Research-Funding and Quality Systems

An international knowledge overview

SUHF
Sveriges universitets- & högskoleförbund

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Foreword

This knowledge overview was initiated by the expert group on quality in the Association of Swedish Higher Education (SUHF). The group comprises Anders Söderholm (Chair, Mid Sweden University), Johan Alvfors (Swedish National Union of Students, SFS), Erik Arroy (formerly at SFS), Bengt-Ove Boström (University of Gothenburg), Ingrid Elam (University of Gothenburg), Marianne Granfelt (SUHF), Stephen Hwang (Linnaeus University), Kristina Josefsson (Malmö University), Anders Malmberg (Uppsala University), Fredrik Oldsjö (Stockholm University), Karin Röding (Mälardalen University) and Kent Waltersson (Linköping University).

The background to this overview is the discussion, in Sweden in recent years, concerning current systems for allocating research funds. This discussion gained even greater prominence when the Swedish Government commissioned the Swedish Research Council (Vetenskapsrådet, VR) to draft a proposal for a new system including peer review. To assist SUHF, universities and other higher education institutions (HEIs) and also, it was hoped, the Swedish Government to form an opinion on VR's proposal, the expert group considered that more knowledge of various national funding models, experience from using them and the changes to which these models had given rise, was necessary.

In the main, this report was drawn up by a small subgroup of the expert group comprising Stephen Hwang (convener and principal author of the report) and Anders Malmberg, assisted by Ulf Heyman in particular. The content was then circulated among group members and revised by the whole expert group into its present form. In addition, factual scrutiny was carried out by Ulf Heyman and Mats Benner. Interim results have been presented on various occasions, such as SUHF's dialogue seminar with research funders in January 2014 and SUHF's General Assembly in April 2014. The report and its main conclusions were briefly presented at SUHF's General Assembly in October 2015. Representatives of HEIs and research funders in the Netherlands were interviewed to boost knowledge of this country's system and experience. Private discussions with representatives of universities in other countries have also contributed to this report.

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1. Summary

This knowledge overview was initiated by the expert group on quality in the Association of Swedish Higher Education (SUHF) to boost knowledge of various national research-funding models and experience of these models. Sweden has a history of success in higher education and research. This country also has world-leading knowledge-intensive enterprises that depend both on highly educated employees and on extensive collaboration with the world of research. Over the past 20 years, Sweden's strong position in research has weakened in relation to certain other countries. In this country there has been a smaller increase in research with a strong international impact than in, for example, the Netherlands, Switzerland and Denmark.

In this overview, we present various countries' research policies and models for allocating research funds. We also attempt a brief account of the state of knowledge associated with these policies and models.

The overview starts by assessing, in an international perspective, Swedish research policy in the past 20 years (a broad summary may be found in Appendix 1). Öquist and Benner [2012] consider that Swedish research policy has been characterised by major changes. Its focus has been poor and new functions have been progressively laid on the HEIs.

Swedish HEIs have a complex reality to navigate. External research funders abound, which means that HEIs are confronted by numerous different, and sometimes irreconcilable, agendas and priorities. Moreover, governments have pursued a policy in which they have chosen to see the whole higher education (HE) sector as uniform, i.e. all HEIs as having formally the same remits in education and research. Both for universities and for other HEIs, this lack of clarity creates problems in terms of being able to 'understand' their own role in the national system. This makes it more difficult to give each HEI a distinctive profile.

In our overview, we shall see examples of what appears to be a considerably closer relationship between government and HE sector. Denmark and the Netherlands apply a type of "contract" between the HEIs and the government that clarifies the HEI's role. Several other countries do the same. Table 4 in the report on the *Designing Strategies for Efficient Funding of Higher Education in Europe* (DEFINE) project issued by the European University Association (EUA) [Pruvot 2015, p. 35] gives 14 different examples of European countries and German federal states where 'contracts' being used. A 'contract' of this kind can certainly entail stronger political governance and involvement, but the picture we get is that, in practice, the contracts are characterised by the two sides' mutual respect for each other's roles and avoidance of unnecessary control. We believe that trying this type of contract out in Sweden could be advantageous. It might generate a profiling of the HE landscape that would be desirable and positive.

To a high degree, Swedish HEIs are dependent on external funding. The fact that such a large share of the funding is external means that there is limited scope for management at various levels in the HEIs to act independently from the priorities set by the funders. Long-termism suffers from this and so, accordingly, does risk propensity, a key component of the 'living space' of research. Swedish research policy has also been founded on the conceptual model assuming that the more the HEIs compete for research funds the better it is, and that ability to attract external funding is a measure of success. This is shown not least by the allocation model applied for direct government grants (appropriations), where external funds are one of the indicators. Our overview seems to suggest that this conceptual model is not supported by the evidence in other countries.

The external research funders have been an important element in Swedish governments' allocation of research funds, since strategic initiatives have been channelled through these funders. Interestingly, HEIs in successful research nations like Switzerland, the Netherlands and Denmark depend considerably less than Sweden on external funding: there, direct grants to the HEIs account for some 70% of the total, against the Swedish share of less than 50%. There are also results, presented in this overview, suggesting that countries where there is less dependence on external funding are generally more successful. We therefore believe that less focus and dependence on external funding than at present would favour Swedish HEIs' long-term quality development.

Another observation is that the external research funders in Sweden do not coordinate their priorities, which results in fragmentation or overlapping of different

strategies and initiatives. This lack of structure becomes even more obvious if Sweden is compared with some other successful countries, such as the Netherlands, which has a strong stakeholder that both coordinates strategic initiatives and runs its own research institutes. Our conclusion is that it is worth discussing anew the need for stronger coordination and possible mergers of state research agencies — an issue last explored in 2008 [Sandström 2008].

Swedish HEIs have been subjected to a strong reform policy over the past 20 years. Other countries have also carried out major changes. The Netherlands seems to have undergone changes on at least an equal scale, but appears to have used the reform to achieve beneficial development of the country's research. Denmark, too, has implemented major, sweeping changes that also appear to have resulted in favourable development. From this it may be concluded that reforms, if well considered, can be beneficial. What distinguishes the Netherlands and Denmark from Sweden in this particular respect is that the changes in Sweden have not yielded the same long-term prospects. The trend towards greater influence of external funders and strategic initiatives, which have often been more in the nature of short-term measures, has not given Swedish HEIs the strategic room for manoeuvre they have needed.

Another observation made is that from comparisons with the Netherlands, Switzerland, Denmark and the UK, for example, these countries' political governance of HEIs appears relatively weak compared with Sweden's. In the UK, HEIs' freedom from direct political control is guaranteed by the fact that state research funds are channelled to the HEIs through an intermediary. In the case of the Netherlands, the differences lie not in the formal sphere but, rather, in how policy is implemented. If the Netherlands' research policy, expressed in aims and ambitions, is compared with those expressed in Sweden's government research bills, the differences between the two countries do not seem particularly large. On the other hand, Sweden and the Netherlands differ substantially in terms of policy implementation. Thus, in both the UK and the Netherlands politicians exhibit growing confidence in the sector. In each of these countries, the quality system introduced seems to have been an important means of obtaining trust in the policy. In our view, a similar trend would be beneficial for Sweden as well.

Chapter 4 of the overview describes different countries' systems for allocating research funds among HEIs according to performance and quality. We find that there are slightly more countries that use funding allocation based on indicators, rather than peer review. Moreover, only UK and Hong Kong appear to have allo-

cation of research funds as the primary purpose of peer review [VR 2014]. In Australia, for example, only a small proportion of research funds are allocated through peer review, and its primary purpose is to achieve higher quality. In Spain, peer review is at individual level and voluntary, enabling researchers to obtain higher salaries.

We describe some research on, and experience of, various systems. Indicators are easy to use, but hardly capture more than part of what characterises quality in research. Peer review also has many shortcomings and there is plausible reason to think that, at national level, it does not afford adequate precision to be a basis for allocating funds. We report research results that support this conclusion.

Although research seems to question peer review at national level, the Research Excellence Framework (REF) system affords considerable legitimacy in the British HE sector. In addition, the Government has confidence that the system will develop research in the UK in the desired direction. These two aspects are crucial for the legitimacy and continued use of the system, despite heavy costs to the research community.

In our discussion of allocation models for research funds, our view is that the overarching purpose should be to develop Swedish research in the direction of higher quality and greater relevance — that is, to be forward-looking. Discussing various models in this light is therefore most relevant. We highlight the fact that there are research results indicating that the channel in which a publication is published, measured by the journal's impact factor, i.e. its rank in terms of numbers of citations, gives the most reliable forecast of the publication's quality, and is superior to peer review or citations.

The implication of this result is that a system based on the ranking of publishing channels brings about favourable development. Systems based on this principle are used in Norway, Denmark and Finland. The Netherlands, too, has developed a system of this kind for use as a quality measure in its national postgraduate programmes. The advantage of the system, besides its possible forecasting capacity, is that it is also clear and has considerable potential influence on researchers. Since the publishing channels regarded as the most distinguished are known, it provides a clear incentive for researchers to use the best channels. Other positive features of the system are that it is applicable to all disciplines and cost-effective.

Analysis of the system in Norway reveals its success in enhancing both quantity and quality, in terms of the number of points. On the other hand, the system is less successful in boosting the number of highly cited articles. The fractional

counting of authors also seems to have negative effects that work against certain disciplines. The conclusion on the Norwegian system is that it can be made even more successful through, for example, introduction of more levels and improved balance in the point-setting to take the effects of fractionalisation into account. In our view, an improved system of this kind would be interesting to study further.

The associations pointed out by Ulf, which we discuss in detail in one chapter, are interesting and perhaps somewhat surprising. First, there is an association between the amount of research funds and the number of citations. Variation in the latter, both among different countries and from one year to the next in Sweden, can be explained largely by corresponding variation in the quantity of research funding. Thus, the simplest way of increasing a country's citations is to increase the research funds.

The second association, which is one of the second order, relates to the variations in citations over and above the impact of changes in research funding. Here, there appears to be a connection between a country's basic resource provision (resource base) for research, i.e. the proportion of research funds going directly to the HEIs, and how successful the country is in terms of citations. Switzerland, the Netherlands and Denmark are examples of countries that are successful and have a high proportion of funds in their resource base: roughly 70%. The UK, on the other hand, is not particularly successful in Heyman's analysis. Nor is a particularly high proportion of British research funding in the form of a resource base; rather, this is on a par with the share in Sweden.

In this overview, we argue that the effect shown by Heyman is due not only to the extent of this resource base. Other factors are also significant in the context and co-vary with the size of resource base. One factor of this kind is that successful countries like the USA, Switzerland, the Netherlands and Denmark have a strong quality culture and that this is one of the keys to their success. We therefore believe that an increase in the volume of the resource base should be combined with strengthening of the quality culture to bring about a rise in research quality and effectiveness.

Heyman's analysis does not indicate that peer review for allocating research funds is a success factor. None of the three successful countries the Netherlands, Switzerland or Denmark use peer review to allocate funding. The UK, which does so, is not particularly successful in Heyman's analysis. As we discuss in the overview, the Netherlands has a national quality system based on peer review but has chosen not to allocate funds on the basis of this assessment.

On the other hand, the national quality system has played a central part in developing the quality culture, and recent analyses show that all the universities and research institutes' publications now have roughly the same impact, and that this has grown since the quality system was introduced. The fact that the two countries that use peer review at individual level, Spain and New Zealand, also do well in Heyman's analysis may indicate that individually based reward systems are strong quality drivers.

For some time, SUHF has worked to bring about freer use of appropriations for education and research in the HEIs, through a block grant for both. The 'research' category includes postgraduate education as well. In recent years, postgraduate education has undergone a relatively large decrease at national level. This is probably due to the HEIs giving higher priority to research at senior than at postgraduate level, in order to boost their performance in terms of publications and external funding. There are weak financial incentives for an HEI to engage in postgraduate education, and at the same time it is very important for the renewed increase in the numbers of researchers and HE teachers, that postgraduate education should not decrease too much.

One way of avoiding this is to introduce a system like that of the Netherlands or Finland, where part of the research funding is allocated on the basis of performance in postgraduate education. As with education at other levels, limits (i.e. caps on maximum remuneration) can be imposed on payment for these performance levels, with the limits varying among the HEIs. The latter would also clarify the division of roles among HEIs.

Greater flexibility in the use of grants for research and education would enhance freedom and reduce inefficiency due to actuarial difficulties. Together, education and research make up a whole that is hard to divide up completely among the current accounting areas. While it is important for each of the two core activities to be fully funded, the HEIs should have the freedom to consider their own activities as a whole, although the grant is calculated on the basis of different activities and results. Today, HEIs in several European countries receive block grants: examples are Norway, Denmark, the Netherlands, the UK, parts of Germany, Switzerland, Spain and Italy. This practice seems to work well without giving rise to weakening of either education or research.

One key conclusion from our knowledge overview is that the Dutch system stands out as exemplary in that the country is both one of the foremost in research nations and has simultaneously developed a strong quality culture. Another mod-

el that Sweden can learn from in some respects is Denmark.

On the basis of the overview, we venture to formulate a few recommendations on research policy. This policy must become clearer, to enable Swedish HEIs to be improved further in three important respects:

Clarify the HEIs' various roles and develop their long-term profiling.

a. The HEIs' roles in the research landscape need clarification. All HEIs should not have the same functions; instead, efforts should be made to give them distinctive profiles. This must be done in close cooperation, and with mutual respect, between the Government and each HEI.

Develop the HEIs' capacity for strategic renewal and prioritisation.

a. The proportion of basic grants for the HEIs' research needs to rise. One benchmark should be that some 65% of total research resources in the sector must consist of block grants.
b. The research-funding landscape needs to be coordinated. Coordination of public research funders in Sweden would have positive effects. It may therefore be worth investigating further how the state research funders can work in a more coordinated way, or alternatively merge to form a single agency.
c. Greater flexibility in the use of basic grants for research and education would enhance freedom and reduce inefficiency due to actuarial difficulties. Together, education and research form a whole that is difficult to divide fully into the present accounting areas. While it is important for each of the two core activities to be fully funded, the HEIs should have the freedom to regard their activities as a whole, even if a block grant is calculated on the basis of different activities and results.

Strengthen the HEIs' quality culture by making them responsible for their own quality development.

a. Put the HEIs themselves in charge of ensuring and developing the quality of their research by means of external peer review. Do not introduce a national mode of resource allocation on the basis of external peer review.
b. Investigate further whether an improved model of publication performance along the lines of the Norwegian or Danish model could be introduced.

2

2. Introduction

Internationally, higher education and research are more in focus than ever before. A country's development and prosperity are bound up with the population's education level and the resources devoted to development, research and innovations in both the private and the public sector. Educational and research initiatives therefore become important tools of development policy.

Western countries' lead in these areas is challenged by countries like China, India and Brazil. The reputation of universities in these countries is growing fast, and the same trend is evident from citation analyses. Correspondingly, leading companies in the West are being challenged by rapidly expanding companies in, for example, Asia, with substantial resources for development and research. For this reason, it is important for every country's government to pursue an ambitious research and education policy to develop the country further, so that it is capable of holding its own as a knowledge nation.

As a result, governments are placing ever more emphasis on research policy and how research funds are best used to achieve the national objectives for research. Linked to this is the governments' wish to be capable of evaluating their own countries' progress in research. The emergence of various allocation systems based on quality and performance is a natural result of this ambition.

The Research Assessment Exercise (RAE) launched in the UK in 1986 was the first performance-based system to be introduced for allocating research resources among a country's HEIs. Since then, many other countries have introduced various performance-based systems. The foundation of RAE is peer review. Several countries have followed the British example and introduced systems based on peer review; examples are Australia, Portugal, Italy and Hong Kong. Other countries have introduced indicator- or parameter-based system for allocating research funds according to performance. In the most common systems there are indica-

tors like publications, citations and external funding. Sweden has a system of this kind, and countries with similar systems are Denmark, Norway, Finland, Slovakia, Poland and Belgium.

In this overview, we shall present various systems of research funding and discuss their advantages and disadvantages. This is particularly relevant since, at present, Sweden is considering a transition from a parameter-based system to one founded on peer review. This makes knowledge of various systems, their pros and cons, and in particular the extent to which they appear to result in a desired course of events, highly relevant. It is also the reason why this overview was drawn up.

In 2014, the expert group on quality in SUHF took the initiative for this overview with the aim of assisting Sweden's HEIs and the Government alike by providing knowledge and recommendations based on international experience of existing systems. It is also the expert group's ambition to be able, to some extent, to provide guidance on success factors. For the overview, existing research and analyses of research policy, publications and different funding systems have also been studied. We have attempted to find relevant literature, but cannot claim to have covered, in any way, everything that has been written. We do not present any newly produced research findings; nor do we make any claims that the selections we have made and analyses we perform are comprehensive or self-evident. But we have attempted to give a nuanced and multifaceted picture of the area we discuss.

3

3. Swedish research policy in an international comparison

Sweden has a history of success in higher education and research. This country also has world-leading enterprises that are knowledge-intensive and depend both on highly educated and trained employees and on well-developed collaboration with the world of research. A high proportion of the resources for research and development (R&D) is tied to these companies: they account for more than 60% of R&D investments in Sweden (2010). This makes Sweden a country with relatively ample R&D resources provided with non-public funding. Over the past 20 years, Sweden's strong position in research has weakened in relation to certain other countries [Öquist and Benner 2012]. In Sweden, research with a strong international impact has grown less than in, for example, the Netherlands, Switzerland and Denmark [Karlsson 2012]. There is more about this in a later chapter.

What research policy, then, has been conducted in the past 20–25 years and given rise to this outcome? The policy is best described by means of the various research-policy bills presented by Government every four years from 1992 to 2012 inclusive [1992 Govt. Bill], [1996 Govt. Bill], [2000 Govt. Bill], [2004 Govt. Bill], [2008 Govt. Bill], [2012 Govt. Bill]. These bills also reflect the direction and ambition that ultimately set limits to research and development (R&D) in Sweden. A description and an analysis of the policy pursued are therefore important if the trends of Swedish research are to be understood and compared in an international perspective. Appendix 1 presents a brief summary of some of the main features of the past quarter-century's policy.

In these government bills, Swedish research policy has focused to a high degree on quality and on the aim of Sweden belonging to the foremost research nations, but the question is whether these objectives have been attained. One popu-

lar measure of qualitative research production is to count the number of well-cited academic publications (such as the 10% most highly cited within a field). Using this measure and comparing Sweden's own development with comparable countries (those that were reasonable strong in research terms in the early 1990s), one finds that Swedish research developed in a way roughly similar to that of the other countries in the 1990s. From the turn of the millennium to 2009, however, all these countries except Japan and Israel show better trends. Since then, Swedish research has regained a little of its competitiveness, although most countries' trends were better for the whole period 2000–15. The Swedish Research Council [Karlsson 2012] has come to similar conclusions.

It should be obvious that funding trends are a key explanatory factor in the trend of publishing, and data from the OECD indeed shows that funding in Sweden, compared with other countries, declined fairly sharply during the same period in which the relative publishing rate decreased. However, it appears that Swedish HSS research also yields fewer highly cited publications than several comparable countries, even taking the funding into account. Accordingly, there is scope for improvements other than increasing the grants.

Sweden's research policy as such, and in an international perspective, is discussed in detail by Öquist and Benner [2012]. Their report, which was commissioned by the Royal Swedish Academy of Sciences, includes an analysis of the overall policy pursued in the past 20 years and compares it with that of four other countries: Denmark, Finland, the Netherlands and Switzerland. Another, similar analysis of research policy in different countries was performed by the Nordic Institute for Studies in Innovation, Research and Education (NIFU) in Norway and commissioned by the Royal Swedish Academy of Engineering Sciences (IVA) [IVA-Nifu 2014]. The main author of this report was Mats Benner, and the countries covered are Denmark, the Netherlands, Norway, Switzerland, the UK, Sweden and Germany. The conclusions regarding Swedish research policy largely agree with those of Öquist and Benner [2012].

In comparing countries, one can look at overarching policy differences and how policy is implemented by means of steering documents and allocation models. One can also look at structure and organisation of research in the country, and finally at recruitment and mobility among researchers.

In their analysis of Swedish research policy, Öquist and Benner think that Sweden stands out in relation to the reference countries because of the 'fuzziness' of research goals. All the other countries have several established aims for their

research but Sweden is different; as the authors express it:

> *But this country is notable for its jumble of different policy goals and tendency to keep adding new ones, with an apparent disregard for how this may affect the universities' ability to stay at the forefront of knowledge renewal in terms of new discoveries and understanding. [Öquist and Benner 2012, p. 25]*

Historically, 1997 is pinpointed here as the year when the "third mission" (sharing knowledge and information through public outreach) was added to the two main functions of education and research. The HEIs' dues were thus to include, with equal vigour, pursuing research in the international frontline and to ensuring the practical benefits of research.

Another key factor affecting Swedish research is the sweeping change undergone by the sector during the period: structure, management, research funding and career systems alike were reformed. Research funding became not only more dependent on external funding, but also a great deal more complex. Resources were said to be in relatively ample supply, but governance to be weak.

All in all, the impact of a research policy that is fragmented and a sector that has undergone major changes is that it is difficult for the HEIs to be truly successful. Öquist and Benner summarise this as follows (p. 26):

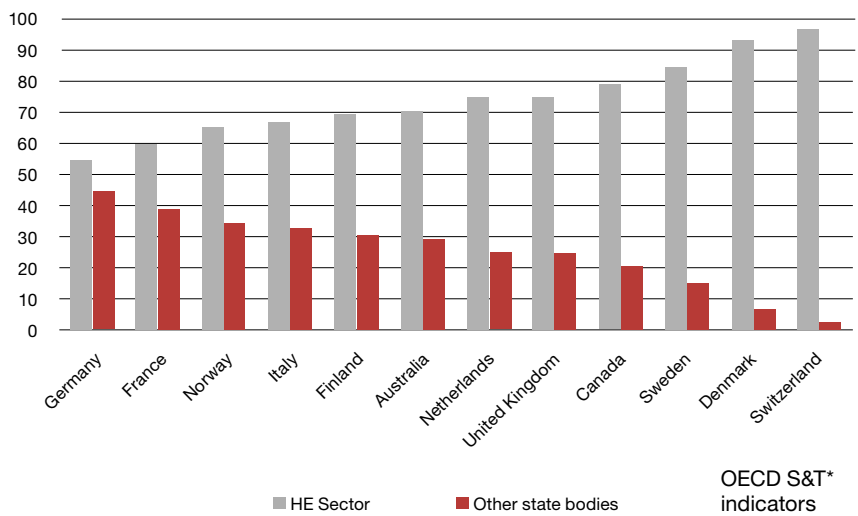
> *Universities are expected to function both as bastions of basic research and as arenas for applied research, innovation and development. They are expected to serve the interests of diverse stakeholders, including industry, politicians, students, trade unions and the academic community. In effect, Swedish universities have become multifunctional conglomerates designed to support our knowledge-based society. However, governance of these conglomerates is not optimal. We see examples of more successful conglomerate strategies elsewhere, particularly in Denmark, where universities have seen an extension of their organisational mandate but remained committed to stringent scientific standards.*
>
> *This complex mix of goals and missions was, in retrospect, bound to impede the universities' capacity to*

pursue high-quality research. This is an important factor in our explanation of the relative decline of Swedish research.

Öquist and Benner point to other factors, too, that have influenced Sweden's research development. One is that there has been an ambition to greatly boost the number of PhDs. This resulted in refocusing from more senior research to postgraduate education, which in the authors' view reduced opportunities for ground-breaking research.

In a comparison of research in different countries, there are a range of aspects to consider. Research policy is one key aspect. Perhaps even more important is the structure of a country's research bodies, and also the relationship between them and the government, i.e. the manner in which the government implements its policy. The bodies that conduct research are, above all, HEIs, research institutes and companies. A substantial share of R&D in Sweden and several other countries is carried out in industry. Research under the aegis of the state outside higher education is done mainly by institutes, and these can make up a substantial share, as in Germany and France, for example.

Relative Size of public-sector research bodies



** Science and technology.*

Relationships among HEIs matter too, as does the HEIs' relationship with the state. In Sweden we mainly have state HEIs. Formally homogeneous, the HEI

system is in practice dichotomous. The dividing line, with respect to research, is between research-intensive universities, which have more than half their resources in research, and other HEIs. Several other countries, such as the Netherlands, the UK, Finland and Norway, have a similar dichotomy.

Like Sweden, many European countries have a close connection between the state and the HEIs. In the UK, the HEIs are considerably more independent and have great freedom to decide for themselves on their resources, to possess their own buildings and so forth. In Finland, a reform was recently introduced whereby the HEIs are no longer part of the state. Another example of key structures that influence research is the organisation of research funding.

Denmark

For Sweden, Denmark is a country we can learn from. Its research trends have been successful, largely owing to sharp increases in resources. In the Swedish Research Council's analysis of publications [Karlsson 2012], Denmark occupies one of the top positions. Heyman's analysis, too, indicates the success of Danish research. It is noteworthy, in view of the above comments on Sweden and the impact of changes, that Denmark appears to have undergone even more sweeping changes than Sweden.

The combination of increased resources and a well-implemented policy explains why Denmark has retained and even improved its leading position, Öquist and Benner [2012] think. They discuss several possible reasons for the country's successes. Denmark has made changes in virtually all areas, coupled with a massive boost to resources. The reforms may be divided into four categories [Oddershede 2009]: 1) reform of management, 2) reform of education, 3) financial reform and 4) mergers of HEIs and research institutes. The resource increments were allocated purposefully, with initiatives focusing on such areas as research environments and young researchers [Öquist and Benner 2012].

In 2003, moreover, Denmark implemented a significant reform replacing collegial elections of leaders by a professional recruitment procedure [Langberg 2003]. HEI boards now obtained an external majority and the right to appoint the vice-chancellor, who were given greater power, including appointing deans, who in turn started appointing department heads. Another relatively large change was the merger of several HEIs. This 2007 reform meant that 12 universities became eight and 13 national research institutes three. Several of the institutes were incorporated into the universities.

Denmark differs from Sweden in one key aspect of research policy. Denmark has no explicit national research policy formulated by the government or parliament [EC-Dk 2015]. High-priority and strategically important areas are, instead, identified by means of a process that involves stakeholders in the academic community and the private sector, in particular. The latter is involved, by example, by having a say in research strategies drawn up by the research councils.

Öquist and Benner [2012, p. 38] point out that individuals seem to have been instrumental in shaping Danish efforts. Although the country lacks the type of explicit research policy that exists in Sweden, liaison with and informal governance by the Danish Government appear to be stronger. The HEIs seem to have a closer relationship with the Government, with a type of 'contract' in which goals and priorities for an individual HEI are agreed between the Government and the HEI concerned [Dawson 2009]. The following examples are given.

Denmark: Contract with the universities

Several countries have tried to implement increased governance autonomy of universities together with contract-related institutional funding. Denmark has actually developed such contracts. An example is the contract with the University of Arhus for the period 2007-2010. The contract describes the development of the university and on four areas performance indicators are specified: research, education, knowledge dissemination and consultancy. For each indicator the ambitions per year are specified in the contract. For research and knowledge dissemination, the performance indicators are:

Objectives research	Indicator
Production	Number of publications
Internationalisation	Number of new international researchers employed
Acquisition of external funding	Amount of EU funding
	Amount of funding from business and funds from abroad
PhD activities	Number of Graduate Schools
	Number of new PhD students
	Number of PhDs granted
Objectives knowledge dissemination	
Education and Post graduate courses	Collaboration with polytechnics
	Number of paying participants of post graduate courses
	Amount of income of post graduate courses
Participation in public debates	Number of contributions to newspapers and magazines
	Public lectures
	Participation in committees, councils and boards
Collaboration of business enterprises	Number of collaborative agreements
	Number of patents
	Income from patents and licenses

United Kingdom

England, Scotland, Wales and Northern Ireland (the UK) are another interesting example, which is often claimed to be one of the most successful. In an evaluation of UK research prepared by Elsevier [Elsevier 2013] and commissioned by the UK's Department of Business, Innovation and Skills, the country's showing is very good. Support for their conclusion includes the following:

> *While the UK represents just 0.9% of global population, 3.2% of R&D expenditure, and 4.1% of researchers, it accounts for 9.5% of downloads, 11.6% of citations and 15.9% of the world's most highly-cited articles.*

In the Swedish Research Council's analysis of six countries' publications [Karlsson 2012] – Sweden, Denmark, Finland, the UK, the Netherlands and Switzerland – the UK ranks among the top three, with Denmark and the Netherlands.

The conclusion that Britain is one of the most successful research nations is, however, by no means undisputed. The analysis carried out by Heyman [2014] (see below) indicates that this country has not been particularly successful and, on the contrary, ranks among the inferior performers in the comparison. Clearly, the UK has been a pioneer when it comes to regularly evaluating its research and allocating funds on the basis of this evaluation. Funding allocation according to these evaluations has amounted to 25–30% of total research funding for the HEIs. This system, introduced back in 1986, is run by the Higher Education Funding Council in England (HECFE), which is independent from the government.

HECFE is a distinctive and important feature of English research policy as such. Through it, all direct state resources for education and research are channelled to the HEIs. Free, independent HEIs are thereby created, with HECFE acting as an intermediary between the Government and the HEIs. The system prevents direct governance of the HEIs. The Government channels resources into HECFE for allocation according, above all, to internal criteria like quality, relevance and needs. There are also some guidelines from the Government that HECFE must follow; but the guidelines are overarching, general and brief.

Below, we reproduce in full the priorities applying to research ahead of allocation in 2016 [HECFE funding 2015]. These priorities may be compared with the ones formulated in the Swedish research-policy bills (see Appendix 1), comprising documents several hundred pages long.

- Outstanding research lies at the heart of the sector's global reputation. The Dual Support system has delivered an increasing share of the world's best research, and Quality Related research funding remains fundamental to our country's success. We welcome the outcome of the 2014 Research Excellence Framework (REF), which has demonstrated substantial improvements in the UK's research quality and delivered compelling evidence of the impact of research. We therefore wish you to continue selectively to fund world-leading and internationally excellent research wherever it is found, to provide selective support for the next generation of researchers, and to recognise research funding leveraged from external sources such as the charitable and business sectors.
- We continue to push forward the implementation of open access to research publications and the underlying data. You should support Jisc's work to determine how our objectives on increasing open access to research outputs can be delivered without significantly increasing costs to the sector. You should consider how to reward open data as part of future REF assessments, subject to the evaluation of REF 2014.
- The UK Research Partnership Investment Fund (UKRPIF) has also proved highly effective in developing collaborative research programmes at scale between universities and the private sector, with excellent leverage obtained for the Government's investment. We wish you to ensure that maximum benefit is derived from the previous and current (2016–17) rounds of successful bids, with a clear focus on delivery of the committed projects. Evaluation and the lessons learned from the scheme so far will be important to informing delivery of the Government's priorities set out in the Science and Innovation Strategy, in which an additional £200m was announced, to be allocated through the Research Partnership Investment Fund over the next Parliament.
- We need to get the most research benefit possible from the £5.9bn investment over the next six years to be spent on the Grand Challenges and World-Class Laboratories programmes announced in the Science and Innovation Strategy. You should continue to allocate science and research capital to institutions based on excellence-based formulae and you should develop arrangements to provide increased transparency which can highlight the developing impact of this spend on the wider re-

search base including where single, large-scale facilities, and expensive research equipment are used, they should reflect modern and professionally-run collaborative arrangements.

- Through the additional research capital and revenue funding that the Council will now allocate under these programmes, we will want you to promote openness and collaboration through the better sharing of infrastructure, data assets, and other research resources to improve the efficiency and productivity of research in a more agile sector. We wish you to lead a programme to effect these improvements and the recognition that collaborating universities should obtain, working closely with Research Councils UK and other partners at national, regional and local levels. You will need to work with our officials to agree the overall shape and implementation of a programme of efficiency measures that take account of any relevant recommendations in the Report from Professor Sir Ian Diamond's Review and the recommendations that may be made later in the year in any response to Sir Paul Nurse's review with the Research Councils.

Switzerland

Switzerland is another country with a very good showing when publications are used to measure success in various ways. In both the Swedish Research Council's analysis [Karlsson 2012] and Heyman's (see Chapter 5), Switzerland ranks among the top nations — perhaps, in some respects, at the very top.

Swiss research policy is shaped on the basis of a research strategy in which the Government presents its priorities and strategies every four years. The process of defining these is thorough and extensive, and includes important research stakeholders. The goal is for the strategy to be well supported and accepted. This consensus-oriented decision process for research strategy means that implementation and acceptance are optimal [EC-Ch 2015]. The risk of excessively high ambition where consensus is concerned is also identified, and this spells a risk of the rate of change being too slow. Nevertheless, the country has adopted a prioritisation policy that particularly favours two universities. At the same time, the other universities are also well supplied with research funds compared with Sweden [Öquist and Benner 2012].

Another example of a well-implemented policy according to Öquist and Benner [2012] dates back to the late 1990s and early 2000s. First, the Government intro-

duced stiffer competition between the HEIs; second, more distinct profiling of the HEIs was forced into existence. A further important change was in the view of external funding: as a result of government policies, it came to be seen as legitimate to supplement the basic grant. The reforms implemented followed consultations with leading researchers and other stakeholders. In summary, Öquist and Benner [2012] think the Government's control through research policy is weak and consensus-oriented. The HEIs' position as autonomous entities independent from political governance is strong.

The Netherlands

The Netherlands is interesting, perhaps especially because the country has chosen a path towards excellence that is entirely its own. It seems to be one of the most successful research nations. The Swedish Research Council's analysis [Karlsson 2012] places the Netherlands among the top nations in terms of the impact of its research. The Netherlands also ranks top in the analysis carried out by Heyman [2014]. Moreover, the Netherlands has developed a unique method of quality assurance for its research at national level.

The Dutch Government shapes its research and innovation policy by publishing a strategic plan every four years. The most recent was issued in 2011 [NL Gov 2011]. In 2014, in a more overarching form, the Government published its vision for research in 2025 [NL Gov 2014]. The main points in this vision are summarised below [Rathenau 2015].

Ambition 1: Dutch science is of worldwide significance

The government wants to ensure that Dutch science maintains its top position. In a number of research areas, Dutch research leads the way. To maintain this position there needs to be room for creativity and innovative ideas. Science can contribute even more to tackling societal challenges and boosting economic growth.

This leads to a number of actions:

- To give scientists opportunities for creativity and innovative ideas, €50 million will be provided for matching European projects.
- The initial flow of funds to universities will be made more stable by being based on three-year averages of the funding parameters. The share of the PhD component in the funding will be capped.
- A National Science Agenda will be drawn up by scientists, universities,

colleges, businesses, community organisations and concerned citizens. Science will focus on themes that are identified, for a period of seven years. The first agenda is expected in autumn 2015.

- The intention is to agree on a new framework agreement with the universities in 2015, and the National Science Agenda will play an important role in this agreement. Further steps will be taken to profile university research.
- The role of NWO[1] will change as a result of the National Science Agenda, which will have implications for how its work is organised (with stronger central programming and budget allocation).
- A permanent commission for large-scale scientific infrastructures will be established to monitor the broad spectrum of research facilities at universities, research institutes and institutes for applied research. NWO and KNAW[2] will focus on the National Science Agenda. These institutes will also be periodically evaluated for their international connections, national function and added value.

Ambition 2: Dutch science is more connected to society and business and has maximum impact

Dutch science should have maximum impact on society and business by 2025. This leads to a number of actions:

- Strengthening open access (OA) to academic publications and their underlying data. By 2016 60% of publicly funded scientific articles in the Netherlands should be published with OA, and by 2024 the target is 100% OA.
- Promoting private investment in science (by alumni, other individuals, companies and charities).
- Promoting science communication and more involvement of citizens in science.
- A single national body in the area of scientific integrity for all knowledge institutions (by strengthening the existing National Board for Research Integrity, LOWI).
- Continued collaboration of researchers in the public and private sectors in the Dutch top sectors through the Top Consortia for Knowledge and

1 *The Netherlands Organisation for Scientific Research (translators note)..*
2 *The Royal Netherlands Academy of Arts and Sciences (translators note).*

Innovation.

- Fostering entrepreneurship at universities and colleges.
- Making better use of patented knowledge in industry through improved cooperation among the Technology Transfer Offices.
- Making valorisation a more important consideration in NWO's evaluation of research proposals.
- Strengthening the knowledge function at the universities of applied sciences.
- Strengthening the relationship between education and research (education based on the latest academic findings).
- Stimulating better collaboration between (regional) governments and science.
- Achieving a more effective advisory system and a biennial 'Balance of Science'.

Ambition 3: Dutch science is a breeding ground for talent

The government wants talent in science to come into its own even more. This leads to a number of actions:

- Focusing human-resource management (HRM) policy more on education and valorisation, and also on research.
- Attracting international talent: strengthening Dutch science abroad by involving representatives of Dutch research in overseas missions.
- Achieving greater differentiation in postgraduate education (PhD students, promotion agreements with industry, PhD graduates in government).
- Achieving a more balanced staffing establishment in universities.
- Extending entitlement to the *ius promovendi*[3] to associate professors.
- Achieving more opportunities for talent, including women's. In 2025, the Netherlands should at least be at or above the European average with respect to the proportion of female scientists.
- Reducing pressure to publish and acquire funding.

Governance of research policy in the Netherlands appears to be, if anything, somewhat more explicit than in Sweden. Funds allocated for research and edu-

3 *The legal right to supervise PhD students, present and examine candidates for doctoral degrees (translator's note).*

cation are divided among different disciplines and focused initiatives in what are known as 'top sectors', introduced in 2011. The Government negotiates and concludes agreements with the HEIs (especially the research-intensive universities) for the period ahead (see [NL Gov 2011, p. 62, regarding focus areas for the universities and strategic plans for development). The HEIs receive block grants for research and education. However, deduction against the grant is differentiated between research and education, and also between research-intensive and education-intensive universities.

Öquist and Benner [2012] identify internationalisation of postgraduate education as another factor contributing to the Netherlands' success. During the 1990s, postgraduate education was professionalised by the introduction of national postgraduate programmes or graduate schools. These applied high requirements, and a strict, formalised system emerged with the introduction of calibrated impact factors, which were used to impose requirements on PhD theses. Today, some 120 of these graduate schools exist.

Öquist and Benner [2012] also hold the view that the superficially powerful political control is not, in practice, particularly strong. Research policy is characterised by continuity and great respect for research practitioners. Moreover, KNAW has a key role in advising the Government. Another factor involved, according to Öquist and Benner, is that the Netherlands has an advanced system of research evaluation and analyses of research systems – perhaps the 'most advanced in the world', in the authors' opinion.

An interesting aspect of the Netherlands, and one that is particularly topical at present, is that in the 1980s the country had far-reaching plans to introduce a system of resource allocation for research at the research-intensive universities, based on peer review. National peer review was introduced, but plans to allocate resources according to the assessment were not realised. The system of national evaluations of research through peer review was retained, but without resource allocation as a result of this assessment.

The national system for developing quality that emerged was the outcome of development of a national protocol for research evaluations by the Association of Universities in the Netherlands (VSNU), the Dutch counterpart of SUHF, in cooperation with other stakeholders. Following the first version of this protocol in 1993, it was developed further and since 2003 responsibility for carrying out the evaluations has been borne by the universities and research institutes themselves – something that, with hindsight, appears to have been successful.

National coordination continued through a common national Standard Evaluation Protocol [NL evaluation 2015]. The universities and research institutes undertake to carry out, at least once every six years, evaluations of their research based on this Protocol, and also to publish their evaluations so that the Government and stakeholders in business or society can find out about them. The universities and institutes now define for themselves the actual units to be evaluated according to the general criteria defined in the Protocol, and have assumed responsibility for following up the evaluations. The Protocol defines three main evaluation criteria:

1. Research quality
2. Relevance to society
3. Feasibility and viability.

Each evaluation unit is graded and placed in one of the following four categories:

- World-class/excellent
- Very good
- Good
- Unsatisfactory.

The criteria for the various categories are also specified. For research quality, for example, the unit must be among the world's most influential units in its field, make an exceptional contribution benefiting society and be well prepared for the future. Postgraduate education, too, is included in the evaluation. The Protocol also includes an overview of how the evaluation is to be implemented – the kind of self-evaluation to be undertaken, how external experts are to be used and the form the report should take, for example.

In van Drooge et al. [2013], experience of 20 years' research evaluations is summarised. The main conclusions are as follows:

- The Netherlands has a long-standing and stable system of quality assurance in academic research, including in comparison with other countries. Thus far, however, we have no overview of the evaluations performed and positions adopted by the boards of research organisations in response.
- There is great variety in terms of the scope of evaluations, ranging from entire disciplines and entire disciplines minus a few organisations, or a combination of disciplines within a research organisation, to a single centre or research group. The quality of the research covered by these evaluations cannot therefore be systematically compared.

- Scores for the quality of research have risen over the past twenty years. Currently, virtually all aspects of all research rate as at least internationally competitive. As a result, there are barely any observable differences between the scores of different research units.
- The Dutch system differs considerably from other national systems. The Netherlands has no national goal, predefined consequences or central organisation that is responsible for the system. Goals are defined at research organisation level and organisations themselves are responsible for the evaluations, and for deciding what consequences should apply.

As mentioned above, the Netherlands has a dual university system, with 14 'research universities' and 37 'universities of applied science'. Research funds are allocated to the research universities as a resource base. Paid directly to the universities, this makes up more than 70% of total research resources. Researchers employed at the universities are funded from this base, although to a minor extent there are also appointments based on external funding [VSNU 2015]. The resource base for the HEIs' education and research is provided in the form of a block grant. Deduction against the grant differs between the two main categories of HEIs. The research universities receive, besides the basic resource provision, funding on the basis of their undergraduate and PhD degrees. The education-intensive universities receive funds based on student numbers and undergraduate degrees on top of the basic resource provision.

In summary, the Netherlands is distinctive in many ways and has created a research system with unique characteristics. According to Dawson [2009], these characteristics are as follows:

- The role of the government and more specifically of the Ministry of Education, Culture and Science in strategy and planning is weak compared with other countries. In other countries we find a tendency to strengthen coordination at the national level, while in the Netherlands there is no national strategy. The idea of 'governance at arm's length' is to some extent possible because reforms have been implemented much earlier. As a result, actors in the research system have comparatively more freedom regarding strategy. The flip side is that when actors expect the government to intervene, it has few instruments to do so, though some actors maintain high expectations of the government.

- Compared with its sister organisations abroad, NWO has developed in an intermediary body with a range of different responsibilities and organisational divisions. It owns research institutes, has disciplinary boards and foundations to allocate competitive funding and manage research programmes and some of the national coordinating bodies for strategic funding. In most countries such tasks are divided among different organisations. In a recent evaluation of NWO the evaluation committee made proposals for organisational change.

- The competition for funding through open competition is relatively strong in the Netherlands; in some fields like the social sciences it seems too strong. The results of the review suggest that there might be an inverted U curve relationship between competition and scientific performance. In the Netherlands, and more recently in Denmark, scientific performance improved together with an increase in competition. The figures suggest also that competition in the UK has become too high, and the costs of competition exceed the benefits.

- There is hardly any reputational and quality differentiation among universities in the Netherlands. Dutch universities have a good reputation, but none belong to the international elite or rank at the top of international ranking lists. Compared with other European countries, this is currently in contrast only to the UK, but other countries are also trying to achieve such differentiation to create one or two elite universities within the country. In the Netherlands, policy instruments have been implemented that could have led to quality and reputational differences, examples being the systematic evaluation of research, funding of top graduate schools and the Vernieuwingsimpuls[4], but this has not happened. Instead, some of these instruments have led to another notable system characteristic: strong networking of university research in inter-organisational graduate schools, virtual institutes, research consortia and the like, which seem to be preventing the differentiation of universities, instead of inducing it.

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4 The Innovational Research Incentives Scheme (http://www.nwo.nl/en/funding/our-funding-instruments/nwo/innovational-research-incentives-scheme/index.html)., (translator's note) .

- Quality control of scientific research at Dutch universities and research institutes is standardised though a joint protocol, which delegates some responsibilities for the actual assessments to the research organisations. As a result, it is unclear whether the different committees use comparable standards. The results of the assessments have no direct effect on resource allocation and limited effects on the research policies of universities and other research organisations.

- The Netherlands has no initiatives for explicit priority setting to be implemented. Some of the organisations in the research system have set their own priorities and, as part of innovation policy, priorities have been set. More significant are those priorities that have been set de facto or emerged as a result of several policy instruments to create strengths, clusters and collaborations. Such an approach of incremental priority setting needs a regular impulse to promote research quality as well as additional funds. Currently, the approach is not institutionally settled and depends on *ad hoc* policy.

4

4. National systems for funding and quality development

This chapter describes, relatively briefly, various national systems for funding and quality development. Since the UK launched the first performance-based research-funding system (PRFS) in 1986, many countries have followed the British example and introduced some kind of allocation model based on performance assessment. By 2010 there were at least 14 national systems of this kind [Hicks 2012]. Diane Hicks has carried out a fundamental review of different national systems for assessing research performance [Hicks 2012]. To be included in her overview, the systems must meet the following criteria, according to Hicks:

1. Research must be evaluated. Evaluations of the quality of degree programmes and teaching are excluded.
2. Research evaluation must be ex post. Evaluations of research proposals for project or programme funding are ex ante evaluations and are excluded.
3. Research output must be evaluated. Systems that allocate funding based only on PhD student numbers and external research funding are excluded.
4. Government allocation of research funding must depend, or will soon depend, on the results of the evaluation. Ex post evaluations of university research performance used only to provide feedback to universities or to the government are excluded.
5. It must be a national system. University evaluations of their own research standing, even if used to inform internal funding allocation, are excluded.

There are two fundamental principles for assessing performance:

- qualitative assessment carried out by experts, i.e. peer review
- quantitative assessment based on various quantitative measures.

Of the 14 countries that have introduced a model, the majority have laid responsibility for the system on the government level, in the ministry concerned. Only a few countries have made an external party responsible; this has been done in, for example, Italy, Spain and Flanders in Belgium [Hicks 2012]. In the UK this party

used to be HEFCE but it is now formally the ministry concerned (the Department of Business Innovation and Skills) that bears overall responsibility. In Table 1, Hicks [2012] summarises the various national systems.

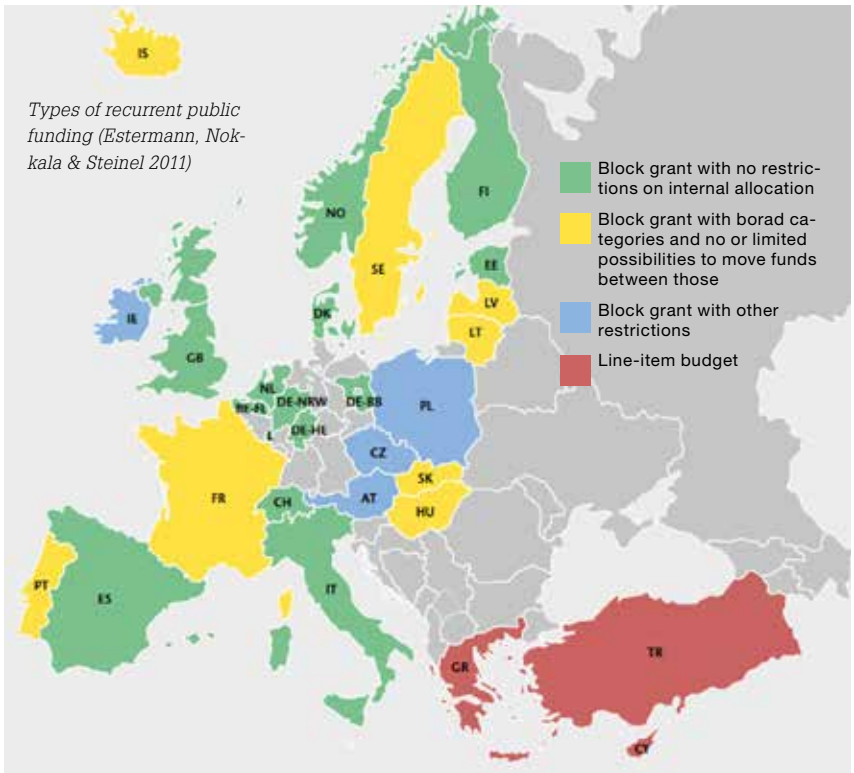
Table 1. National performance-based research funding systems for universities

Country	System	Year implemented/ major revision	Agency
United Kingdom	RAE moving to REF – research excellence framework	1986/current	Formerly Higher Education Funding Council for England (HEFCE), now Department of Business, Innovation and Skills
Spain	sexenio	1989	National Commission for Evaluation of Research Activity (CNEAI)
Slovak Republic		1992/2002	Ministry of Education
Hong Kong, China	RAE	1993	University Grants Committee
Australia	Composite Index, Research Quality Framework (RQF), Excellence in Research for Australia (ERA)	CI – 1995/ERA – 2010 (next scheduled for 2012)	Australian Research Council (ARC)
Poland	parametric evaluation	1991/1998-99	Science Council – advisory body to the Minister of Science and Higher Education
Portugal	research and evaluation	1996	Science and Technology Foundation
Italy	Valutazione Triennale della Ricerca (VTR/ Valutazione Quinquennale della Ricerca (VQR)	Evaluated 2001-03 in 2006 (VTR), Evaluation of 2004-2008 (VQR) to be continued	Agency for the Evaluation of University System and Research (ANVUR) / CIVR
New Zeeland	Performance-based research funding (PBRF)	2003/current	Tertiary Education Commission
Belgium (Flemish Community)	BOF-key	2003/2008	Steunpunt O&O Statistieken (SOOS)
Norway	Norwegian model (new model for result-based university research funding)	2006	Ministry for Research and Education
Sweden	New model for allocation of resources	2009	Ministry for Education with some methodological support from the Swedish Research Council
Denmark	Implementation of the Norwegian model	Current	
Finland	Funding formula for allocation of university resources	1998/2010	Ministry of Education

Several other countries have elements of research performance assessment, but not systems that meet the criteria listed above by Hicks. We have already discussed the Netherlands, which has a well-developed national system for peer review of research but where funds are not allocated on this basis. Other examples are France, Germany and South Africa, which perform national assessment

of performance in various ways [Hicks 2012]. The US lacks any national system for allocating funding or assessing research on a national basis. However, in recent years several federal research agencies — the National Institute of Health, the National Science Foundation and the Office of Science and Technology Policy — have been collaborating on a national project known as STAR METRICS (Science and Technology in America's Reinvestment — Measuring the EffecT of Research on Innovation, Competitiveness and Science), which is a system based on indicators for assessing performance associated with federal resources [Wilsdon 2015, p. 41].

The recent report from the EUA's DEFINE project contains, in Table 3 [2015 pp. 32–33], an overview of various funding systems in Europe and use of different performance measures in these systems. The report also contains a summary of restrictions on use of block grants in various countries' funding systems, as shown in the map below. In the countries coloured green, HEIs receive their resources in the form of a collective block grant with no restrictions, for example with no division into education and research.



Thus, several countries – such as Norway, Denmark, the Netherlands, the UK, parts of Germany, Switzerland, Spain and Italy – use block grants. This means that the HEIs are free to use the funds as they see fit or, as expressed in Pruvot [2015, p. 49]:

> **Universities that have the freedom to manage their funds can make the most efficient use of public money and redistribute it to their priority areas and institutional profile and thus adequately fulfil their mission.**

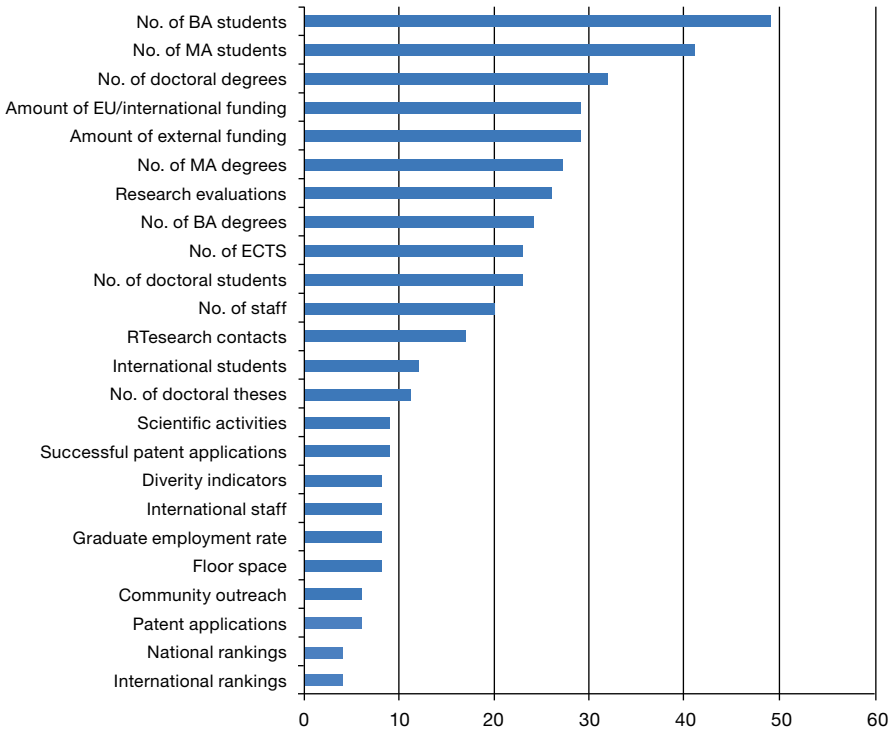
Although free use can be made of the grant internally, this does not mean that, in practice, the HEIs can do exactly as they wish. Obtaining the grant requires various forms of performance in education and research. Experience of block grants for education and research in the countries that use them is that the systems appear to function well without impairing either educational or research activities. Below in this chapter there is an account of, for example, Finland's system for allocating block grants for research. The figure below, from Pruvot [2015, p. 30], specifies various performance measures and how frequently they are used in different national systems.

The underlying logic of the national systems is, first, that they steer resources to HEIs that can show a track record of superior performance. The assumption here is that this is a good way of assessing future performance as well. Accordingly, the resources are assumed to be used in the most efficient way, which results in an improvement in overall research performance. Moreover, and perhaps more importantly, it creates an incentive for all HEIs to develop their activities towards better performance.

National systems for allocating research funds on the basis of performance are therefore a key feature of research policy. How the systems are configured affects the allocation of resources among the HEIs and a change will therefore take place in the research conducted. The larger the reallocation of funds, the greater the impact that the incentive effects are expected to have.

The national systems vary in several respects [Hicks 2012, p. 8]: units assessed, method of assessing performance, frequency of assessments and which period they cover. For example, anything from individual researchers to whole universities can be assessed. EC [2010, p. 39] recommends using 'knowledge clusters' as the evaluation units. The problem of evaluation at the level of research groups is that this is virtually impossible to implement at national level.

The importance of indicators in funding formulae



Predefined list of indicators wich were rated by National Rectors'Conferences of 21 systems according to their importance in the funding formula. The length of the bar indicates the importance of the indicator.

The number of groups is very large and the groups are difficult to delineate, since they overlap [Hicks 2012, p. 8].

Individually based assessment is carried out in Spain and New Zealand [Hicks 2012, p. 8]. Spain's supplementary salary scheme *(sexenio)* means that individual researchers can voluntarily, every six years (hence the name: the word means 'six-year period' or 'six-year term'), apply to be assessed by external experts. These experts evaluate the researcher's scholarly work in the form of, for example, publications and activities connected with postgraduate education during the period, and if these are considered adequate the researcher receives a salary increase. This system involves only binary assessment, i.e. the criteria for the salary rise are either met or not. It has been in use since the late 1980s and been successful in improving research performance according to the OECD [OECD Economic Surveys: Spain 2007, p. 130]. Spain thus emerges favourably in Heyman's analysis in the next chapter. However, one well-informed assessor thinks that attaining the

criteria for a higher salary does not require a great deal [Spain 2015]. Nonetheless, systems at individual level like those in Spain and New Zealand appear to boost quality and these countries have good results in Heyman's analysis.

According to Hicks, the most practical level for implementing more detailed assessments is that of HEI departments (or equivalent). If the aim is to carry out university-wide assessments, these are performed most easily with quantitative measures. There are examples of such systems in Norway, Denmark and Finland, which have points systems that reward quality as well as quantity. The Finnish system does so by giving a premium in the form of considerably higher points to the foremost publishing channels (see below), which thus represent superior quality.

The Norwegian points model is based on HEIs registering and reporting all academic publishing. All publishing channels are classified in three levels. The lowest (Level 0) consists of channels that do not fulfil the demands for academic publications that have been peer-reviewed for quality; these receive zero points. The next (Level 1) comprises academic publications that have undergone peer review and are judged to be at a 'normal level'. The highest (Level 2) contains academic publications published through the foremost channels, making up 20% of the total volume of academic publications at Levels 1 and 2 in the field concerned. Points are assigned to every publication at Levels 1 and 2, depending on the level and the type of publication (see below). The points are then divided (fractionalised) by the number of authors, so that a single researcher's points correspond to the total for the publication divided by the number of researchers listed as authors. The highest divisor permitted in fractional counting is 10: thus, even if there are more than 10 authors of a publication each nonetheless receives one-tenth of the points. Points assigned to various publications are listed in the table below.

	Level 1	Level 2
Article in journal or series	1 point	3 points
Article in anthology	0.7 point	1 point
Monograph	5 points	8 points

Publishing channels are grouped in the various levels on the basis of a nomination and support process that includes the whole Norwegian research community, and is entirely public. It is possible for researchers or research departments and institutes to propose publishing channels for assessment. Researchers from other countries, such as Sweden, may also submit proposals.

An evaluation of the Norwegian Publication Indicator was carried out by Aagaard et al. [2014] on behalf of the Norwegian Association of Higher Education Institutions (UHR) in Norway. They state the following about the system in an international perspective [Aagaard et al. 2014, p. 6]:

> *Each model is characterized by a number of trade-offs. The overall assessment of the construction of the Norwegian Publication Indicator is, however, that its objectives, coverage, and incentive structure are sensibly balanced, where its construction appears to be well grounded in the international literature.*

The system has disadvantages as well as advantages. The latter include its transparency, simplicity and applicability to all academic fields. One of the disadvantages is the trade-off between quantity and quality, which is problematic in its current form. Another disadvantage is that the system does not appear to be neutral regarding different academic fields, with the ratings in use at present. For example, a professor in humanities has been found, on average, to have 2.5 times as many points as one in the field of medicine. This is very largely, according to the authors, due to the fractionalisation effect. In Norway, the model is allowed to have an impact among academic fields, i.e. it permits a particular field to receive more funds as a result of the model. In Denmark, the model is applied in such a way that the allocation among academic fields is fixed and reallocation takes place only within a single field.

The system has brought about a sharp increase in the number of publications and the number of points since 2004 (funds were first allocated according to the system in 2006). Between 2004 and 2014, the total number of publication points rose by 82%. The number of publications in the Web of Science in the same period increased by 69%. Aagaard et al. [2014] found that resources for research expanded greatly in the period, and this explains part but not all of the increase. A more detailed analysis shows that the biggest increase is due to the sharp rise in the number of researchers getting their work published — this almost tripled during the period. This should be compared with the 21% increase in the total number of researchers in these years, and the fact that publication activity, on average, increased by the same order of size.

The number of Level 1 publications rose by 20% and those in Level 2 by 10% during the period, but the average rating per researcher fell by 9%. The most

probable cause of this, according to the authors, was that a rise in co-publishing took place. Accordingly, the effect of the fractional counting was a reduction in the points per author. The main conclusion on the effects of the system on the publishing pattern is, according to the authors, that many more researchers have become active in publishing their work in rated channels, while researchers who were already productive have not been influenced to such an extent.

No signs that the publishing system has given rise to 'perverse effects' on publication quality are discernible in Aagaard et al. [2014]. Nor are any clear signs of any sharp rise in publication quality to be found. Both citation data and the journal selection were relatively stable during the period, and at a relative low international level. According to the data obtained by Heyman (see Chapter 5), however, Norway performed better than Sweden and also Denmark. An analysis of the Norwegian rating system by Ahlgren [2013] compares it with a detailed analysis of a citation-based indicator for the impact of the publishing channel. This indicator takes into account the citation volume of different subject areas, which enhances the validity of the indicator. Ahlgren's conclusion regarding the Norwegian system is that 'the manual assignment of sources to levels, as is done in Norway, is reasonable'.

Finland has a system similar to those in Norway and Denmark. The biggest difference in Finland is that three levels (Levels 1–3) have been introduced for peer-reviewed academic publications [Finnish Publication Forum, 2015], For serial publications, i.e. those in journals etc., Level 2 consists of a maximum of 20% of the aggregate publication volume for all series in a certain group of academic fields. For publishers, all the publishers in a certain group of areas make up approximately 10% of Level 2. For Level 3, publication volume may consist of no more than 25% of the publication volume in Level 2, and roughly 10% of the publishers in Level 2. In Finland, the classifications at the various levels are determined by panels of researchers, with each panel representing a group of subject areas.

The Finnish system for allocating research resources allocates 38% of the basic grants for research, according to the above points system for publications [Finnish Ministry of Education and Culture, 2015]. Appendix 2 contains the schematic presentation of the whole system of basic grants for the HEIs taken from the above source [Finnish Ministry of Education and Culture, 2015]. Besides allocation based on publication points, these basic grants for research are allocated as follows: 29% according to doctoral degrees (26% based on Finnish citizens' PhDs and 3% on international citizens' PhDs), 27% according to external funding (18%

based on national funds and 9% on international funds) and 6% according to numbers of international teachers and researchers at the respective HEIs5.

Hicks [2012, p. 10] presents the following table of different systems.

Table 2. Bibliometrically oriented classification of PRFSs

Unit of evaluation	*Method*	*Country & system*	*Frequency*	*Census period*
University	*Indicators – paper counts*	*Australia Composite Index**	*1*	*2*
		Denmark	*1*	
		Finland	*1*	
		Norway	*1*	*1*
	Indicators – paper & citation metrics	*Flanders, Belgium*	*1*	*10*
		Poland	*5*	*4*
		Slovak Republic	*3*	
		Sweden	*1*	
Department or field	*peer review*	*UK RAE,*	*3, 4, 5, 7*	*8*
		Italy VTR		*3*
		Portugal	*3*	*4*
	Peer review informed by metrics	*Italy VQR*		*5*
	Expert review informed by metrics or peer review	*Australia ERA*	*2*	*6*
		Poland	*5*	*4*
Group (never implemented)				
Individual	*Peer review*	*Spain – sexenio*	*6*	*5*
		New Zeeland PBRF	*3, 6*	*5*

** Countries/systems in italics represent older versions of the PRFS.*

Using indicators is common in the national system. They are easy to administer and, as mentioned above, enable a whole university or even a whole country's performance to be assessed with relative ease. EC [2010] gives the following categorisation of indicators:

- Research productivity
- Quality and impact
- Innovation and social advantages
- Sustainable development
- Research infrastructure

Another table (Table 4, pp. 43–48) lists various indicators in the above-mentioned categories and their advantages and disadvantages. The categories of 'research productivity' and 'quality and impact' from Table 4 in EC [2010] are shown below.

5 *Note that the percentages in Appendix 2 apply to proportions of the entire basic grant for education and research. The percentages above apply only to the proportion of the grant for research.*

Table 4. Overview of indicators and some positive (pros/potentialities) and negative (cons/limitations) features

Indicators	Description	Pro/Potentialities	Con/Limitations	What development is required
Research Productivity				
Research publications and outputs	A count of publications and other research outputs.	Depending on purpose only selected types of publications can be counted. Publishing is vital for progress in science scholarship.	Different disciplines produce different types of research outputs. Emphasis on quantity of publication.	Suitable data bases for a variety of disciplines and research related outputs, especially in social sciences and humanities.
Research outputs per 'Research Academic' staff	Number of publications and other research outputs per academic staff or full-time equivalent (FTE).	Supports cross-institutional comparisons, adjusted for scale of institution.	Comparable definition of 'Academic Staff' and 'Research Time' can be difficult.	Agreement on definition of 'Research Academic'
Quality and Scholarly Impact				
Number and percentage of publications in top-ranked, high impact journals	The number of percentage of journal articles published in the top-ranked, high impact journals for the fields of research.	In the exact sciences, peers tend to consider citation impact a relevant aspect in assessments of research performance. Widely used, especially in the exact sciences which tend to be well covered. Data must be accurate and verified.	Although one of the most popular indicators, it is not always the most appropriate one. Especially in social sciences and humanities, expert rankings do nor correlate very well with impact factors. In these fields and in engineering, other sources are important as well (books, proceedings).	Discipline specific journal rankings, especially in social sciences and humanities, based on expert opinion in combination with indicators. Value of developing a ranking or hierarchy of scientific-scholarly publications.
Citations	Citation data are derived from citation indexes, i.e. databases that do not only contain meta data on included publications but also their reference lists. Principal indexes are Web of Science, Scopus and Google Scholar.	In the exact sciences, peers tend to consider citation impact a relevant aspect in assessments of research performance. Widely used, especially in the exact sciences which tend to be well covered, although the most popular indicators are not always the most appropriate ones. Data must be accurate and verified.	Citations reflect intellectual influence but do not fully coincide with research quality. Are of limited value in disciplines not well covered by the citation indexes, especially certain parts of social sciences, humanities and engineering.	Expansion of existing databases and creation of new databases (e.g. based on data from institutional repositories) will improve the value of this indicator and coverage of disciplines. Theoretical research into the meaning of citations (clusters) in social sciences and humanities.
Number of Keynote Addresses at Nat'l/Int'l Conferences	A count of the number of invited and keynote addresses given at national and international conferences	Used as proxy for quality, impact and peer-esteem. Data can be verifiable by conference programme.	No agreed equivalences that apply internationally and facilitate comparison across disciplines.	This will probably require direct entry by researchers. A list of internationally comparable items for different disciplines might help a lot.
Number Prestigious Nat'l/Int'l Awards and Prizes	A count of the number of prestigious national and international prizes won either in total or per academic staff.	Used as an indicator of research quality and impact. Data is verifiable.	No agreed equivalences that apply internationally and facilitate comparison across disciplines.	Unless lists are publically available this will require entry by researchers. A list of internationally comparable items for different disciplines might help a lot.
International Visiting Research Appointments	A count of the number of visiting at other academic and/or non-academic agencies and organisations.	Visiting Appointments provide indication of peer esteem or support by the academic community. Numbers are verifiable.	No agreed equivalences that apply internationally and facilitate comparison across disciplines.	Will probably require direct entry by researchers.
Editorial and Refereeing for Prestigious National/International journals/publishers	A count of the numbers of national and international appointments as editor, member of editorial board or as reviewer	An indicator of the extent to which the researcher's opinion is highly regarded by the academic community. Data is verifiable.	No agreed equivalences that apply internationally and facilitate comparison across disciplines.	Unless lists are publically available this will require direct entry by researchers. A list of internationally comparable items for different disciplines might help a lot.

Wilsdon et al. [2015] discuss in detail assessments based on quantitative measures, with the objective of developing what is described as a framework for 'responsible metrics'. The use of indicators and the Research Excellence Framework (REF), the UK's system of academic research assessment, are also discussed. HEFCE has, moreover, taken the initiative for a corresponding comparison connected with its evaluation of REF in 2014 [Wilsdon 2015, p. 8]. Its main results are as follows:

- There is pressure to use indicators to a greater extent at the universities.
- In the academic community, there are divided opinions and misunderstandings regarding the description, production and use of indicators to assess research performance.
- Despite its disadvantages and pitfalls, peer review has great legitimacy in the research community.
- The use of misleading indicators generates poor incentives.
- To make full use of the potential of indicators, underlying data must be transparent and challengeable.
- A correlation analysis performed on REF and its outcomes in 2014 shows that individual indicators yield results that differ appreciably from the peer review carried out in REF. The correlation is heavily dependent on publication year, with the correlation decreasing for newer publications. For young and female researchers, too, there is a lower correlation between indicators and REF peer review.
- At present it is not possible in REF to assess quality solely by using indicators.
- Nor is it feasible to assess the component of 'impact', which in REF denotes influence and benefit in society, by using indicators.
- There is a need to carry out academic studies of research as such.

In addition, 20 recommendations are given to leaders in academia and other stakeholders regarding the use of various indicators in Wilsdon et al. [2015, pp. 12–15]. The correlation, as mentioned above, varies from one field to another. Particular emphasis is laid on the problems of using quantitative measures in humanities and some social science fields. In science and medicine, the correlation is better. Mryglod [2014], studying the correlation between RAE 2008 and the Hirsch index (h-index), found a very good correlation at depart-

ment level. The subject areas chosen were in physics, chemistry, biology and sociology.

Several countries use peer review. In 1986 the UK was, as mentioned above, the first to introduce this system. It has undergone several reforms since then, for example to take the social benefits of research into account better. Peer review is generally used as the most reliable way of evaluating quality in academic contexts. Wilsdon et al. [2015, p. 74], express this as follows:

> *Peer review is arguably the most important method of quality control in all disciplines and can be characterised as a core family of mechanisms by which academic communities control themselves and maintain their social order, academic ethos and norms.*

Only in the UK and Hong Kong, however, does the peer review model appear to serve the main purpose of allocating funds [VR 2014, pp. 85–86]. In the UK, this model accounts for 25–30% of the resource base for the HEIs. In Australia, where only a small proportion of resources is allocated by means of peer review, the system serves primarily to enhance quality since the reviews are prestigious.

Peer review is used for assessing research quality of manuscripts submitted for publication, research-funding applications, job appointments, doctoral theses, research performance for various types of research unit, and so forth. There is probably hardly anyone in the academic community who can see a better tool for assessments of this kind, where experts with a full command of the area concerned can be used. It should also be remembered that such quantitative measures as the number of citations or amount of external funding are also based, if indirectly, on peer review. At the same time, peer review has weaknesses. Assessments based on people's judgements can, for various reasons, be coloured in ways that spell a lack of the desired objectivity. Wilsdon et al. [2015, pp. 75–76] summarise the advantages and disadvantages of peer review in the following table.

The table above shows that peer review is marred by many weaknesses and problems. Nevertheless, as we have seen, it is respected and deeply rooted in the academic community. Wilsdon et al. [2015] discuss various ways of improving it. One option that seems to be on the rise is 'informed peer review', where peer review makes use of a number of indicators in the assessment process.

Weaknesses of Peer Review	*Strengths of Peer Review*
▪ *It is slow, inefficient and expensive, although most costs are hidden;* ▪ *Human judgment is subjective – which may relevant for specific decisions: however also be seen as a strength;173* ▪ *It is almost by definition not transparent;* ▪ *It is inconsistent, sometimes characterised as a lack of inter-rater reliability;* ▪ *It is a biased process (e.g. gender bias regarding career decisions, bias against negative studies in publication decisions, bias in favour of prestigious institutes, bias in favour of dominant paradigms);* ▪ *Its bias is strengthened by the Matthew effect;174* ▪ *The process can be abused (e.g. to block competitors, to plagiarise);* ▪ *It is not very good at identifying errors in data or even in detecting fraudulent research;175* ▪ *It cannot process the complete research output of a nation and will therefore result in distorted rankings (since rankings are sensitive to the selection of submissions to the assessments);* ▪ *It cannot provide information about the productivity and efficiency of the research system;* ▪ *The selection of peer reviewers may create problems because of a variety of reasons (bias, lack of experts in emerging and interdisciplinary areas, lack of experts due to the speed of research areas, etc).*	▪ *Its foundation in specialised knowledge of the subject, methodology and literature relevant for specific decisions* ▪ *Its social nature;* ▪ *The subjectivity of this approach could be seen as a strength (as well as a weakness)* ▪ *It can help assess elements of research which are challenging to quantify e.g. novelty;* ▪ *It can deliver more nuanced and detailed understandings of research in the context of research production.*

In our context, it is important to discuss peer review as part of a national system. At national level, such a system is very costly. An independent consultancy, PA Consulting Group, estimated the cost of RAE 2008 at £60 million [PA Consulting Group, 2008]. For REF 2014, the figure was £55m solely for the cost of participating HEIs [Manville 2015]. According to HEFCE's own assessments, the total cost of REF 2014 was £246m [HEFCE 2015]; again, the HEIs accounted for most of the cost.

Manville [2015] evaluates the component of REF 2014 consisting of the social relevance or 'impact' of research, a new component in REF 2014 in relation to RAE 2008. The main conclusions are that:

- Participants saw several advantages of the greater focus on research impact in society, although it entailed substantial extra work for participating HEIs.
- As part of REF 2014, the HEIs succeeded in identifying and describing 'impact'.
- The biggest challenge and burden of the preparations was the necessity of 'proving' impact and understanding what it means.
- The HEIs felt that the evaluation had given research users excessive responsibility.
- There was uncertainty about how the panels should evaluate impact, and this caused concern among those who were being evaluated.
- The focus on impact has resulted in a change of culture among the HEIs.
- Among the HEIs, there was considerable variation in the view of impact as part of REF 2014.
- The case studies of how research exerted an impact on society ('impact cases') that were selected for evaluation may possibly not be representative of HEIs' overall impact on society.
- There is a concern that focusing on societal impact as a detrimental effect on basic research.

In several of the articles dealing with indicators for assessing research performance, peer review is used as 'the correct assessment'. The question of the reliability of peer review in the context that is relevant here, at the overarching level, was studied by Eyre-Walker [Eyre-Walker 2013]. In this article

peer review, average journal impact and citations are compared as bases for assessment. By comparing peer review of articles carried out at an early stage with the amount of attention (in terms of citations) paid to the articles in a later stage, the author reached an assessment of colleagues' ability to determine the success potential of publications. They were also able to compare different experts' assessment of the same publication, to gauge the reliability of peer review. The article reports on a 2005 study of two different categories of academic publications: one group of 716 publications and one with 5,811 publications, 1,328 of which had been reviewed by more than one expert. The peer review was then compared with a citation analysis performed six years later. Peer review has also been compared with the impact factor (i.e. the impact of journals in terms of their citations) of journals in which the articles are published. The conclusions regarding peer review are [Eyre-Walker 2013, p. 6]:

> *Our results have some important implications for the assessment of science. We have shown that scientists are poor at estimating the merit of a scientific publication; their assessments are error prone and biased by the journal in which the paper is published. In addition, subjective assessments are expensive and time-consuming. Scientists are also poor at predicting the future impact of a paper, as measured by the number of citations a paper accumulates.*

The following is another conclusion:

> *We also demonstrate that the number of citations a paper accumulates is a poor measure of merit and we argue that although it is likely to be poor, the impact factor of the journal in which a paper is published may be the best measure of scientific merit currently available.*

Other studies with similar conclusions concerning peer review have been conducted as well (see [Eyre-Walker 2013] for further references).
Anders Flodström, who was assigned by the Swedish Government to present a system, including peer review, for allocating research resources [Flodström 2011],

did not recommend introducing a system of peer review. His reasons were as follows [unofficial translation of Flodström 2011, p. 12]:

> *Peer review has poor precision, low reliability, cannot be implemented annually and is resource-consuming. We consider that the peer reviews initiated by the HEIs themselves are, as such, sufficient drivers of quality and that a national system is not justified.*

The report also contains a survey of the peer reviews carried out at various HEIs in Sweden. The conclusion of this survey and the experience gained is that peer review is valuable when it is conducted at HEI level. According to Flodström, bibliometric data cannot replace peer review but they can supplement it. The advice given by the reviewers on developing and improving activities is a valuable feature of peer review.

A very similar conclusion on peer review is drawn by Geuna and Martin [2003]:

> *On the basis of this comparison, and focusing in particular on Britain, we examine the advantages and disadvantages of performance-based funding in comparison with other approaches to funding. Our analysis suggests that, while initial benefits may outweigh the costs, over time such a system seems to produce diminishing returns. This raises important questions about its continued use.*

Despite Flodström's report and recommendations, the Swedish Research Council was assigned by the Government to propose a model for a system of resource allocation involving peer review. The Council's proposal [VR 2014], known as 'FOKUS', comprises two parts: the evaluation model itself and an algorithm for converting the evaluation into resources. The ambition is, according to the report [VR 2014, p. 8, unofficial translation]:

> *In its proposal, the Swedish Research Council has endeavoured to attain a balance between two principles. On the one hand, the model had to be resource-efficient; on the other, the outcome had to be informative enough to be of value to the HEIs. Since the proposal*

is based as far as possible on existing statistics, and is conducive to development of the national publication database SwePub, the Research Council considers that a reasonable balance between the two principles has been attained.

The Council's work to devise the model has included studying the national evaluation systems of other countries, especially the UK, the Netherlands and Australia [VR 2014, p. 8]. The model emphasises research quality, proposing that it should be given a weighting of 70% in resource allocation, while a 15% weighting should be composed of factors that develop quality, such as postgraduate education. The remaining 15% is based on the impact of the research outside academia. The Research Council's model is not a purely peer-review system; rather, it is supplemented by citation analyses where possible. Here, we shall not report in detail on the Council's proposal but simply refer to their report, with its thorough presentation of the proposal.

The allocation of research funds according to the indicators of publications and citations, on the one hand, and external funding on the other was presented in the Research and Innovation Bill of 2008 [Swedish Govt. Bill 2008] and introduced in the following year. This decision was preceded by a government inquiry by Dan Brändström [Brändström 2007], who proposed that half of the research funds should be allocated according to various indicators: publications and citations (20%), external funding (20%), number of PhD graduates (5%) and number of women professors (5%). In 2014, 20% of the direct grant was allocated on the basis of the former two indicators.

For an indicator-based model to provide genuine incentives, it is vital for it to reflect the quality and efficiency of the work to a reasonable degree and to be transparent. The model introduced in Sweden was built on a relatively sound base but has not been developed, followed up or adapted. The bibliometric indicator is based partly on estimation of the normal publication volume for a researcher in a given field, and no attempts to update these parameters have been made. This means that the model rests partly on more than 10-year-old data. The Government also introduced special area-specific weights to make the model yield the 'right' results, rather than their being based on an analysis of the differences among academic fields, since it has not been possible to find out how the weightings were

calculated. Accordingly, transparency — an important aspect of the model — was lost. Moreover, a number of issues were left without remedies: the handling of university hospitals, the weighting of external funding, grants earmarked for work that is not to be published, and so forth.

A model that reallocates 20% of the grant by using indicators that are largely size-dependent will not bring about particularly large reallocations. Since the model is also, using weightings, adjusted in such a way as to reduce the differences among HEIs, the reallocation may be expected to be relatively small; and this was indeed the case. A recently published report by the Swedish Higher Education Authority [Kesselberg 2015] analyses the effects of the Swedish allocation model in the years 2010–14. During this period, approximately SEK 125m changed hands as a result of the model. It has been found that the two indicators are not independent from each other: instead, they show a relatively strong correlation, with a correlation coefficient of 0.92. It is also found that the effects of the weighting factors introduced by the Government have discouraged HEIs specialising in technology and medicine and favoured those that are strong in social sciences and humanities.

At the same time as the indicator-based model, the model of strategic research areas was introduced. In the latter, reallocation had the potential of becoming considerably greater, while the requirement of an existing strong research environment excluded small HEIs to a high degree. Accordingly, the incentives worked strongly to encourage older universities to obtain strategic research areas, while new HEIs were referred to the indicator-based model. The outcome conformed to expectations in that the indicator-based model played a relatively large part in determining the allocation of grants to the new HEIs while, overall, it lacked covariation with grant allocation to the older universities where it was the strategic research areas instead that were crucial to the outcome.

The launch of the indicator-based allocation model and that of the peer-review model for strategic research areas are hard to evaluate, since they coincided with a relatively sharp increase in grants in relation to other countries too. How far they affected quality and efficiency is thus, to a high degree, masked by the increase in resources and the fact that the systems worked so largely on different parts of the Swedish HE system. At the same time, there

are clear indications that the incentives in the indicator model influenced researchers. Kesselberg [2015, diagram 13] shows the trends of two indicators, external funding and bibliometrics, for various groups of HEIs in the period 2009–14. Interestingly enough, there are major differences among these groups. The largest change is displayed by the group of new universities and the smallest is in the group of broad, established universities.

Publishing in channels registered in the Web of Science has increased more in humanities, social sciences and technology than in medicine and science. In other words, the subject areas with the greatest scope for changing publishing channel have been influenced by the incentives. The same type of effect is also evident in the fact that authors increasingly seldom specify a university hospital as their address and, instead, give the university address or a dual affiliation.

5

5. Country comparisons: how does Swedish research fare?

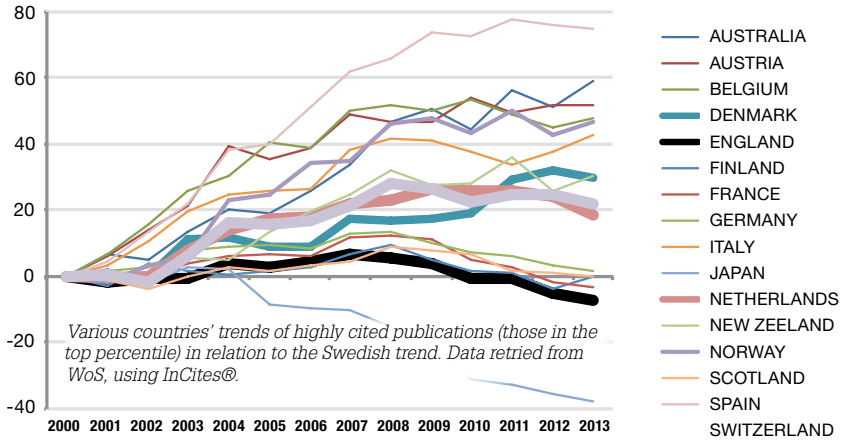
Quantitative comparisons of countries' research systems in terms of efficiency are tricky and the pitfalls many. The data material is incomplete, and countries' conditions and structure differ so much as to render meaningless such measures as the number of articles from the Web of Science (WoS) divided by the volume of R&D resource inputs in US$, corrected for purchasing-power parity (PPP).

As for academic publishing, we depend on databases like WoS or Scopus, which means that there is poor provision for publishing work in the humanities, in particular. Nevertheless, publication data are based on what is published internationally, of relatively good quality and comparability, where different weightings can satisfactorily compensate for differences among subject areas. The problem is that the countries vary in size and the same is true of their research systems. Comparisons therefore require some way of normalising for size. In bibliometrics, this problem has been solved by comparing data for an average publication, through calculation of citation rates of proportions of highly cited articles. However, such measures are also affected by the number of publications produced that have low citation numbers. The measures will give a negative impression of a country that, besides having highly cost-effective, cutting-edge research, also permits a broad range with somewhat lower quality, not because the cutting-edge research is less effective but because the breadth pulls down the average.

A better measure for comparison purposes is the type of bibliometric index that the Swedish Research Council has developed for grant allocation or, quite simply, the number of highly cited articles, such as the top-ranking 10%. Absolute comparisons, then, require some measure of system size; but it is also possible to compare development of different countries over time.

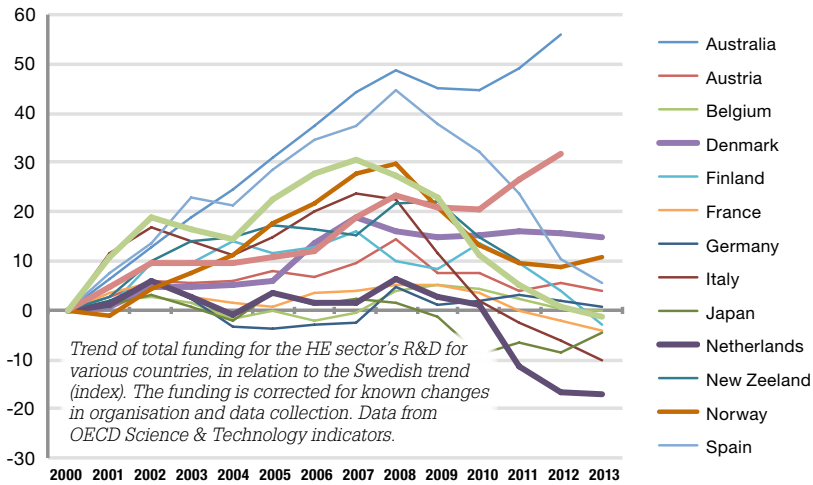
The diagram below compares a number of countries with Sweden as follows:

their total production of the top 10% of most cited publications is divided by Swedish production. To include all the countries in the same diagram, the figures have been indexed so as to express the percentage change in the relationship. For example, the relationship between Switzerland and Sweden was constant between 2000 and 2002, after which Switzerland's relative production rose by more than 15% by 2004 and continued to gain strength until 2008. Since then, Sweden has partly caught up: the gap has narrowed.



Various countries' trends of highly cited publications (those in the top percentile) in relation to the Swedish trend. Data retried from WoS, using InCites®.

A figure like the one above conveys a relatively good picture of how Sweden has performed in competition with the other countries. But it does not describe whether the Swedish research system is efficient or not, since the key factor in production is the trend of funding. A corresponding depiction of the funding trend is fairly similar to the publication graph.

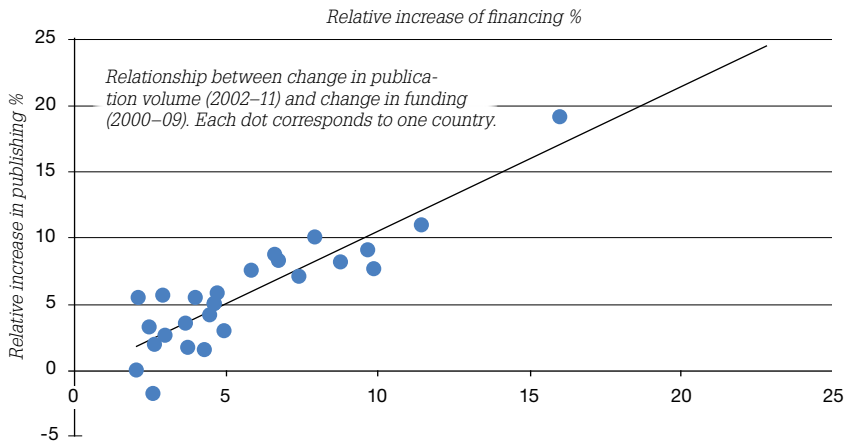


Trend of total funding for the HE sector's R&D for various countries, in relation to the Swedish trend (index). The funding is corrected for known changes in organisation and data collection. Data from OECD Science & Technology indicators.

To compare the systems, the publication figure must thus be divided by funding. This makes it possible to study the systems' productivity with comparable funding. Here, the figures available are the OECD's financial data on funds allocated to R&D in various countries' HE sectors. (The HE sector accounts for 80–90% of publications, so including other sectors would just introduce errors.) The revenue may be expressed in US$ corrected for PPP to enhance comparability among countries. Comparisons of this type have been made but subsequently criticised strongly for reflecting structural differences in costs, rather than actual differences in efficiency. For example, costs are substantially affected by whether PhD students receive salary from the HEIs or finance their own expenditure with fellowships, loans or the like. Granted, such differences express divergent costs, but they hardly describe the efficiency of the research system. Whether the PPP correction is particularly relevant to the costs of academic research is, moreover, questionable.

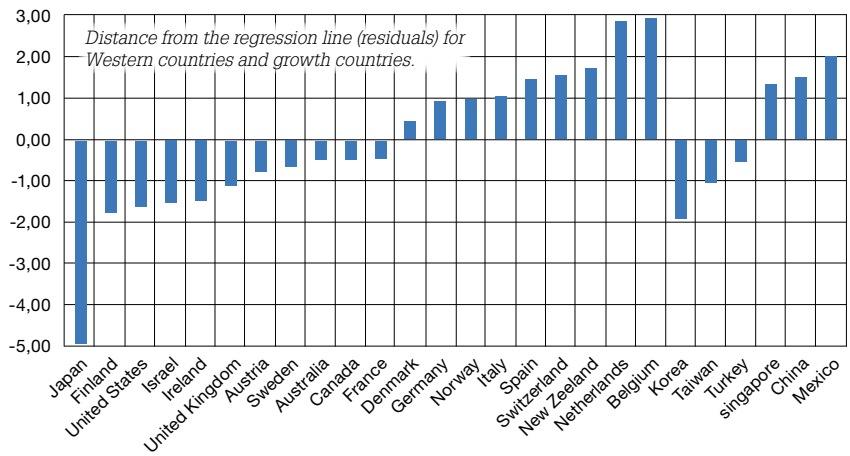
One means of avoiding countries' structural and organisational differences is to compare the relative change in publication volume with the relative change in revenue, with revenue expressed in local currencies adjusted for inflation. This measure (publication points per krona invested) is relatively unaffected by international differences but more sensitive to organisational changes over time within one country.

The figure below shows the mean change in the number of cited publications in the top 10% in the years 2002–11 as a function of the mean change in funding in 2000–09 for all the countries for which OECD data are available (provided that the number of publications at the beginning of the period exceeded 200 and the financial statistics are credible). The relationship is fairly strong and implies that the difference in funding explains 77% of the publishing difference. The remaining variation is, however, appreciable and this may be used to compare the efficiency of different countries' research systems, since the effect of variable funding is removed.

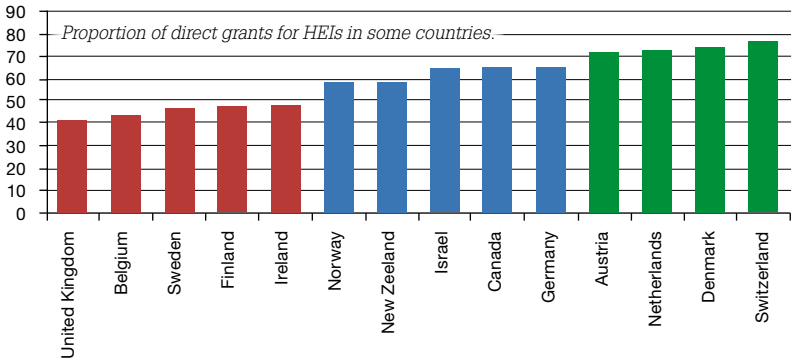


However, it is worth noting that several countries below the line, where the relationship points to their research systems being relatively inefficient, are among those marked by high publication volumes at the start of the period. There thus seems to be a marginal effect whereby already high efficiency makes it harder to raise it further. Regression including initial values (number of top 10% publications per funding, corrected for PPP) shows this variable as significant, raising its explanatory value to 82%.

Residuals, i.e. the difference between the actual change in the top 10% cited and the change that can be estimated from the regression, depict efficiency in a way that departs appreciably from the norm. This is partly connected with the inclusion of so many countries, several of which simply cannot be compared with Sweden. Among Western countries, however, the Netherlands and Switzerland may be said to be maintaining their joint lead with Belgium, New Zealand and Spain. But Denmark is only slightly better than average and the UK appears to have efficiency clearly inferior to the average (the mediocre publication trends for England and Scotland in recent years have the same implications).



Looking solely at Western countries and trying to find characteristics that affect efficiency, i.e. to relate the residuals to some other variable, one finds that the main shortcoming of the analysis is that it is difficult to obtain data for a sufficient number of countries. However, various national surveys are available and of the variables 'autonomy', 'academic freedom' and 'institutional funding' only the latter significantly co-varies with the residuals. Thus, the data imply that a high degree of external funding is negative for HE research. The figure below shows the HEIs' proportion of direct funding in a few countries.



A relatively detailed comparison between HEIs in Sweden and in the UK was made by Danell [2014, in Swedish only]. In his analysis, he studied the citation rate at a number of HEIs in the two countries and compared the HEIs after dividing them into two categories: older and newer HEIs. Danell found, for example, that publications from the British HEIs had a normalised citation impact of 1.7%, and 20% of publications belong to the 'excellent' category. The corresponding figures for Swedish HEIs, he stated, were a normalised citation impact of 1.55% and 18% of publications classified as 'excellent'. Here, then, a normalised impact of 1.7% means that it corresponds to a figure 70% higher than the worldwide benchmark.

Danell's analysis shows a major difference if the best HEIs in Sweden and the UK are compared. For example, seven British HEIs have a normalised citation impact exceeding 2.0, which represents a citation rate twice as high as the world average. The best Swedish HEI has a citation impact of approximately 1.8. Older and newer HEIs are also compared, and interesting differences between Sweden and the UK emerge. On page 22, Danell summarises them as follows (unofficial translation):

> *The analyses also showed that academic production from the newer Swedish HEIs is cited more than, or as much as, academic production from newer British universities. Articles written by researchers at older Swedish universities are, by comparison, less cited than those written at older British universities, despite the fact that a higher proportion of articles from older Swedish universities have been published in top-ranking journals.*

6

6. Discussion

Above, we present an overview of various countries' research policy and models for allocating research funds. We also attempt to briefly describe the state of knowledge associated with this subject. The purpose is, as mentioned in the introduction, to propose some positions for the sector regarding Swedish research policy and allocation models.

The overview opens with a summary of Swedish research policy over the past 20 years and how it is assessed in an international perspective. Öquist and Benner [2012] consider that Swedish research policy has been characterised by major changes. Its focus has been poor and throughout the period it has added new functions for the HEIs.

The HEIs undeniably have a complex reality to navigate. There are a large number of external research funders, which means that HEIs face numerous different and sometimes irreconcilable agendas and priorities. Moreover, successive governments have pursued a policy of choosing to see the whole HE sector outwardly as uniform, as if all HEIs formally have the same functions in education and research. This lack of clarity creates problems both for universities and for other HEIs in terms of being able to 'understand' their own role in the national system. This makes it more difficult for the HEIs to profile themselves.

In our overview, we have seen examples of what appears to be a considerably closer relationship between the government and the HE sector. Denmark and the Netherlands employ a type of 'contract' between the HEIs and the government that clarifies the HEIs' role. Several other countries in Europe use a similar type of performance contract. The EUA report on the DEFINE project gives 14 different examples in Table 4 [Pruvot 2015, p. 35] and describe the connection, if any, between the contracts and the research funding. A contract of this kind may entail stronger political control and involvement, but the picture we have obtained is

that the contracts are characterised by mutual respect for one another's role and that unnecessary control is avoided. We believe that this type of contract could, with advantage, be tested in Sweden. It could create a profiling of the HE landscape that would be desirable and positive.

Swedish HEIs are highly dependent on external funding. Since such a large share of their funding is external, there are limited opportunities for managements at various levels in the HEIs to act independently of the priorities set by the funders. Their long-termism suffers and therefore so, too, does their propensity to take risks, which is a key element in the living space of research. Research policy has also, to date, been clear about the wish to see the HEIs competing more for funding, and about external funding being a measure of success. This is shown, not least, by the allocation model applied to block grants, in which external funding is one of the indicators. The external research funders have also evidently played a key part in governments' allocation policy, in which strategic initiatives have been made to go through the funders. We believe that a reduced focus, and less dependence, on external funding than at present would have a favourable effect on long-term quality development.

A government inquiry [Sandström 2008] investigated the state external funders' activities, which were reformed in 2001. The inquiry took the view that these funders had not fully realised the intentions and ambitions underlying the reform.

Criticism included the assertion (on page 7) that the support for basic research was too fragmented and on too small a scale, and also that the support for making research useful, though proactive, was excessively unstructured.

The main criticism was, however, the absence of linkages among these areas of initiatives, and the limited interfaces between the Swedish Research Council, the Swedish Council for Working Life and Social Research (FAS) and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas), on the one hand, and VINNOVA, Sweden's innovation agency, on the other. The recommendation from the inquiry was to merge these four funding agencies into a single agency, the 'Research and Innovation Agency'. However, the then Swedish Government did not implement this recommendation, on the grounds [Swedish Govt. Bill 2008, p. 28] that diversity in the funding system is important. Instead, the agencies concerned were tasked with collaborating more.

One feature that makes the Netherlands unique, according to Dawson [2009], is the Netherlands Organisation for Scientific Research (NWO). This organisation

has numerous different roles and areas of responsibility: as research funder, owner of several research institutes and coordinator of part of the national strategic initiatives, for example. Accordingly, NWO has a very central position as an intermediary between the Government and the universities. NWO's role is highly reminiscent of the role as a concerting force that Sandström, in his report, recommends as something that should exist in Sweden.

Swedish universities and other HEIs have been subjected to a vigorous reform policy over the past 20 years. Governments have shifted from relatively clear control, with faculty grants and detailed initiatives for selected HEIs, to a policy of diminished governance through the direct state grants for the HEIs. Instead, much of the funding is steered through the research funders, both to prompt focused, often short-term initiatives and to generate competition. At the same time, one government after another has asserted the importance of, and responsibility for, keeping research free, independent and long-term. Moreover, policy has moved towards a higher degree of autonomy, with ever less regulation of the HEIs' internal organisation.

Other countries have also implemented major changes. The Netherlands seems to have undergone changes that are just as large but used the transformation to achieve favourable national development in research. In Denmark, too, there have been sweeping, transformative changes that have resulted in a positive trend there as well. It may be concluded from this that changes, if well considered, may be beneficial. Rather, what distinguishes the Netherlands and Denmark from Sweden in this particular respect is that the changes in Sweden have not yielded the same long-term prospects. The trend towards greater influence of external funders and often more short-term strategic initiatives did not give the Swedish HEIs the strategic room for manoeuvre that they needed.

If the Netherlands' research policy, expressed in goals and ambitions, is compared with what is expressed in Sweden's research bills, the difference between the two countries does not seem particularly large. On the other hand, they differ considerably in terms of policy implementation. As we described in Chapter 2, the Netherlands is distinguished by weakness of political control, which is probably a manifestation of the confidence enjoyed by the higher education sector in Dutch politics.

Similar confidence in the sector exists in the UK, where HEFCE is an intermediary between the Government and the HEIs, which guarantees the HEIs' auton-

omy. HEFCE's government remit is highly comprehensive, albeit brief, and leaves great scope for HEFCE to work freely to enhance the quality of research. Chapter 2 includes the whole remit and the priorities the Government wanted to see for 2016. In both the UK and the Netherlands, our perception is that the quality system introduced has been an important factor in gaining political confidence. In our view a similar development, i.e. for politicians to have confidence in long-term quality development, would be positive for Sweden as well.

In Chapter 3, we described various countries' systems for allocating research funds on the basis of performance. We find that there are slightly more countries that apply indicator-based allocation than peer review. We have reported on some research concerning, and experience of, different systems. Indicators are easy to use but hardly capture more than a portion of what distinguishes quality in research. Peer review also has many shortcomings and there is reasonable cause to believe that, in line with the conclusions drawn by Flodström [2011], peer review at national level lacks sufficient reliability to serve as a basis for allocating funds.

Wilsdon et al. [2015] take the view that the UK's REF system of allocating funds according to peer review cannot be superseded by anything else. According to the authors, no other system that can appraise research quality equally well exists. This is due partly to the difficulty of carrying out citation analyses in the humanities and parts of the social sciences. Their conclusion does not, however, imply that peer review in REF is reliable, but rather that it this is an assumption. There seems to be some correlation with certain indicators; see, for example, Mryglod [2014]. But this correlation is not proof of quality, unless we believe that these indicators can capture quality in research.

Although research appears to call into question the reliability of peer review at national level, the REF system has legitimacy in the British HE sector. Moreover, the Government is confident that the system will develop research in the country in the desired direction. These two aspects are crucial for the system's legitimacy in the UK and its continued use, despite heavy costs to the research community.

In the discussion on allocation models for research funding, it is important to clarify the purpose of introducing a particular model. The overriding purpose should be to develop Swedish research in the direction of higher quality and greater relevance, i.e. to be forward-looking. Discussing various models in the light of this purpose is therefore the most relevant approach. Eyre-Walker and Stoletsky [2013] discuss different systems' capacity to predict future success, and

their results indicate that the channel in which a publication is published, measured in terms of the journal's impact factor (i.e. its rank based on the number of citations), yields the most reliable prediction of publication quality and is superior to peer review or citation numbers as such.

The implication of their results is that a system based on the publishing channel's ranking results in favourable development. Systems based on this principle are used, as described above, in Norway, Finland and Denmark. The Netherlands, too, has developed this kind of system for its potential use as a quality measure in the national postgraduate programmes or graduate schools (see Chapter 2). The advantages of the system, apart from its potential predictive capacity, is its transparency and the fact that it has a major potential impact on researchers. Since the publishing channels regarded as foremost are known, the system provides a clear incentive for researchers to use the best ones. Other positive features of the system are that it can be applied to all academic fields and that it is cost-effective.

Analysis of the system in Norway shows that this system is successful in terms of boosting its performance regarding both quantity and quality. On the other hand, the system is not as successful in bringing about genuinely major successes in terms of citation analysis, according to the Danish evaluation. However, Heyman's analysis indicates that Norway is relatively successful — more so than Sweden. We believe that the Norwegian system needs modifying, for example by introducing more levels and improved balance in the points ratings to take into account the effects of fractionalised credit, to make it neutral among different academic fields. The conclusion on more levels is strengthened by the analyses performed in Eyre-Walker and Stoletsky [2013], where the journals are classified in considerably more levels. We think an improved system of this kind would be interesting to study in detail.

The associations demonstrated by Ulf Heyman [2014], and discussed in Chapter 5 above, are interesting and perhaps somewhat surprising. The first result is that there is a linear association between research funds and citations. The variations in citations, first, between countries and, second, between years in Sweden can largely be explained by corresponding variations in the volume of research funds. If the aim is to increase a country's citations, the simplest way is thus to boost research funds. There appears to be a further, if weak, connection. This is an effect of the second order, and relates to variations in citations over and above the impact of changes in research funding. According to Heyman's analysis, there

appears to be a connection between a country's resource base and its success in terms of citations. Successful countries more often have a larger base. Switzerland, the Netherlands and Denmark are examples of countries that are successful and have a high proportion of funds, approximately 70%, in their resource base. The UK, on the other hand, is not particularly successful in Heyman's analysis; nor does it have a particularly large share of funds in its resource base, which is instead on a par with Sweden's.

Given this background, one might draw the conclusion that an increase in the resource base in Sweden would have a positive effect in the form of more citations. However, this may be a simplistic conclusion. Many different factors influence a country's successes, and there may be covariation with other factor. A citation analysis of the publications emanating from projects supported by the state research funders has been performed [Swedish Govt. Bill 2012, Table 5.2, p. 39]. This type of analysis entails certain difficulties but, if correct, shows that projects supported by the state funders result in publications that are cited more than the average for publications in Sweden in the same field. The conclusion from this analysis appears to point in the opposite direction to the conclusion drawn from Heyman's results, i.e. that reducing the resource base for the HEIs and allocating more funds through the state funders would raise the citation rate.

These two ostensibly different conclusions may be made reconcilable with the following reasoning. The effect demonstrated by Heyman is due not only to the size of the resource base but also to other factors that play a part in the context, and co-vary with the size of the base. One such factor pinpointed by Öquist and Benner [2012] is that successful countries like the US, Switzerland, the Netherlands and Denmark have a strong quality culture and that this is among the keys to their success. Here, the facts about these countries that we have reported confirms Öquist and Benner's assertion. The conclusion for Sweden may therefore be that *combining an increase in the size of the resource base with strengthening of the quality culture results in research of higher quality and greater efficiency*.

Heyman's analysis does not indicate that using peer review to allocate research funds is a success factor. Of three successful countries — the Netherlands, Switzerland and Denmark — none use peer review to allocate funding. The UK, which does, is not particularly successful according to Heyman's analysis. The low share constituted by the resource base and the use of peer review for resource allocation combine to create, for the British HEIs, a short-termism that does not favour qual-

ity development. The Netherlands, as we discussed in Chapter 2, has a national quality system based on peer review, but opted not to allocate funding on this basis. On the other hand, the quality system has been a central factor in developing the quality culture. Analyses performed in the Netherlands [Drooge 2013] show that all the universities and research institutes now have roughly the same impact on their own publications and that this impact has increased since the quality system was introduced.

Spain makes a good showing in Heyman's analysis, with its *sexenio* system of peer review at individual level, which is described briefly in Chapter 4. But this is a voluntary and relative simple, two-tier form of assessment. New Zealand, which also does well in Heyman's analysis, also has an individually based system of peer review. Australia's peer-review system has similarities to that of the Netherlands since in the former, too, the proportion of funds allocated by means of peer review is relatively small [VR 2014, p. 86].

SUHF has been working for some time to bring about a comprehensive basic grant for education and research. The research side also includes education at postgraduate level. In recent years, postgraduate education has undergone a relatively large decrease in Sweden. This is probably because funding senior researchers has been a higher priority than funding postgraduate education, to make it possible to enhance performance in the form of publications and external funding. There is a weak financial incentive for an HEI to engage in education and it is also, at the same time, very important for replacement of researchers and HE teachers that postgraduate education should not decrease excessively. One way of avoiding this is to introduce a system like the Dutch or Finnish, in which research funds are allocated partly on the basis of performance in postgraduate education. Finland has a relatively extensive system of this kind in which internationalisation, too, is rewarded by means of funding allocation [Finnish Ministry of Education and Culture 2015]. Like education at other levels, a cap (i.e. a ceiling for maximum remuneration) can be introduced on payment for these categories of performance, with the cap varying from one HEI to another. The latter feature would also clarify the division of roles among different HEIs.

7

7. Conclusions and recommendations

In this report, we describe and discuss various countries' research policy and models for allocating research funds. The Dutch system stands out as exemplary in terms of, first, being one of the foremost in research and, second, having developed a strong quality culture. Another model that Sweden can, in some respects, learn from is that of Denmark.

On the basis of the overview compiled, we propose some recommendations on research policy.

Research policy must become clearly defined to make it possible for Swedish HEIs to improve further in three key respects:

Clarify the HEIs' various roles and develop their long-term profiling

a. The HEIs' roles in the research landscape need to be defined. Instead of them all having the same remit, efforts should be made to develop distinctive profiles. This must be done in close collaboration, and with mutual respect, between the Government and each institution.

Develop the HEIs' capacity for strategic renewal and prioritisation

a. The proportion of basic research funding for the HEIs needs to rise. One benchmark should be that basic grants should make up roughly 65% of aggregate research resources in the sector.

b. The research funding landscape needs to be coordinated. Coordination of public-sector research funders in Sweden would have positive effects. It may therefore be worth further exploring how the state research funders can coordinate their work more or, alternatively, merge to form a single agency.

c. Greater flexibility in the use of block grants for research and education would enhance freedom and reduce inefficiency due to actuarial difficulties. Together, education and research form a whole that is hard to split entirely into the current accounting areas. While it is important for each of the core activities to be fully funded, the HEIs should have the freedom to regard their work as a whole, although a block grant is calculated on the basis of various activities and results.

Reinforce the HEIs' quality culture with responsibility for their own quality development

a. Make the HEIs themselves responsible for safeguarding and developing the quality of their own research by means of external peer review. Do not introduce a national model for resource allocation on the basis of external review.

b. Investigate further whether an improved model of publication performance along the lines of the Norwegian or Danish model could be introduced.

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8. References

[Aagaard et al. 2014] Aagaard, K., Bloch, C., Schneider, J. W., Henriksen, D., Ryan, T. K. & Lauridsen, P. S. *Evaluering af den norske publiceringsindikator* ('Evaluation of the Norwegian publication indicator'). Danish Centre for Studies in Research and Research Policy (CFA) on behalf of the Norwegian Association of Higher Education Institutions (UHR), Aarhus University, 2014.

[Ahlgren 2013] Ahlgren, P. *Indikatorn* source normalized impact per paper *i relation till den norska modellen* (*'The "source-normalised impact per paper" indicator in relation to the Norwegian model'*). Stockholm University 2013, http://www.sub.su.se/media/826307/nm-snip.pdf http://www.sub.su.se/media/826307/nm-snip.pdf.

[Brändström 2007] Brändström, D. *Resurser för kvalitet* (*'Resources for Quality'*). SOU 2007:81.

[Danell 2014] Danell, R. *Starka forskare och starka forskningsmiljöer vid nya universitet och högskolor* (*'Strong researchers and strong research environments at new higher education institutions'*). Report from Inforsk research group, Department of Sociology, Umeå University 2014.

[Dawson 2009] Dawson, J., van Steen, J. & van der Meulen, B. *Science systems compared: A first description of governance innovations in six science systems.* The Hague, Rathenau Institute 2009.

[EC 2010] *Assessing Europe's University-Based Research*, European Commission report, EUR 24187 EN.

[EC-Ch 2015] *Private Sector Interaction in the Decision Making Processes of Public Research Policies. Country Profile: Switzerland,* European Commission's website, http://ec.europa.eu/invest-in-research/pdf/download_en/psi_country-profile_switzerland.pdf.

[EC-Dk 2015] *Private Sector Interaction in the Decision Making Processes of Pu-*

blic Research Policies. Country Profile: Denmark, European Commission's website, http://ec.europa.eu/invest-in-research/pdf/download_en/psi_countryprofile_denmark.pdf.

[Elsevier 2013] *International Comparative Performance of the UK Research Base — 2013*, a report prepared by Elsevier for the UK's Department of Business, Innovation and Skills.

[Eyre-Walker and Stoletsky 2013] Eyre-Walker, A. & Stoletsky, N. 'The Assessment of Science: The Relative Merits of Post-Publication Review, the Impact Factor, and the Number of Citations'. *PLoS Biology* 11(10): e1001675. doi:10.1371/journal.pbio.1001675, 2013.

[Finnish Ministry of Education and Culture, 2015] See website: http://www.minedu.fi/export/sites/default/OPM/Koulutus/yliopistokoulutus/hallinto_ohjaus_ja_rahoitus/liitteet/uni_funding_model_2015.pdf.

[Finnish Publication Forum, 2015] See website: http://www.julkaisufoorumi.fi/sv/bedomningar/klassificeringsgrunder.

[Flodström 2011] Flodström, A. *Prestationsbaserad resurstilldelning för universitet och högskolor ('Performance-based resource allocation for higher education institutions')*. Report from the Swedish Ministry of Education and Research, 2011.

[Geuna and Martin 2003] Geuna, A. & Martin, B. R. *University Research Evaluation and Funding: An International Comparison*. Minerva, 41 (4), 277–304.

[HEFCE 2015] PPT presentation from HEFCE, private communication HEFCE, 2015.

[HECFE funding 2015] Annual grant letter to the Higher Education Funding Council for England. 2015, downloadable from http://www.hefce.ac.uk/news/newsarchive/2015/Name,100772,en.html.

[Heyman 2014] Sandström, U., Heyman, U. & van den Besselaar, P. 'The complex relationship between competitive funding and performance', in E. Noyons (ed.), *Context Counts: Pathways to Master Big and Little Data*. STI 2014, Leiden University: Centre for Science and Technology Studies (CWTS), pp. 523–533.

[Heyman 2015] Sandström, U. & Heyman, U. 2015, 'Funding and research quality', in RJ's Yearbook 2015/2016, *Thinking Ahead: Research, Funding and the Future*. Makadam Publishers, pp. 39–60, and material undergoing revision for publication.

[Hicks 2012] Hicks, D. *Performance-based university research funding systems,* Research Policy 41 (2012): 251–261.

[IVA-Nifu 2014] *Mot en kunskapsbaserad forskningspolitik? En jämförande studie av några lander i Europa (''Towards a knowledge-based research policy? A comparative study of some countries in Europe')*. Report from the Nordic Institute for Studies in Innovation, Research and Education (NIFU), commissioned by the Royal Swedish Academy of Engineering Sciences (IVA), 2014.

[Karlsson 2012] Karlsson, S. & Persson, O. *The Swedish production of highly cited papers*. The Swedish Research Council's 'little report series' 5:2012.

[Kesselberg 2015] Kesselberg, M. *Forskningsresurser baserade på prestation ('Research resources based on performance')*. Report from the Swedish Higher Education Authority (UKÄ), 2015:15.

[Langberg 2003] Langberg, K. *Changes in Research Management at Danish Universities and Government Research Institutes*. Danish Institute for Studies in Research and Research Policy 2003/04.

[Manville 2015] Manville, C., Morgan Jones, M., Henham, M-L., Castle-Clarke, S., Frearson, M., Gunashekar, S., Grant, J. *Preparing Impact Submissions for REF 2014: An evaluation*, RAND report commissioned by HEFCE, 2015.

[Mryglod 2014] Mryglod, O., Kenna, R., Holovatch, Y., Berche, B. *Predicting results of the Research Excellence Framework using departmental h-index.* arXiv-1411.1996, 2014.

[NL evaluation, 2015] *Standard Evaluation Protocol, Protocol for research assessments in the Netherlands 2015–2021*. Downloadable from the Royal Netherlands Academy of Arts and Sciences (KNAW), https://www.knaw.nl/en/news/publications/standard-evaluation-protocol-2015-2013-2021?set_language=en.

[NL Govt., 2011] *Quality in Diversity*. The Netherlands Government Strategic Agenda for Higher Education, Research and Science, 2011.

[NL Govt., 2014] 2025 *Vision for Science*. The Netherlands Government, 2014. See also the Government's website, http://www.government.nl/issues/science/science-in-question.

[Oddershede 2009] Oddershede, J. *Danish Universities: A Sector in Change*. Universities Denmark: Report 2009-1111-07.

[OECD Spain, 2007] *OECD Economic Survey of Spain*. 2007.

[PA Consulting Group 2008] PA Consulting Group. RAE 2008 Accountability Review. Available from http://www.hefce.ac.uk/media/hefce/content/pubs/2009/rd0809/rd08_09.pdf.

[Pruvot 2015] Pruvot, E. B., Claeys-Kulik, A-L. & Estermann, T. *Designing Strategies for Efficient Funding of Universities in Europe*. EUA report on the DEFINE project, 2015.

[Rathenau 2015] Rathenau Institute website. http://www.rathenau.nl/en/web-specials/the-dutch-science-system/policy-and-advice/science-policy.html.

[Sandström 2008] Sandström, M. *Research Funding: Quality and Relevance*. SOU 2008:30.

[Spain 2015] Private communication from Spanish Vice-Chancellor, 2015.

[Swedish Govt. Bill 1992] *Research for Knowledge and Progress*. Swedish Government Bill 1992/93:170.

[Swedish Govt. Bill 1996] *Research and Society*. Swedish Government Bill 1996/97:5.

[Swedish Govt. Bill 2000] *Research and Renewal*. Swedish Government Bill 2000/01:3.

[Swedish Govt. Bill 2004] *Research for a Better Life*. Swedish Government Bill 2004/05:80.

[Swedish Govt. Bill 2008] *A Boost to Research and Innovation*. Swedish Government Bill 2008/09:50.

[Swedish Govt. Bill 2012] *Research and Innovation*. Swedish Government Bill 2012/13:30.

[van Drooge 2013] van Drooge, L., de Jong, S., Faber, M. & Westerheijden, D. *Twenty Years of Research Evaluation*. Rathenau Institute, 2013.

[VR 2014] *Forskningskvalitetsutvärdering i Sverige – FOKUS ('Research quality evaluation in Sweden: FOKUS')*. Report from the Swedish Research Council, 2014, ISBN 978-91-7307-250-2, ref. 111-2013-2496.

[VSNU 2015] PPT presentation from the Association of Universities in the Netherlands (VSNU) in 2015. Private communication from VSNU, 2015.

[Wilsdon 2015] Wilsdon, J., Allen, L., Belfiore, E., Campbell, P., Curry, S., Hill, S., Jones, R., Kain, R., Kerridge, S., Thelwall, M., Tinkler, J., Viney, I., Wouters, P., Hill, J. & Johnson, B. The Metric *Tide: Report of the Independent Review of the Role of Metrics in Research Assessment and Management.* DOI: 10.13140/RG.2.1.4929.1363, 2015.

[Öquist and Benner 2012] Öquist, G. & Benner, M. *Fostering breakthrough research: A comparative study*. Report from the Royal Swedish Academy of Sciences, 2012.

Appendix

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Appendix 1. Swedish research policy, 1992–2015

The following is a brief account of the Swedish Government's bills on research policy since 1992.

1992 Research Bill: Research for Knowledge and Progress

In this Research Bill [Swedish Govt. Bill 1992], the Government gives priority to two main aims:

- concentrating research initiatives in strategic areas
- strengthening interaction between higher education institutions (HEIs) and business and society at large.

Additional aims are:

- enhancing renewal capacity in research at HEIs
- boosting researcher recruitment
- expanding international collaboration.

The starting point for these priorities is, according to the Government, that research policy has to adapt to new conditions in society. Competition is increasingly stiff, and this is changing the demands that society must meet. The Bill also highlights the importance of research contributing to an open, tolerant and vibrant society. Wide-ranging knowledge development is vital to enable current research results from other parts of the world to be used and exploited in Sweden. The fact that a country with a small population, such as Sweden, has to concentrate its efforts in a few strategic areas where it has an international lead is also pointed out.

The Bill states that one long-term priority in Sweden has been to channel the greater part of state research resources to HEIs. This kind of strategy requires companies and the public sector to be given access to the research conducted at HEIs. Further development of established forms of collaboration and development of new ones is therefore needed.

The Bill also emphasises that the HEIs' renewal capacity in research needs to be improved. The HEIs must also become better at tackling new problems and challenges. Another shortcoming identified relates to researcher recruitment. Sweden is found to have a low proportion of people with postgraduate education. The Government seeks to promote the inception of dynamic research environments by:

- mergers of relatively small HEI departments to form larger units
- special initiatives by research councils to foster young researchers, researcher mobility and cross-border research
- more highly developed faculty procedures for allocating research resources to groups and individuals
- introduction of a national system for activity-based allocation of resources according to postgraduate education and research activity.

The Government seeks to promote recruitment of researchers by means of various measures to boost volume and throughput in postgraduate education.

The Bill asserts that the state's role in research policy is, above all, to conserve and develop academic infrastructure, i.e. by concentrating on more fundamental and intradisciplinary parts of research and postgraduate education. It is also stated that contributing to knowledge development in areas of particular interest to various sectors of society, by supporting research with particular purposes, is an important task for the state. Moreover, the state has a role in fostering research in key industrial sectors.

For the HEIs' intradisciplinary research, according to the Bill, the greatest possible freedom must be guaranteed. One important step was taken in December 1992 with the implementation of an amendment to the Higher Education Act that gave the HEIs considerably greater freedom, for example to use their own resources for research and education as they saw fit. The HEIs were also given freedom to create their own institutional organisation, set up professorships and create career paths for teachers and researchers. In the 1992 Bill, the state's role is to assume responsibility for overall prioritisation among different research areas. It is also stated that systems of resource allocation and evaluation need to be

shaped in such a way as to foster inception of creative research environments and promote high quality. Pluralism with respect to funding sources and assessment criteria is thought to be particularly valuable. In some cases, focused support for especially urgent and neglected areas of knowledge is justified.

One way of making these ambitions achievable is to revise priorities. Above all, however, new resources from the now dissolved 'wage-earner funds' mean that exceptional opportunities are created for Swedish research. These resources are to be channelled to strategically important areas in science, technology, medicine, the environment and cultural studies.

The 1992 Bill allocates funds totalling some SEK 8.2 billion to research and postgraduate education. Of this funding, 51% is allocated as a block grant to the HEIs and the remainder to research councils etc. The funds allocated to the HEIs are earmarked for each HEI and faculty. The Bill contains assessment of and conclusions on research in the various faculty areas as a whole, but also for the specific HEIs, and makes a corresponding assessment of the various research councils, with conclusions regarding their measures.

Although the outcome of the 1993 general election was the Social Democratic Party's return to power, the Bill was implemented in a relatively intact form except for the activity-based allocation model. Foundations to manage the wage-earner funds were introduced before the change of government and have influenced HE research considerably since then. First, they have helped to boost the proportion of external funding. Second, they have changed the nature of research projects by imposing greater demands on co-funding, larger programmes, a more distinct emphasis on benefits and clearer external governance.

1996 Research Bill: Research and Society

In its 1996 Research Bill [Swedish Govt. Bill 1996], the Government sets out to improve Sweden's capacity to develop knowledge of high quality and relevance that can be utilised better in society. It therefore considers that closer relations between research and other sectors of society and increased collaboration among stakeholders in the research system are necessary. The concerns of research must correspond to society's needs. Accordingly, research must relate to all areas in society and contribute to development in these areas.

Overarching goals to which research must contribute according to the Government are:

- new essential facts about the natural environment, society and culture, and perspectives on the place of humankind in the universe, in Earth's ecosystems and in history
- preserving and developing health, culture, welfare and the environment for all individuals and population groups in society, and also for future generations
- promoting economic development, efficiency in the business and public sectors and society's progress towards sustainable development, and thus also fostering employment and prosperity
- a high general level of education and promotion of cultural development critical thinking and scientific approaches in society, thereby fostering and strengthening democracy
- international collaboration and peace, and solutions to global problems.

The following general guidelines are laid down for research policy.

- The focus of research must correspond to society's needs and research must be put to good use.
- Overall research-policy decisions must be taken by the Government, while bodies with expert knowledge in the fields concerned decide on the details of funding allocation and activities.
- Stringent quality requirements in terms of scholarship must be imposed on state-funded research.
- Joint action with the community at large must increase.
- Greater attention must be paid to problems of research ethics and researchers' responsibility in these matters.
- Gender equality in research must increase, and the same applies to research with a gender perspective.
- The connection between education and research must be strengthened.
- All higher education institutions must control the use of their own research resources.
- Swedish research must engage in an active interplay with research in other countries.
- Sweden must work for EU-funded research to give broad support to development in Europe.

The Bill therefore proposes that international evaluations be conducted of all research fields funded by the state, and that all HEIs should receive fixed research

resources through the grant of research funds to small and medium-sized HEIs. This will improve prospects of long-term knowledge development, and enable collaboration with the regional business community to keep increasing. Another reason is that the Government wants to see a greater connection between education and research, which investing in a particular resource base at all the HEIs will provide.

The Government wishes to facilitate Sweden's participation in the EU's Sixth Framework Programme. Its particular priorities are the areas of humanities, social sciences, environmental research and support for small and medium-sized enterprises' (SMEs) participation in EU research aimed at boosting growth and employment, and at achieving solutions to global problems and concrete social problems in Europe.

The Government considers that the existing research system is broadly appropriate for achieving the goals that the Government has, and for complying with its guidelines, for research and research policy. No major organisational changes are therefore proposed. On the other hand, the Government wishes to see closer collaboration among public agencies in certain special areas.

Examples of measures to enhance collaboration and improve the usefulness of research are new professorships in production technology; a plan to start a technical research institute; and new initiatives in, for example, provision of technology and skills to SMEs, use of IT and service production.

To enhance the research councils' potential for renewal and mobility in research, allowing them to set up time-limited professorships is proposed. The Bill also proposes that the Swedish Council for Research in the Humanities and Social Sciences should receive a resource increment to boost the number of junior researcher positions.

For the 1995/96 fiscal year, the 1996 Bill allocates funds for research and postgraduate education totalling some SEK 9.9 billion.

The clearest repercussion of this Bill is the establishment of more research at HEIs.

2000 Research Bill: Research and Renewal

This Research Bill [Swedish Govt. Bill 2000] states that the objective of the Government's research policy is for Sweden to be a leading research nation, in which high-quality scholarship characterises the research. Sweden must be one of the world's most R&D-intensive countries, which calls for the continuation of major inputs from both the state and the business sector. All research must be of high quality, and research initiatives must accommodate both breadth and spe-

cialisation. Sweden must become a modern knowledge society that includes everyone. Government policy therefore involves extensive investments in education at all levels and in research.

One starting point for this Bill is the imminent generation change in Swedish research. To bridge the gaps, in terms of forthcoming retirements (pension attrition) and the growing need for researchers with postgraduate training, initiatives are to be implemented in postgraduate education in the form of national programmes or graduate schools, and funds are to be granted for recruitment of young researchers.

Another premise is the need to create better scope for concentrating forces in strategic research areas and fostering interdisciplinary and multidisciplinary research. The Bill proposes initiatives in a number of priority areas: bioscience and biotechnology, information technology and IT research, materials science, humanities, social sciences, educational science, art, care sciences, and the environment and sustainable development. The Government has previously decided to set up, on 1 January 2001, a new agency organisation for research funding that the bill proposes should receive increased resources. The Government is also developing its view of the agencies' activities. Expansion of the Universities of Karlstad, Växjö and Örebro is continuing, and all the HEIs are to receive increased research resources.

The Bill lays down that the state bears special responsibility for guaranteeing research freedom and supporting basic research and postgraduate education. These are considered to make up the foundation of other knowledge development and provision of knowledge, and are therefore of the utmost importance in meeting society's, including the business sector's, knowledge and skills requirements. Modern basic research can hardly be conducted on a reasonable scale without public funding. One reason for this is that the long-term quest for knowledge entails taking high risks, in the sense that it is difficult to assess the future usefulness of research results in advance. Moreover, the findings of basic research must be freely available in order to contribute to general development of knowledge.

The Bill includes measures to increase the use of examinations in postgraduate education. In the knowledge society, the need for people with postgraduate education is increasing both in higher education and in society.

The Bill lists the following priority issues:

- More concentration of efforts, prioritisation and profiling in vitally important research areas; investment in young, talented researchers; a higher

proportion of women at all levels in the research community; competitive and dynamic research environments and increased mobility in academic research, national and international alike.

- More highly developed collaboration among HEIs, both internationally and nationally. Better provision of information and more collaboration with the community at large are important for all parties: research is then enriched with ideas and questions found outside academia while society at large can simultaneously learn about the research results.
- A new, strengthened agency organisation for research funding.
- Development of cutting-edge skills in key research fields: bioscience and biotechnology, information technology, materials science and materials technology will receive a total of SEK 275 million in the period to 2003. The area of environment and sustainable development will receive SEK 20 million in the same period.

Quality requirements are once more emphasised. Most of the research resources will be allocated after review by national research funders. These research funders perform regular evaluations of research programmes and whole research areas. One fundamental requirement of this quality work is that the research must be scrutinised by researchers, since only researchers have the academic expertise to determine what constitutes good academic quality.

Apart from the Swedish Research Council, which will play a central role in the future agency organisation, special research councils are to be set up in two areas: first, work sciences and studies of society and, second, the environment, agriculture, forestry and fisheries, and urban development, where the Government sees a great need for knowledge. In addition, a more efficient and hard-hitting organisation will be created for needs-driven research, to support the Swedish innovations system and for sustainable development and growth.

The budget to be presented entails an increment in funding for research, especially basic research and postgraduate education, of SEK 1,279 million for the period 2001–2003.

This Bill entailed a clear emphasis on project-funded research and, accordingly, increased external funding. The research councils were brought considerably closer to the Government by being given clear-cut governing boards and agency functions. National postgraduate programmes (graduate schools) were set up and have had a positive influence on postgraduate education. Expansion of non-university HEIs and new universities continued.

2004 Research Bill: Research for a Better Life

This Bill [Swedish Govt. Bill 2004] announces a permanent strengthening of the research and postgraduate education level through extra transfers of SEK 2.34 billion: SEK 521 million to be paid to the HEIs directly and the remainder to be allocated among research councils etc.

Research policy from the previous period still stands. By ensuring that outstandingly talented researchers receive enough support to develop independent, innovative research, Sweden can keep the best Swedish researchers and also attract distinguished researchers from other countries.

While having a clear, explicit responsibility for basic research, the state also has an interest in supporting research to meet the needs of various sectors of society, including the business sector.

During the period, the Government aims to start the following strategic initiatives, for example:

- Initiatives in the priority research areas of medicine, technology and research to support sustainable development, and also in certain other areas, such as research in design, gender studies and educational sciences.
- Good prospects should be ensured for the researchers of the future through initiatives in positions conferring qualifications for academic careers, and in national postgraduate programmes (graduate schools).
- Resource inputs should be provided to fund research infrastructure in all areas.
- The HEIs should draw up action plans for commercialisation and technology transfer. The holding-company structure is reviewed and strengthened with a capital contribution.
- Special initiatives will be undertaken to expand SMEs' interface with research. A long-term strategic investment in the industrial research institutes will be made.

The Bill also makes the following observations (page 54 in the original Swedish document):

- 'The Government's aim is for research to be of consistently very high quality. A substantial share of research resources should therefore be applied for in competition, and the quality of applications should be scrutinised by means of peer review.'

As a comment to the fact that the HEIs had stated that the high proportion of external funding entails difficulties:

- 'The resources earmarked by the state for the respective HEIs' research and postgraduate education [should] provide a basis for developing good research environments in which new, untried research specialisations get the chance to develop. The resources directly allocated to HEIs must also enable them to decide on their own priorities, and also make possible collaborations with institutes, the business sector and the community at large, as well as with other HEIs. These collaborations can strengthen the HE system's organisation and quality, and also bring increased profiling and division of labour.

This Bill represents perhaps the clearest investment in project-funded research. The Swedish Research Council (VR) becomes a dominant player.

2008 Research Bill: A Boost to Research and Innovation

The 2008 Bill [Swedish Govt. Bill 2008] gives a powerful boost to resources for research and postgraduate education: SEK 5 billion. The HEIs' share of this increment amounts to more than SEK 3 billion. At the same time as this increase in grants, the new funds are allocated on the basis of quality indicators. A proportion of existing grants is reallocated according to the HEIs' capacity to attract external funding and to a quality assessment of each HEI's research, for the purpose of strengthening research and facilitating the HEIs' internal quality work.

The bill has two fundamental starting points. First, the greatest challenges to humankind — those related to climate change, energy, water supply, poverty, demographic shifts, international conflicts and pandemics — cannot be tackled successfully without new knowledge. Second, Swedish competitiveness in a globalised knowledge economy must be based on a high knowledge content in our export products, and research, development and innovation are therefore central components of growth policy.

In this bill, the Government is launching a new element in the research-funding system: strategic initiatives. The investment in strategic research areas totals SEK 1.8 billion. The HEIs, possibly in collaboration with other HEIs or researchers, must compete for grants for broad research initiatives in the strategic areas of medicine, technology and climate that have been identified by the Government as important to Sweden. This funding is included in the block grant for the HEIs that have received them, and the system therefore functions as an allocation model based on peer review.

The contribution to the Swedish Research Council for infrastructure proposed in the Budget Bill for 2009 is SEK 100 million. As a planning requirement, the grant should be raised by a further SEK 50 million by 2012.

The Government has invited other countries to join in the construction of the neutron research installation in Lund known as the European Spallation Source (ESS). Funding is taking place within existing limits.

Collaboration with researchers in other countries is a natural part of research on the international research front. To facilitate this collaboration, the Government has concluded agreements on research collaboration with various countries. This too is being funded within existing limits.

In the Government's estimation, Swedish research suffers from several grave problems by international standards. These may be summarised in the following points:

- Inadequate quality. To an excessive degree, the direct research grants to the HEIs ('faculty grants') have been allocated without competition or independent quality assessments.
- Fragmentation and lack of long-termism. Underfunding and short-termism in the provision of grants have resulted in inadequately quality-driving effects from the research councils' resource allocation.
- Poor interdisciplinarity. The disciplines' rigid territorial boundaries and the research funders' inadequate cooperation have restricted scope for interdisciplinary research.
- Poor commercialisation. Research results have too seldom culminated in jobs, new products and growth in Sweden.
- Constant challenges to the independence and integrity of research. Inadequate public-sector research investments risk creating an imbalance that adversely affects the integrity of basic research. Another risk is politicisation of academia.
- Poor capacity to create long-term, coordinated strategic initiatives. Emergence of the will and ability, at national level, to engage in long-term strategic research initiatives and prioritisation has been lacking.

A new allocation model for part of the direct grants is to be introduced. This model is based on the HEIs' scope for attracting external funding and their publication numbers combined with a citation analysis. This method of quality-based allocation and redistribution is also intended to encourage HEIs to find research profiles

that give them competitive advantages in relation to others. A clearer division of roles among HEIs and increased specialisation is thus attainable.

Dependence on external grants has brought about a decline in the researchers' time for free, unrestricted research. Simultaneously, it is argued that review and allocation of research grants following applications in competition is a way of allocating research resources according to quality and academic criteria, and one that is hard to beat.

For the strategic initiatives, there were three guiding criteria when the Government prioritised the strategic areas:

- research that can help to find solutions to urgent global problems and issues
- areas where Sweden already has world-class research
- areas where there are Swedish companies engaged in their own R&D, and where state measures strengthen the business sector's and Sweden's development and competitiveness.

The system of strategic research areas is aimed at concentrating research efforts in areas where Sweden has good scientific and industrial prospects. The system is also expected to help improve research quality; enhance conditions for commercialisation; encourage interdisciplinary approaches; and boost the sector's scope for obtaining EU funds.

An official report, *Research funding – quality and relevance* (SOU 2008:30), proposes that the state research funders should merge into one. This proposal will not be implemented. Diversity in the funding system is important. Instead of them merging to form a single large agency for external funding of research, the agencies concerned should be assigned to collaborate more closely within the framework of the present organisation.

The Bill resulted in a clear increase in total funding in relation to most comparable countries, and the two different funding models were implemented. On the other hand, the degree of external funding has continued to rise although this was seen as a problem in the Bill.

2012 Research Bill: Research and Innovation

The 2012 Bill [Swedish Govt. Bill 2012] is presented as the first step in a further vigorous investment in Swedish research that would entail a successive rise by SEK 4 billion altogether up to and including 2016. The HEIs' direct grants for re-

search and postgraduate education are set to increase by SEK 1.2 billion during the period. These raised grants also include investments in a national centre for research in life sciences, the Science for Life Laboratory (SciLifeLab), research on drug development and artistic research.

The Government proposes an initiative of SEK 300 million (by completion) for the Swedish Research Council, for international recruitment of outstanding researchers and support for young researchers.

Investments in life sciences research, totalling SEK 455 million for 2013, are also proposed and one planning premise is that the funding should be raised by SEK 600 million by 2016. This investment includes focused initiatives for research on infections and antibiotics, ageing and health, treatment research, clinical studies, register-based research, research on drug development, increased funding for SciLifeLab, and an institute for process development and catalysis. In addition, the Swedish Research Council and the Swedish Council for Working Life and Social Research (FAS) should implement an initiative in research in the care sciences.

To strengthen the international competitiveness of Swedish research, the Government has the following starting points for the assessments made in this bill:

- long-termism and resource increments to provide greater scope for quality and risk-taking
- more of a focus on individuals and good conditions for researchers
- heavier investments in research to meet the needs of society and the business sector
- greater use of research-based knowledge.

To pave the way for free, independent research, the direct grants paid to HEIs for their research and postgraduate education are crucial. With these funds, researchers get opportunities to conduct long-term research, and to choose their own research areas and questions freely. It is therefore the Government's view that there needs to be a massive increase in the direct grants for HEIs.

The research is of great breadth, but in a country of Sweden's size it is not possible to be best at everything. Cutting-edge research, in the areas where Swedish research has the potential to be among the foremost research worldwide, must be prioritised.

Recruiting researchers at a high international level is, in the Government's view, another key measure for a capacity to develop Swedish research. It should then be possible to give them favourable conditions for further developing their research in Sweden. Moreover, this requires Sweden to be capable of offering attractive research environments.

The previous research and innovation bill identified a number of what were termed 'strategic research areas', and resources have been set aside for long-term research in these areas. The 2012 Bill now identifies additional areas in which to launch focused initiatives in long-term research and knowledge building accumulation for business and society. These areas include research on mining, minerals and steel; forest raw materials and biomass; and sustainable urban development.

This Bill pays particular attention to life sciences, an area of major importance to Sweden as a country of advanced technology, and to Sweden's contributions to finding solutions to global problems in the area of health care, for example.

The Government also presents a number of measures to further improve the preconditions for HEIs to assume responsibility for their own functions and work to put research-based knowledge to practical use.

Regarding Swedish research, the Bill also draws the following conclusion. Swedish research is broad, but has problems with the cutting edge. Its quality is generally not poor, nor has it deteriorated sharply. But given the rapid improvement taking place in a number of countries, Sweden finds it difficult to compete.

This conclusion prompts the Government to propose measures aimed at enhancing the quality of Swedish research and making it more useful. A handful of measures should, in the Government's view, be taken to lay the foundations of long-term favourable development of the quality and efficiency of Swedish research, in terms both of its scholarship and of utilising its results:

- Grants for HEIs' research and postgraduate education should be increased by SEK 900 million up to and including 2016.
- A larger share of existing funds, and all new funding, should be allocated according to quality criteria that also partly measure collaboration.
- A special allocation of resources based on assessment of quality, performance, relevance and utilisation of research results should be introduced with effect from 2013.

- A special programme for recruiting foreign researchers at a high level should be set up, and by 2016 funding for this programme should total SEK 250 million.
- A special initiative to provide better career opportunities for young, promising researchers should be implemented.

The Bill also describes Swedish HEIs as heavily dependent on external funding. 'External funding' means funds awarded to researchers following their application to a research funder. In 2011, 43% of total revenue for research and education at postgraduate level was from research grants and 57% from external funding. Many individual researcher and research groups may be exclusively dependent on external grants. These grants are a key quality-driving factor, but excessive dependence on external funding also brings uncertainty and short-termism that impede long-term planning by individual researchers, as well as by the HEIs. Risk-taking in research is too limited, and initiatives are instead taking place in research where the researcher can reliably demonstrate results when the time comes to apply for new funding. Submitting applications also, in many cases, takes up much of an individual researcher's working time. Greater dependence on external funding may also contribute to excessive tying-up of resources, since many research groups accumulate reserves as security to meet the risk of future funding applications not being approved.

The Government judges that systems for resource allocation that include peer review should be investigated further, with the aim of enabling them to be introduced in the long term, although several consultative bodies have pointed to problems associated with introducing such a system. Peer review should be carried out in response to conditions prevailing in each research field, and be based on relevant statistics and data.

A system that includes peer review could provide a more coherent assessment in which the current potential of a research field can also be considered, instead of resource allocation being based solely on historical data. In this way, a more balanced overall assessment of an HEI's research, in which different

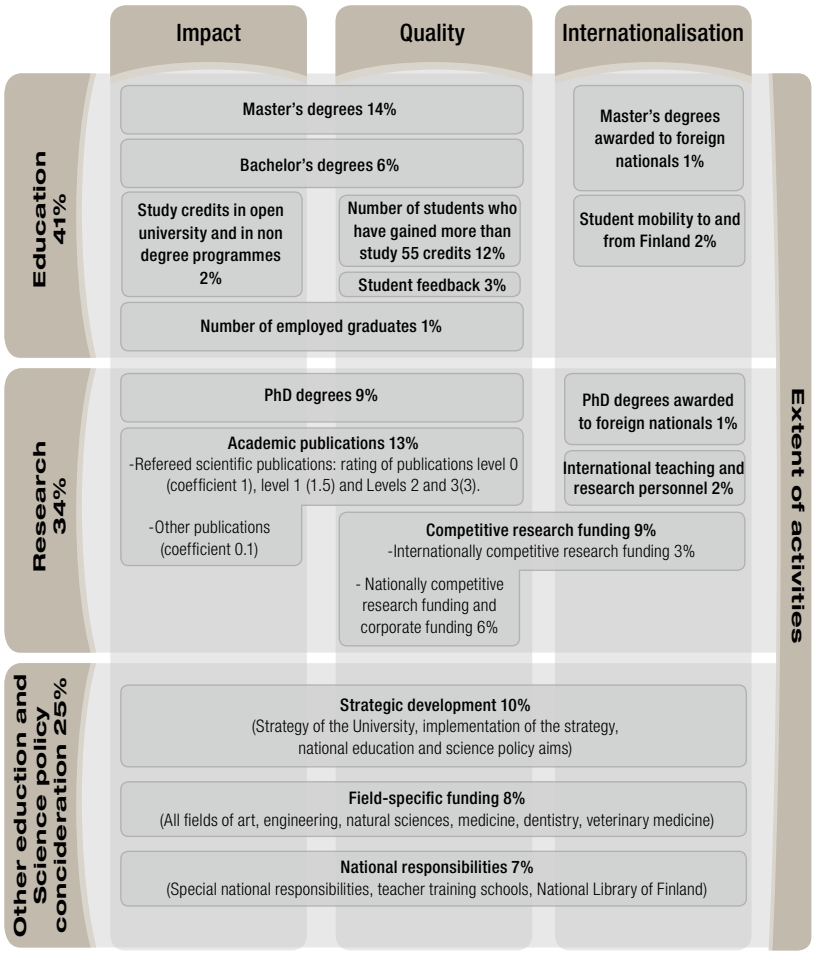
subject areas are valued according to their distinctive nature, can be obtained. This kind of system rewards quality in a broader way than the present-day allocation model, promotes quality and can also pave the way well for long-term planning at the HEIs. Moreover, it is a system that suits research areas whose publishing traditions are not fully included in indicators like citations, publications and external funding.

With this Bill, the comparatively sharp increase in funding of research is continuing. New strategic areas are being introduced. The proposal of resource allocation by means of peer review is also raised again and investigated further, although the previous investigation found it inadvisable to introduce such a system.

Appendix

2

Appendix 2. Finland's model of grant allocation



Finland's model for allocation of block grants for education and research [Finnish Ministry of Education and Culture 2015]. The percentages refer to the relative proportion of the aggregate block grant for the HEIs.

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