communication, parameter f, but if this is included in the indicator, a scientist's own blog should be weighted about the same as b and c. Participation in chat forums should be given the same weight as participation in the mass media (e).

If scientists have co-authored an article, book or teaching materials, each scientist is given the same number of points to minimise administration.

II. Engagement with industry and other users of research

Within this indicator we suggest including the following parameters:

a. Patents
b. Licensing agreements
c. Responsibility for collaborative projects with industry/users
d. Academic advisor/examiner for industry PhDs (documented by signed agreements clearly indicating names; each PhD can only be counted once)
e. Participation in conferences aimed at customers
f. Participation as a mentor, "ambassador" or leader in a (long-term) project aimed at stimulating interest among young people in science
g. Completed guest posting in a non-academic organisation lasting at least four months

VA suggests giving parameters a–d, f and g the same weight. Participation in conferences should clearly be given less weight.

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