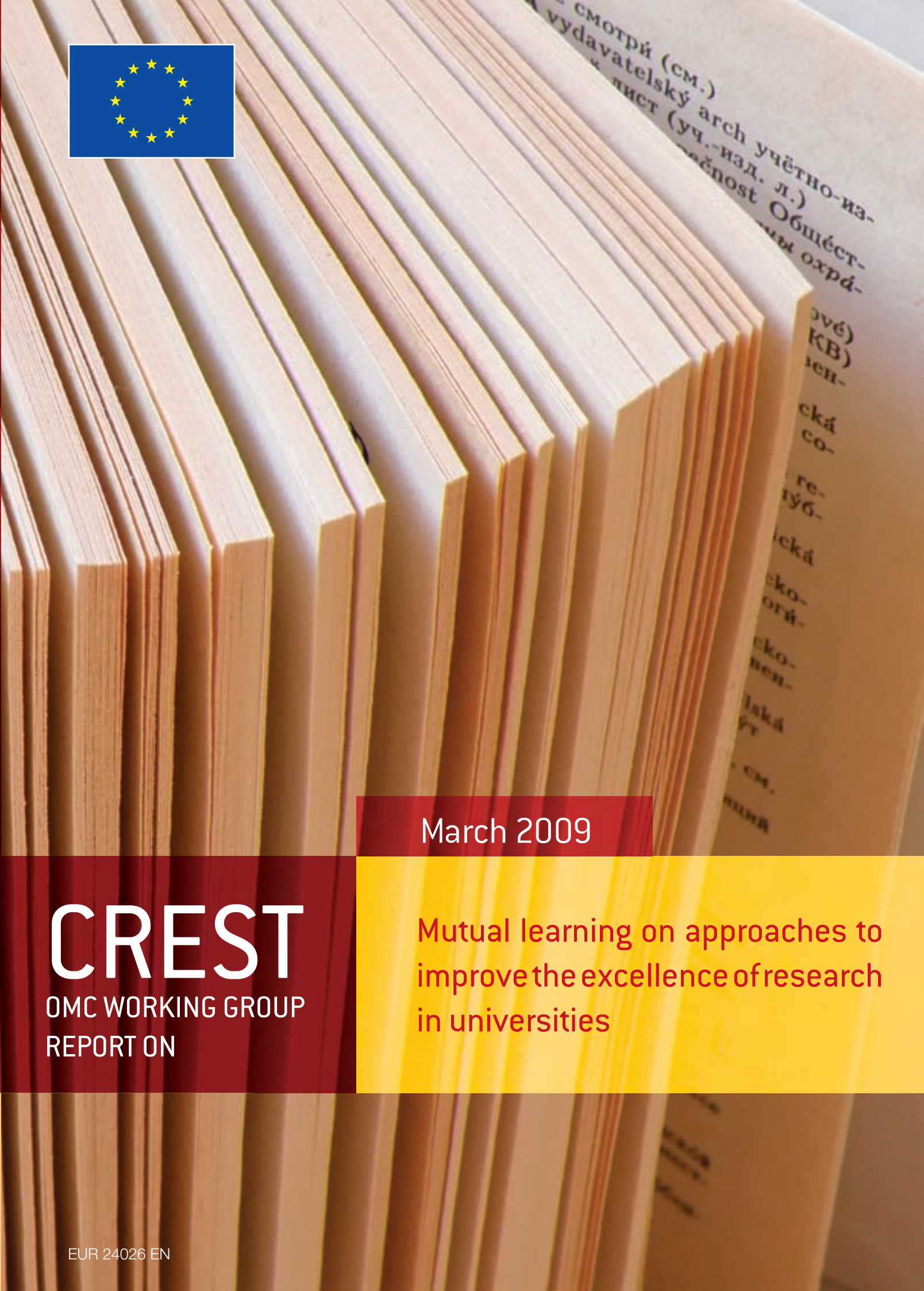

March 2009

CREST

OMC WORKING GROUP REPORT ON

Mutual learning on approaches to improve the excellence of research in universities

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CREST Fourth OMC Working Group:

‘Mutual learning on approaches to improve the excellence of research in universities’

March 2009

Final Report

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Executive summary

This summary presents the main findings, rationales and recommendations for regional, national and Community policies to improve research excellence in universities. It relies on the study carried out by the CREST Working Group (WG) on 'Mutual learning on approaches to improve the excellence of research in universities'. The study offers a great variety of information: analysis tools, good practices, comparisons of certain instruments used at the national level, inventories of new developments, and existing policies and instruments, etc. It is recommended to use all dimensions of the information available in the study for policymaking, relying on the main recommendations presented here as a quick and broad guide to the results of the WG.

The overall objective of the WG was to carry out a mutual learning exercise on the scope, objectives and measures of national policies to improve research excellence in universities, to learn more about the effect of these policies, to identify good practices, and to develop recommendations for improving the policies and their impact on research in universities.

The revision of the Lisbon strategy and the discussions on the vision of the European research area, have reinforced the conclusion that if Europe wants to continue playing a key role in the global production of knowledge, not only the volume but also the quality of the research needs to be increased. This includes maintaining commitment to the goal of providing 3 % of Europe's GDP towards research. To put it bluntly, the achievement of research excellence is improbable without the financial support to back the measures required to promote this excellence. Further, it cannot be achieved without the adequate instruments to operationalise the objectives related to the European research area (ERA).

The future development of cutting-edge, world-class research in Europe, especially in research universities, needs to be fostered by adopting appropriate policy measures. An initial step towards achieving success in this crucial task was taken in this CREST mutual learning exercise, which offered a place where member countries ([1]) could exchange and reflect upon current trends and practices. It should be mentioned that most developments are so new that no empirical proof of the value of certain instruments can be offered. Given the exploratory nature of this exercise, the opinions and experiences of policymakers were relied upon to conduct the analysis and to present good practices.

Above all, this effort, which is the first of its kind, aimed to pull together information about new European policy initiatives and specific tools to promote research excellence. It is a first approach in 'mapping the field' — giving an overview of the instruments forming national policies. Additionally, the existing instruments were clustered into three 'strategy types':

(A) capacity-building, focusing on the setting-up, updating and development of infrastructure, young researchers and researcher careers;

(B) competitive research stimulated by a framework of autonomy and competition in a bottom-up approach, based on incentives, quality management systems, evaluation and peer review;

(C) prioritisation of research groups and fields, promoting the setting-up of elite segments to achieve world-class excellence through policies ensuring the promotion of first-rate research groups and the stimulation of network structures.

As policy implementation is not a trivial task, the typology derived from existing practices offers some guidelines to help member countries orientate their specific strategies towards optimal measures for increased excellence in research.

1 Throughout this report, 'member countries ' refers to both EU Member States and associated countries which took part in the CREST Working Group.

Several of our recommendations parallel the central concerns of the ERA and strengthen the core principles of the latter. In addition, a main observation of the WG is that there is considerable common ground among member countries regarding research excellence policies. Keeping in mind that country strategies must adapt to specific national situations and that there are a variety of different needs and contexts, member countries should nonetheless be aware of and benefit from the common principles of increased funding, institutional autonomy, incentive mechanisms, accountability, collaboration in researcher mobility and human resources development as a starting point for country-specific developments.

Recommendations

The recommendations (printed in bold letters) and some findings explaining the recommendations are grouped into three main areas: strategic orientation, instruments and developments in the European context. More recommendations can be found in the full text of the WG final report.

Recommendations on the strategic orientation of policies which promote research excellence

1. Research excellence can be achieved in a multitude of ways and according to various national situations. For instance, research excellence could be connected to: top-segment or the highest level of research performance in a given context, international competitive standards, being actively engaged with the wider society challenges, leadership in producing knowledge or innovation, etc. The concepts of excellence depend on the underlying objectives and framework conditions; each member country is able to develop some goal-related form of excellence.

   The diversity of understandings concerning excellence in research across member countries should be supported. However, it is recommended to the member countries to formulate an explicit, country-specific understanding of research excellence. A number of core aspects relating to the concept of excellence frequently emerged among member countries and should be used to specify a rational research excellence strategy in a country.

2. Three main types of national strategies to improve research quality were identified in an *ex post* analysis and were derived from existing practices as described by member countries in the questionnaires: capacity-building (A), competitive research (B) and prioritisation (C). Only after the successful implementation of a type A/B-dominated strategy is it likely that a strategy of type C can be successfully implemented. Policy measures addressed to create or develop elite segments at the institutional or team level also require a country-specific mix of policy measures to enhance capacity-building (human and infrastructural) and to increase the average quality through competitive funding for research projects.

   The WG invites member countries to use this typology as a tool to analyse and specify their policies. Reality always involves a mixture between the strategies, especially in the longer run; but country policies can explicitly set priorities for a certain strategy, especially to induce certain short-term changes in the national systems. A member country's strategy should be developed based on a mixture of top-down and bottom-up impulses to ensure the efficiency, consistency and coordination of various policies (top-down from governments) and to incorporate decentralised initiatives using institutional and individual creativity and promoting a broader acceptance of the policies (bottom-up from higher education institutions (HEIs) and researchers).

3. **The member countries should choose and combine the appropriate instruments which will best realise their country-specific strategy. The typology should help to operationalise strategies with instruments.**

   There are certain instruments, especially peer reviews, which could be applied flexibly across all three strategy types. Others are more specific for a certain strategy type: regarding the good practices in the report, the Danish reform of the institutional structure is part of a prioritisation strategy, whereas the Irish example PRTLI is linked to capacity-building and the Italian evaluation exercise is aimed at enhancing quality and competitiveness of structures.

Recommendations on instruments to improve research excellence

4. **When member countries develop new instruments to promote research excellence, it is advised that they make use of the inventory of good practices provided by the WG members based on their national experiences.**

In addition to identifying good practices, WG members were asked to assess the relative importance and success of different instruments. Some instruments with high values of importance and success are rather common, e.g. peer reviews and indicator-based funding or evaluation and accreditation. Other instruments score high in terms of success and relevance in some member countries but are not yet widely used. **Instruments successfully implemented only in a few member countries should be in the focus of further mutual learning**. Examples are the Danish practice of development agreements, the Norwegian publication-based funding formula or the competitive *ex ante* funding of institutional plans to develop research excellence as part of the German excellence initiative.

5. **Emphasis should be placed on the implementation of specific instruments supporting the most promising young researchers.**

   The contribution of young researchers to the vitality and quality of the research system is widely recognised in most countries and needs to be addressed through specific instruments. This is an urgent problem where the need to secure a sufficient base of researchers is becoming evident with the deficit of research personnel needed for current activities. **Special consideration should be given to the promotion of young researchers by taking a deeper look at some of the good practices identified in the report** (international partnerships in research and postgraduate studies in Portugal, the innovation research incentive scheme in the Netherlands, the researchers' careers' development programme in Lithuania, etc.).

6. **The use of funding instruments should be balanced and diverse, i.e. corresponding funding components with different orientations should be combined.**

   Regarding balance in the public research funding of universities, an advisable model should combine:

- stable, core institutional funding ensuring scientific autonomy and a broad coverage of disciplines;
- a performance-oriented formula, providing *ex post* rewards for good research performance based on agreed objectives; and
- an 'innovation'-oriented component to pre-finance new cutting-edge and/or explorative research developments; for example, the competitive *ex ante* funding of research clusters and projects.

   In addition, an adequate balance among instruments addressed at institutional and individual levels is needed to offer researchers different paths and a variety of choices to produce research excellence. Thus, **the support of talented individuals should be combined with the promotion of cooperative institutional structures. Diversity of funding mechanisms regarding explorative as well as exploitative research is advisable to avoid the risk of a deterioration of quality in certain research areas due to limited funding. Attention should be devoted to new funding methods** to ensure greater transparency and accountability and foster international institutional networking through, for instance, performance-based funding, accreditation and certification of research, transnational PhD schools, etc.

7. **Special attention should be paid to how peer reviews can be appropriately and cleverly complemented by data analysis and indicators and other communicative measures. Crucial factors for success in peer review are the openness and transparency of the method, the competence and commitment of the reviewers and the adequate mix of competences of the review team. A follow-up mechanism of the assessment recommendations should be built into the system.**

   Peer review is important, but value can be added through the use of 'informed peer review' including data analysis. Linking the peer review with other measures such as workshops, interviews and hearings (though not simultaneously) allows the possibility to gather more information and feedback on the research environment than does pure peer review. Different types of peer review were identified as good practices to assess the quality of research in universities.

Recommendations on developments in the European context: strengthening mutual learning

8. The CREST WG is convinced that this exercise should not end with the current report, but that **it needs to go further in-depth to allow for more detailed comparisons and a deeper exchange of practices**. To advance and facilitate further steps in the mutual learning among member countries, **the collection of good practices identified in this exercise should be a starting point to develop a benchmarking initiative between interested member countries**.

   The work accomplished by the CREST WG focused on perspectives from 17 different member countries, but a more detailed view is needed. A benchmarking initiative could consist of a subset of member countries with comparable structures of support (similar strategy orientations or instruments) in order to make comparisons in sufficient depth and to better understand how instruments are performing. It should be recognised that there is a need for more monitoring and evaluation of the effects of policies on universities regarding their governance, research strategies and performance. Patterns of optimal instrument combinations can be thus identified to more closely achieve a certain strategy. The benchmarking effort should deepen the knowledge on instruments to foster research excellence and should work on a flexible instrumental toolkit adaptable to specific strategies.

9. The benchmarking exercise could also deliver knowledge for a **European open inventory of existing and tested policy instruments to improve the research excellence in universities, showing the relations between the instruments and the objectives of research excellence.**

   Such an open inventory could be linked with, or an extension of, the existing Erawatch initiative. It should be kept in mind that an inventory should follow the idea of the CREST WG to develop applicable tools instead of an 'information cemetery' with abstract overviews. The WG already developed a toolset to help identify relevant instruments for specific strategies and target groups, i.e.: comparison of the importance and success of the main factors affecting research excellence, ideal profiles for each of type of strategy, indicators, etc. The creation of further toolsets that might be interesting as input or ideas for the existing forum could be a possible direction to be taken. An important insight of the WG is that measuring research performance is not sufficient to attain excellence, but an additional link between measurement and steering processes is necessary.

1. Introduction

1.1. Context

Research is a fundament of the knowledge society as well as the economy and is one of three key features in Europe's knowledge triangle of research, education and innovation (REI). The concepts linked to the REI model are strongly supported by the European Commission where there is explicit acknowledgment that the European research area (ERA) is deeply integrated into the knowledge production systems of European society (namely, higher education systems, the economy and financial markets, and processes for increased innovation).

The importance of the role of universities in the ERA and their strength as stakeholders in the knowledge economy is highlighted in key European documents, including the 2006 communication on 'Delivering on the modernisation agenda for universities: education, research and innovation'. This communication from the Commission to the Council and European Parliament affirms that R & D and universities have been 'acknowledged as foundations of European competitiveness' and that 'stronger action at the European level' is needed 'to drive forward this agenda in universities and research'.

Universities also play a pivotal role in Europe's REI knowledge triangle. Universities play a crucial part in preparing bright students to become strong researchers, in creating the environment for research groups and interdisciplinary collaboration, and in employing researchers. According to the Commission, universities are vital actors in the vision to become the leader of the global knowledge society, contributing to the economic success of countries and providing crucial knowledge to further society's development and success. Given their vital position, Europe must take action to support its universities in leading the initiative towards utilising its research potential to the utmost of its capabilities.

In order to do so, information is needed on the current state of affairs in university-based research across Europe in order to make informed decisions and to plan successful policies. There have been a number of studies and there are a number of initiatives to offer an idea of current policies and trends in the Member States (such as the Erawatch service and the PRIME network of excellence which has included the Observatory of the European University), but there is no single authoritative document concentrating on the *policy level* in order to guide policymakers in providing clear steps for universities to enhance the quality (or excellence) of their country's research area, and of the European research area as a whole.

1.2. Aims and scope of the exercise

Aim and objectives

European countries are well aware of the importance of universities for the European research area and started the CREST Fourth OMC Working Group on 'Mutual learning on approaches to improve the excellence of research in universities'. The orientation of the Working Group (WG), conceived as a mutual learning exercise, has aimed at the following **objectives** outlined by the mandate:

- reviewing the scope, objectives and measures of national policies to improve the research performance of universities (excellence, relevance and impact of research activities) covering aspects such as governance, autonomy and accountability;
- reviewing the effect of these policies on universities regarding their governance, research strategies and performance identifying good practices; and
- developing recommendations for improving the polices and their effects on universities and their research performance.

As specified by the mandate, the **aim** of the WG was to provide an overview of the member countries' ([2]) policies to promote quality/excellence in research, to develop a typology based on instruments employed, to note trends, good practices and problems, and to give some recommendations. A major outcome of the work is the 'mapping of the field' in European policies and instruments to promote research excellence.

Scope of the Working Group's approach

It should be made clear where the borderlines of the study's **scope** are set.

- Universities have three missions (teaching, research and services to society) and, although research evaluation has to take all of these goals into consideration, this analysis focuses on the **research dimension**. In a university context, there are close links between quality/excellence in research and education, but these relationships are not the topic of the following analysis.
- An important aspect in the research context is innovation, technology transfer and the relations between the academic research sector and industry. Innovation processes are relevant for research quality. There has been previous work at the EU level on implications and suggestions in this area, such as the Aho report and several Commission communications and initiatives related to the European research area. Although this aspect is touched upon in Chapter 4 of this report, it does not feature as a main area of concentration.
- Last but not least it should be highlighted that the findings from the questionnaires and based on the WG sessions are a result of the expert opinions, experiences and impressions of the individual representatives. It should be therefore kept in mind that the WG members are a sample of the community of experts in European higher education. Thus, their views should not be presumed to represent the totality of each national higher education system, but rather, a glimpse into the general characteristics and trends.

2 Throughout this report, 'member countries ' refers to both EU Member States and associated countries who took part in the CREST Working Group.

2. Methodology of the study, definitions, conceptual framework and types of policy instruments

2.1. Methodology

In order to obtain an overview of national developments in the member countries and to identify good practices, the CREST WG opted for an empirical analysis with all relevant aspects on quality/excellence in research based on quantitative and qualitative data. The CREST WG validated the questionnaire to collect input on the national policy developments on approaches to improve excellent research in universities.

A total of 17 questionnaires were gathered from member countries in order to capture both the individual situations as well as the general trends in European higher education systems. The questionnaires were filled out by the WG members who are experts on higher education and the research sector, as well as representatives from education and research ministries, national funding agencies and research councils, and government agencies. They were answered from the policymakers' point of view to the best ability of the experts. When necessary, the WG members made use of their national networks to collect the relevant information.

During the work of the group it became clear that the instruments to promote excellence in research are in many cases rather new; it is not possible to make an assessment based on empirical research. Therefore, the WG decided to rely on the policymakers' perspective and is convinced it has produced valuable results using this approach. Nevertheless, further empirical studies on the effects of policies and instruments should be made.

The 17 countries represented in the questionnaires and at the WG sessions were: Sweden, Norway, Romania, Portugal, Germany, Belgium, Denmark, Latvia, Lithuania, France, Turkey, Malta, Ireland, Italy, the Netherlands, the United Kingdom and Poland. Although the analysis was based on these countries' responses, valuable input was also offered through the WG discussions. Another three countries contributed to at least one of the WG sessions: Spain, Greece and Bulgaria.

The questionnaire was structured into two main sections, following the major work streams identified in the project outlined by the CREST WG.

• Topic 1: General strategies and instruments for enhancing research quality in member countries;

• Topic 2: Funding approaches of university-based research and assessment tools for research quality as two main instruments to promote research excellence.

In addition to the questionnaire, representatives from member countries convened at six WG sessions in order to discuss and elaborate upon findings and best practices. In these sessions, clarifications of country contexts were expressed, comparisons made, and a mutual exchange of information was shared, thus fulfilling one of the principal goals of the CREST mandate.

2.2. The role of excellence and quality in research

The report of the CREST WG deals with 'approaches to improve the excellence in universities'. This task requires defining the scope of the analysis, since the concept of 'excellence' is rather difficult to specify. It is quite unclear if 'excellence' should be used as a synonym for 'quality'. The WG noted that this term varies in meaning across countries. In addition, definitions for the term 'excellence', and specifically 'excellence in research', elicited a variety of responses from member countries. Also, in the literature on quality management in the higher education and research context, it is recognised that there is no general definition of quality, neither in teaching nor in research.

There is no concrete, agreed upon or limited definition of excellence, as the scope of the definition can include a variety of factors; boundaries shift and can be flexible, depending on the goals of the individuals working with the concept. The diversity of understandings concerning excellence in research across member countries should be supported. However, a number of core aspects relating to the concept frequently emerged among member countries and the WG has indicated the need to provide some basic guidelines in order to come to a clearer understanding of the notion of excellence which can be applied in most contexts. This common understanding does not imply that a single definition for excellence should be agreed upon, but rather, that the differences should be respected while, at the same time, an effort made to identify similar aspects. Although a pure definition cannot and should not be derived from these member countries' responses, the core features related to excellence which emerged are as follows:

1. The notion of excellence is connected to the top segment in research or the highest level of performance.
2. Excellence relates to an international, competitive standard.
3. Excellence relates to being actively engaged in the wider society and having strong international networks.
4. Excellence relates to being a leader, being able to produce innovation or knowledge that has a positive impact on a world scale (serving to improve living standards and the sustainable development of society).
5. Excellence means maintaining a high visibility and having an ability to attract insider and public recognition; it contains elements of a dynamic organisation balancing competition and cooperation.
6. The objectives relating to excellence have to be consistent with the context, i.e. the geographical situation, historical background and moment in time/development phase.

This confusion of definitions and differentiation between the terms makes finding a pragmatic way to deal with the terms in our study essential. It can be suggested that quality can be interpreted *as a measure trying to enhance research,* whereas excellence can be thought of as a *state of being* and is *goal-related*, taking into account the six aspects mentioned before. Hence, excellence is always related to something outstanding, but the exact implications of excellence are goal-related (giving the possibility to all member countries to attain some country-specific form of excellence). Countries may improve quality and be heading in the same parallel direction (towards excellence), but they may not be heading towards the exact same point. Different notions about excellence will in the analysis determine a strategy typology.

2.3. Roadmap of processes and strategy types

In order to facilitate understanding of the complex relationship of influences and policy ideas forming the backbone of this report, we will briefly describe a roadmap for the reader to better understand the processes at work. This roadmap includes a proposal for the relationship between factors which promote research quality, orientations of research strategies, country contexts, strategy types and instruments.

In the questionnaire, member countries stated the relative importance of various factors which promote research quality and provided information about their general strategy orientations. An analysis of these responses revealed a typology of research strategies, which can overlap or flow into one another, depending on the country's contextual situation and goals. According to the strategy types, there are certain corresponding instruments that could be considered the most adequate to employ. Thus, particular research strategies can be linked with specific instruments; the target group of the instruments as well as its main goal are determined by the strategies.

From the general literature on the promotion of research, a number of **factors relevant for research quality** are derived. Factors which promote research quality include input, process and output factors; these can be, for example, measures for human capacity-building, the geographical mobility of researchers or measures for transparency of research performance. For each country, a picture of the importance and success of these factors can be generated. The factors which promote research quality ultimately influencing a country's choice of instruments are grounded by three main supports: the country context, research priorities and specific definitions. The assessment of importance and success of factors which promote research quality can be used to generate some ideas about a kind of instrumental status quo.

Along with the relative importance and success of the factors which promote research quality, the **strategy orientation** to promote research quality of a member country informs a country's policy choices and guides it to a certain direction. The strategy to promote research quality continuously extends its influence into the domains of instruments and goals. For the purposes of the WG and this report, strategies to promote research quality can be understood as the policies and goals intended to strengthen quality/excellence in research.

A typology for research quality strategies and corresponding instruments

Factors which promote research quality and the strategy orientation vary in the goal(s) they are trying to achieve. There are two dimensions relevant for goal orientation: the link between instruments and strategies and between instruments and target groups (an institution, research team or individual). In order to identify specific instruments that are adequate for a certain purpose, it could be helpful to organise research strategies into a general typology. Based on the responses from member countries, three main types of research policies emerge.

- **Type A: Promoting capacity-building of the research infrastructure** is defined as a research policy characterised by concentration on development of the research infrastructure through skill enhancement or competences, or for general upgrading of research performance ability.
- **Type B: Promoting autonomy and competition within the research system** is defined as a research policy with clear government coordination to make universities autonomous, to promote competition in the sector and to let excellence emerge from the higher education institutions (HEIs) as a bottom-up development.
- **Type C: Promoting prioritisation of research fields** is defined as a research policy where there is a targeted governmental effort to concentrate funds to specific HEIs, centres of excellence or areas of research.

In Annex I a **toolset** to identify **contextually relevant instruments** by assessing the **importance** and **success** of the research quality factors is presented. Ideal **profiles** of the main **research quality factors** for each type of strategy were built, giving one country example for each one (Romania for capacity-building, Sweden for competitive research and Germany for prioritisation) allowing the **comparison** of the national strategies against these profiles.

Table 1 in Annex II (tables and graphs) details a number of instruments and measures that can be employed to support the three types of research policies.

As higher education and research strategies and priorities are in a constantly shifting mode, countries tend to employ a combination of two or all three types of research policies. Therefore, different instruments targeting the respective research policies are utilised. It is also the case that some instruments can drive more than one research policy type at a time. In reality, research policies are always characterised by a mixture of types; but in certain countries, certain strategy types and instruments may dominate, reflecting the prevailing country-specific situation.

It should also be noted that these types should not be interpreted as part of an evolutionary track, albeit, a certain level of capacity needs to have been developed before concentration on autonomy/competition or a focus on prioritisation can take place. For these reasons, these types should only be interpreted as basic generalisations. One category of strategies is not better than the other, as the choice of tools depends on the problems at hand and the context of the country's higher education system. It should also be kept in mind that these may not be the only strategies possible, particularly in countries that did not participate in the survey.

Table 1 shows the types of instruments in relation to the typology of research strategies previously described and the target groups of the instruments (individuals, research groups and institutions). The resulting bi-dimensional matrix provides an overview of the instruments related to the strategy types and in which member countries (participating in the CREST WG) are being implemented.

Use of the conceptual framework by member countries

The conceptual framework given in Annex I could be used by member countries to analyse their research strategy and to identify a course to follow based on their current situation and according to their specific goals. The framework could support policymaking in the following ways.

- Analysis of the used instruments and the importance profile of factors which promote research quality could be used to identify if the country focuses on strategy types A, B or C.
- To implement a certain strategy type, a country could use or be inspired by the corresponding instruments.
- The importance profile of factors which promote research quality allows one to reflect whether the factual strategy priorities coincide with the intended strategies.
- The gaps between success and importance could be identified and it could be asked which measures should be taken to close the gaps and enhance success of a certain factor.
- It could be analysed whether focusing on specific research policies creates systematic differences in the points of view of countries on the instruments. The value of certain instruments may be considered greater than in another country, for example.
- An overview of the target groups enables an analysis of the balance between the instruments/funding at the level of institutions/research groups/individuals.
- National profiles of success and importance could be compared with certain other member countries as benchmarks or with the average of all responses.

3. Questionnaire results and conclusions

3.1. Analysis of the general strategies, policies and instruments for enhancing research quality

In this chapter, we will present the most important findings of the analysis of the questionnaires. Each finding is structured as follows: observation (short general statement to introduce the topic), description, interpretation and outcomes.

Observation 1: Strategies and instruments

There are typical instruments serving the three types of strategies. Therefore, if a member country identifies priorities for one of the strategy types, there is a certain range of adequate instruments that can be implemented.

Description

Most of the member countries stated in the questionnaire that they have a national policy for enhancing the quality of scientific research. This national policy in many member countries combines system instruments (like funding mechanisms for HEIs, competitive funding, etc.) with a more specific strategy for certain target groups (like young researchers in new areas) under more general headlines for the strategy (knowledge creation, capacity-building, visibility at the cutting edge, etc.). It can be argued that the differences between the national policies of the member countries are related to national structures and specific contexts of the research system.

Member countries were asked to name their most successful or most innovative instruments for research quality. These instruments are listed in Table 1 to provide a snapshot of their usefulness for capacity-building, fostering competition and autonomy, and promoting prioritisation and an elite segment in research. The instruments to promote research excellence are, on the one hand, linked to strategies; on the other hand, they have general advantages and problems, independent of the strategy orientation. These advantages and disadvantages are listed in Table 2 (Annex II).

Interpretation

The instruments described in Table 1 can be aligned with the three main typologies that emerged for research policies among member countries (type A: capacity-building; type B: competition and autonomy; type C: prioritisation). Although the contexts may be different, member countries often use similar tools, changing them slightly according to the specific needs of the research policy. This alignment enables member countries to choose the right instrument for a certain strategy. The catalogue of instruments offers guidance to member countries: if one is interested in concentrating on prioritisation, for example, then specific instruments need to be considered.

Strategies should be as explicit as possible. This also means that member countries should analyse the coherence of their instruments with their desired strategy. The use of clear and explicit language in articulating national strategies (or state strategies in federal systems) provides focus and fosters better communication between stakeholders.

The analysis of the countries in the CREST WG showed that research excellence policies should make use of a variety of instruments, looking for optimal combinations. Focusing on a single special instrument creates the risk of neglecting other facets of excellence. National strategies should optimally derive from a mixture of 'top-down' and 'bottom-up' processes. Inclusion of top-down elements should ensure efficiency, consistency and coordination of various policies, while inclusion of bottom-up inputs (from research institutions) should facilitate the incorporation of more creative and decentralised policy initiatives and a broader acceptance of the policy objectives. To create the 'right mixture', member countries must also use a variety of stakeholders and processes in designing their strategy and in developing their instruments.

All of the instruments that relate to a certain strategy could have a positive impact, but they all have some counter aspects. Table 2 in Annex II sums up the major advantages and disadvantages of the instruments most often used. These are general considerations, not depending on the goal context.

Interpretation

1. There should always be a certain mixture between top-down and bottom-up strategic development. A national strategy with no elements of strategy building in the institutions would be too abstract to induce effects. Decentralised institutional strategies without some ideas about national objectives might result in inefficient diversity. The strengths of top-down and bottom-up impulses are rather different; therefore, elements from both sides should exist.

2. In general, existing policies/strategies concerning research quality/excellence should be made as explicit as possible. This also means that member countries should list all the instruments that they have in place as part of strategic thoughts and analyse the coherence of these instruments with their desired policy.

3. Member countries can use the link between typologies and instruments as an 'analytical tool' for choosing the right instruments for a specific strategy. When a country is interested in a certain strategy, it can consider one or more instruments that are aligned with the chosen strategy. In this way, the typology and the instruments offer some guidance to the member countries.

4. The instruments presented in Table 1 are merely a small slice of the diverse tools employed by countries to improve their research policies and research quality. The development of an open inventory of all instruments and the purposes they serve across the member countries could be a valuable source for countries interested in comparing and developing their own instruments.

Observation 2: Assessments of importance and success of instruments

Instruments for research excellence generally fall within a similar range with regard to importance, though the 'promotion of young researchers' and the 'existence of development policies for research infrastructure' are the most decisive factors. Also, most of the scores for factors promoting research quality in terms of success are relatively close. Nonetheless, the 'degree of competition in research funding' and 'autonomy of the HEI in research issues' scored highest in this realm.

Description

In the questionnaire, the member countries were asked to assess the importance of factors which promote research quality on a certain scale (from 1 being 'low' and 5 being 'high'). A total of 23 factors were included, made up of input, process and output factors (see Graph 1 in Annex II). In general, factors mostly fell within a similar range in regards to importance, approximately between 3 and 4 (out of 5). This suggests that all factors are considered relatively or highly important. When we look in more detail, we see that the two

most decisive factors are the 'promotion of young researchers' (4.5/5) and the 'existence of development policies for research infrastructure' (4.5/5). In addition to these high scorers for importance, another small handful of factors also received a high score: 'degree of competition in research funding', 'autonomy of HEI in research issues' and 'promotion of collaboration with the private sector'. In contrast, a few factors which promote research quality generally did poorer than others. The factor considered the least important is 'sanction mechanisms against underperformers' (2.4/5).

The member countries were also asked to assess if the measures were successful in practice. Again, the scores for factors which promote research quality in terms of success are relatively close, forming a single cluster mostly spread between 2 and 3 (out of 5). This suggests that most factors are about average in terms of success and that the factors which promote research quality are considered generally more important than they are considered successful. When we look more into detail, we can see that both the 'degree of competition in research funding' (3.8/5) and 'autonomy of the HEI in research issues' (3.6/5) scored the highest in terms of success. In addition, regarding their importance assessment, these two factors did not fall far behind the top two scorers in importance. Although considered almost a full point more important than 'sanction mechanisms' (importance: 2.4; success: 1.7), the 'establishment of an elite sector in research' fell slightly below the former in regards to its success level.

Interpretation

It should be highlighted that factors which promote research quality are directly related to specific instruments used to enhance and fortify research strategies. As such, the assessment of importance and success of factors which promote research quality can be used to generate some ideas about the instrumental status quo. Factors which promote research quality may implicate capacity-building, autonomy/competition, prioritisation or a combination of these three types of research strategies, as well as institutions, individuals or research teams as the main target group.

For the more successful factors, an explanation could be that these factors exist for quite a long period. Almost each country has a research council, which organises opportunities for young researchers; development policies also have a long history, so procedures could be assumed to be well developed and tested throughout Europe. The least successful factors are 'establishment of an excellence/elite sector in research', 'sanction mechanisms for underperformers' and 'differentiated policies regarding institutions with different levels of research quality'. The low score for sanction mechanisms can perhaps be explained by the negativity attached to sanction mechanisms. A factor in research quality that promotes positive incentives will likely motivate those involved, whereas one that stems from a desire to reprimand poor performance probably would not foster a supportive working environment.

Interesting are the factors that are considered important, but score low in terms of success. 'Establishment of an excellence/elite sector in research' is such a factor. This finding should be particularly noted. If the 'establishment of an excellence/elite sector' has approximately the same success rate as 'sanction mechanisms', greater emphasis should be put on finding ways to enhance this research factor. member countries could look at other countries in order to learn from successful examples in certain areas. This is also the case concerning the instruments with high scores in some member countries (where they are successfully implemented) and low scores of importance in others (because they do not exist). These instruments are highly relevant for mutual learning.

Outcomes

1. As factors which promote research quality are directly related to specific instruments used to enhance and fortify research strategies, member countries could use these research factors to analyse and improve their national strategy. They could try to close the gap between factors which are seen as highly important, but rather unsuccessful, and employ the well-established instruments with high importance and success.
2. Instruments scoring high in terms of success and relevance in some member countries but not yet widely used should be the focus of mutual learning. Examples are development agreements or competitive funding based on publication performance.

Observation 3: Individual and institutional promotion of research excellence

Most of the member countries have elements in their research strategy focusing on researchers. The aspect of developing a broad base of human resources for high-quality research often seems to have higher priority than an institutional focus.

Description

A distinction should be made between an individual, research team or institutional focus of the strategies. One the one hand, strategies are about institutional structures, competitive mechanisms and institutional capacity-building. On the other hand, researcher mobility, career tracks, etc. play an important role in the strategies. Almost all member countries mention the personal dimension of human resources development as an important issue. Relatively less attention is paid to institutionally-oriented instruments.

A major aim of many of the strategies is to raise the performance of more researchers and research groups to a higher level and to increase the sustainability of the research base. Many member countries have two main goals:

(1) assessment of researchers with internationally recognised standards/more international visibility of their researchers;

(2) raising the institutional capacity: the influx of talent and the career perspectives of young researchers.

Interpretation

The individual versus institutional component seems to be an important issue for classification of strategies, in addition to and on another level than the three types mentioned above. The countries' responses show that it is not an either/or decision to follow the institutional or individual path, as normally both aspects go together. Priorities seem to be connected with the special situation of countries.

The human resource dimension (with focus on the broad quality base) is of major importance for countries looking for international competitiveness in top-level research. It is not sufficient to focus on top researchers. It is widely recognised that young researchers contribute significantly to the vitality and quality of the research system and have to be addressed through research strategies. The pressure of securing young research careers is of ultimate importance in the case of certain member countries since the effects of transition are now manifesting themselves, such as gaps in technological knowledge and competences and a deficit of project evaluators. Thus, the motivation at the individual level is intended to play a key role in the evolution of the research, development and innovation system.

With respect to human capital, member countries should also take a closer look at discriminatory structures within academia. Much knowledge and many studies exist about prevalent gender discrimination in the academic sector. Women and immigrants from other EU countries as well as third countries can be mentioned as groups who may face difficulties due to a traditional organisation of the universities. Such difficulties include disfavour of fair supervision and review of applications for funding or positions. An awareness and recognition of still existing problems in this respect is crucial, and concrete efforts are needed in order to change the situation wherever discrimination is discovered. Improved excellence at European universities requires equal participation from both women and men and openness towards new ways of carrying out scientific work, for instance brought in by foreign researchers.

Despite the importance of human resources, more attention could be paid to the institutional component, especially in fostering cooperation between universities. Many universities are joining loose alliances of everything from two/three universities to over 20 universities, where cooperation and exchange of information and students/staff occur. Others take yet a further step and join what may be regarded as strategic alliances or federations, where cooperation is more comprehensive and more intensive. In a few cases, mergers have taken place. In this way, critical mass is augmented, and through combination of both complimentary skills and knowledge, or adding of similar skills and knowledge, the quality of research is strengthened. The European Commission and member countries should investigate the potential benefit of supporting such initiatives, as they can be relatively successful with only a limited initial input of extra funding.

Interpretation

1. Special consideration of the early career of researchers is needed. In order to do so, member countries could take a deeper look at the good practices of some member countries and implement special instruments for the promotion of promising individuals.

2. An obvious way to improve the excellence of the research capacity at universities is to dismiss discriminatory structures.

3. It is recommended that the European Commission support institutional cooperation from a bottom-up perspective, or advise member countries to consider such support, in order to create strengthened critical mass and matching of knowledge. Especially university cooperation and university alliances of various kinds, initiated and negotiated at the universities themselves, are often promising and could lead to increased excellence.

4. The individual versus institutional focus is an important issue for understanding and designing strategies. In the long term, there should be a balanced view on institutional and individual components of the strategy; neither of the two sides should be neglected.

Observation 4: Elite segment

Most of the member countries have a special policy for an elite segment in research. These policies address a variety of target groups.

Description

Most of the member countries have designed a special policy for an elite segment. However, the policies of the member countries concerning elite segments address a variety of target groups. We can distinguish four levels:

(1) individual level;

(2) research groups;

(3) research institutions;

(4) universities.

At an individual level, there are instruments for different groups: top students, PhD students, young researchers, top scientists and top scientists abroad ('brain gain' programme). Most of the member countries have instruments for international mobility/cooperation and for awarding the best researchers or research groups. Rewarding research institutions is often part of a top-down strategy to stimulate focus and mass by funding selected institutions. Universities as a whole are an exception as a target group.

For identification of an elite group, several methods are used. Most often, member countries choose peer review. This could be peer review of the past performance of the researcher (or research group or institution), peer review of proposals and future plans, or a combination of those two elements. Sometimes member countries use the results of a national or international competition and/or the score on certain indicators (like citation indexes). When it comes to a top-down excellence strategy for selected areas, member countries not only look at scientific excellence but also at economic needs/societal relevance.

Interpretation

The finding that those countries with an explicitly defined elite segment in research choose instruments geared towards prioritisation type C confirms that there is a concerted effort to focus energies and funds into a specific and selected number of institutions. A number of countries state having an elite segment in research; nonetheless, when described, these 'elite segment' instruments often concerned aspects of capacity-building, general research centre development and incentives for young researchers and students. Though these are important, a move towards a government organised programme that pushes forth the strongest research-intensive universities still seems to be absent.

Interpretation

1. Those countries with existing elite segments can look to their peers to compare and benchmark their programmes for a stronger success.
2. In order to create an elite sector, it is important to promote the most talented individuals. In addition, it is also important to promote cooperative structures for forming a whole segment belonging to the elite section. Although providing grants and incentives for students and researchers is a crucial instrument in promoting research, targeted efforts on the institutional level to combine these dispersed funds may help to create a convergence of the research area, and thus a stronger research base.

Observation 5: Research infrastructure

Despite the fact that the good state of the research infrastructure is seen as highly important, there is relatively less attention for it in the strategies and instruments directed at this objective.

Description

In the questionnaires, several member countries mentioned improvement of the scientific infrastructure and investments in the research infrastructure as very important. These answers correspond with the increasing attention paid at the international level to research infrastructure. The EU has launched the ESFRI roadmap for big infrastructures, and due to that roadmap, several member countries have made substantial investments in (big) facilities. In the questionnaires, only a few member countries mentioned specially designed instruments for funding research facilities and infrastructure. A selection of some of those instruments is provided in Table 3.

Interpretation

The importance of research infrastructure is still increasing. In many disciplines — including the social sciences and the humanities — top-level research depends more and more on the availability of state-of-the-art equipment. However, in many countries research infrastructure cannot be described as a tool, as it is a priority of the HEI rather than a government strategy. Some countries, however, such as Denmark, have national programmes in place for this purpose. Investments in research infrastructure are considered to be the core business of universities and research institutes. In their basic funding, there should be a component for that kind of investment. In addition, there is also the ESFRI 'roadmap for big infrastructures' in which the European countries were asked to develop a national roadmap in order to contribute to the 35 ESFRI projects. Research infrastructures are thus addressed by universities and research institutes themselves and at a European level, but less often at national level.

Interpretation

1. As infrastructure is very relevant for universities and crucial for a healthy research base, more attention should be given to it. The member countries must continue supporting infrastructure as part of their research strategy, apply rational planning tools and secure that enough funds are available.
2. When it comes to research infrastructure a variety of approaches is needed. This variety concerns, on the one hand, the different levels: institutional, national and European (international); on the other hand, it must differentiate between disciplines (humanities, social sciences, and medical and natural sciences/engineering).

Observation 6: Collaboration with the private sector

Collaboration with the private sector is seen as an important factor for research quality but there is not much understanding about the way research could benefit from this interaction. Furthermore it has a low score when it comes to success.

Description

The member countries highlighted 'collaboration with the private sector' as a rather important factor for research quality. In many policy documents collaboration with the private sector is considered to be driven primarily by commercialisation and academic entrepreneurship. However, several studies show that the leading motivation for university groups participating in industry projects was to support their own academic research rather than entrepreneurship or commercialisation.

'Promotion of collaboration with the private sector' is seen as an important factor, but has a low score when it comes to success. Although there are examples of successful instruments for fostering public–private partnerships (see Table 4), overall most of the member countries regard this as an area for improvement.

Interpretation

There are several studies on the motivation for university groups to participate with industry. These studies show that the most significant benefits for university research are funds for graduate students and lab equipment that complements their own academic research. Besides that, 'learning' is an important rationale for academics to engage with industry: the knowledge exchange enables them to gain valuable insights into their own research and to further their research agenda ([3]). It should be emphasised that in this respect not only the collaboration with industry is important, but that also the interaction with the wider society as a whole should be taken into account.

Regarding the benefits for university from collaboration with the wider society, there seems to be a number of special conditions that are beneficial for university excellence. The most important ones are described below.

- Industry or the partner in wider society should have a decent level of relevant research activity, a certain level of expertise and/or competencies in order to really bring something to the universities.
- The collaboration must be very targeted and focused, particularly on the interaction between the two sides.
- There must be a willingness on behalf of both parties to invest the time and energy needed, as well as the appropriate financial sums, because productive interactions are very hard to achieve (real commitment is needed).
- Mostly, it takes a long period to establish a productive interaction and therefore a long-term timeline of planning and funding is crucial.
- Trust and understanding are crucial factors in this kind of relationship. The exchange of people and intensive interaction between people are important for success.

The form of collaboration but also the way universities benefit from it depends on the typology orientation of the university. For example, cooperation in the PhD context (supported by government programmes) is closely connected to the capacity-building strategy, and the 'big company' kind of collaboration is probably more related to prioritisation.

However, although 'promotion of collaboration with the private sector' is seen as an important research quality factor (it could be beneficial for both industry and academia), it is not considered to be very successful. Although there are some examples of successful instruments, the general feeling is that this is an area for improvement. Why is it perceived not to be successful? Perhaps it is due to the difficulty in finding links with the business community to conduct joint research due to different cultures and different time frames, the wariness of researchers to set research projects along the priority lines of the private sector, or

3 See Y. S. Lee (2000), 'The sustainability of university-industry research collaboration: An empirical assessment', *Journal of Technology Transfer*, Vol. 25, pp. 111–133, and P. D'este and M. Perkmann, *Why do academics work with industry? A study of the relationship between collaboration rationales and channels of interaction.*

because of the relative newness of this factor to promote research quality within the broader research area. Lastly, the lack of success might be induced by the fact that cooperation between HEIs and industry generally comes from personal ties and trust, rather than from top-down state measures. However, institutional autonomy and the provision of platforms for exchange between universities and industry are important underpinning supports.

Interpretation

1. Collaboration with the private sector should not be limited to the ideas of technology transfer, commercialisation and entrepreneurship. There are many examples that show that this type of collaboration can provide benefits to excellent academic research. Partnerships with this focus should be further developed.

2. The notions about good conditions presented by the WG are a good starting point, but are preliminary thoughts. It is important to stress that more research and in-depth work needs to be conducted on this topic, including an analysis of the conditions under which collaboration works best to promote excellent research.

3. The excellence strategy and the form of collaboration with the private sector have to be linked. The capacity-building strategy could be followed by joint PhD programmes and the prioritisation strategy by strategic alliances with large companies.

3.2. Analysis of the funding approaches and assessment tools for research quality

This section continues the discussion on important findings from the analyses based on the questionnaires, concentrating specifically on funding approaches and assessment tools for research quality.

3.2.1. Funding approaches

Observation 1: Design of funding systems

Funding is stated as a critical, if not the most important, instrument for the promotion of research excellence. Critical factors for designing excellence-oriented funding models are: financial and institutional autonomy, balance between core and competitive funding, greater transparency and accountability, diversity of sources of funding, and a strong future outlook.

Description

To varying degrees, HEIs have the discretion and autonomy to spend monies on research areas deemed important, though for smaller countries influenced by external funds, research efforts can be skewed in the direction of these needs. Competitive funding is recognised as helping to improve research quality. Individuals and groups of researchers who have enough funding in basic research tend to receive extra money in applied research. They have the knowledge and the critical mass to achieve a kind of synergy, which can boost a whole discipline in a university. However, when there is not enough or a low level of funding, the critical mass required to be successful in a highly competitive funding situation may not be achievable and can lead to the disappearance of a discipline.

Member countries have a wealth of experience regarding what is successful and what needs improvement in their higher education systems. A number of main lessons learnt in the national funding methods for the future development of quality-oriented research funding attest to this variety of contexts.

Regarding autonomy and competition, it is important to maintain: (1) focus on competitive research funding, encouraging competition, greater results and higher performance in the international arena; (2) a flexible investment model for funds' allocation at the national level in order to preserve the role of the universities' political choices and remain adaptable to current and changing needs; (3) structural optimisation of HEIs and governance support backed funding incentives so that priority is given to management efficiency measures.

Greater transparency of funding systems is valuable for open and fair processes to be developed and promoted so that trust is imbedded in the system. Greater accountability results when all stakeholders are able to easily and quickly obtain complete and detailed information regarding the funding system.

The funding of outstanding developments plays a critical role as an instrument for better research and better researchers. In order for outstanding research performance to be promoted, measures must be developed that concentrate quality into specific areas. Extra special funds or special programmes to foster high performance may include such examples as taken from the successful Norwegian experience (national centres for excellence; centres for excellence research based innovation). In addition, good research requires good researchers, for example through the recognition and promotion of outstanding young investigators. Attractiveness of the profession is an essential key for the future development of research quality.

Balance and diversity in funding is critical and could be achieved through the basic model for institutional public funding, which often includes at least a base-line lump-sum finance, a funding formula based on research performance indicators and an innovation-oriented component. To take another example, matching funding could be considered a 'side effect' of competitive funding and can be a serious problem for the most excellence research groups, preventing fast growth and blocking excellence; full-cost funding would be the better solution for the excellence purpose. However, if used in complement with peer-reviewed competitive funds, matching funds could enable the mobilisation of institutional monies for innovative purposes. In addition, the use of performance-based funding and qualitative instruments (such as public councils and foundations) or output/strategic peer review (mixed *ex ante*/*ex post*) takes advantage of a balanced mixture of instruments. An adequate balance could guarantee the positive benefits of certain instruments while limiting the disadvantages.

A strong future outlook, particularly in the medium-term perspective, could shape the design of funding instruments. This includes steady and regular funding schemes including the provision of sufficient financial support for the development of young researchers.

Interpretation

As governments adopt policies based on new public management theories and greater autonomy is given to universities, funding plays a greater role as an instrument to steer universities in a particular direction and is of crucial importance for the success of research excellence promotion.

The statements of the member countries prove that there is no single financial instrument fulfilling all requirements. HEIs need base-line lump-sum finance on the one hand and incentives through competitive funding on the other hand. *Ex ante* financial measures have to be combined with *ex post* performance rewards. Highly diversified funding systems seem to maintain the best balance. Diversification includes two key aspects: a multi-instrument approach in the public financing of research and a diversification of financial sources.

As the balance between sufficient institutional funding (lump sum) and individualised and third-party funding is important, so is the appropriate balance between rewarding successful and new paths: the right mix between 'exploitation' (successful paths) and 'exploration' (new and, in most cases, unsuccessful paths).

Greater transparency in funding also plays an important role as a critical instrument to promote research excellence, ensuring open and detailed evaluations, building trust, reinforcing the legitimacy of decisions for funding, allowing for improvement of the specific instrument and of the system, potentially strengthening communication processes, and facilitating comparison and benchmarking.

Regarding the promotion of excellence, greater concentration will bring more competitive research groups in the national competition arenas for funding. State funding of universities is often given as a fixed grant, even if the systems for calculating and distributing such funding may differ significantly between member countries. Some member countries have also introduced a competitive funding stream side-by-side the traditional 'stable base-line' funding. The mechanisms behind differ from country to country as well, but the idea remains the same: to direct strong research funding to the most productive and most qualitative research environments. No doubt, this is one important way to support cutting-edge research and reward those who deliver and are interested in reaching out to the surrounding society.

Considering the future, the development of good researchers and increasing the attractiveness of the profession is critical to the sustainability of research promotion; funding plays a pivotal role in this area.

Though there is general acceptance to steer at a distance, measures ensuring accountability, moderation and focus are also supported. Although these main axes for the improvement of research funding echo the general trends in European higher education area (EHEA) reforms, it is not implied that all lessons are included here. Further elaboration is needed.

Interpretation

1. To achieve research excellence, it is recommended that member countries establish research funding systems which include a competitive component. Such components are drivers of quality and lead to excellence at universities, provided that they are of enough scale compared with other funding instruments.

2. Funding should be highly diversified. There should be a balance between stable, base-line funding and competitive funding, different funding sources, instruments and target groups.

3. For institutional public funding, the implementation of a 'three-column model' is recommended. The combination of a basic lump-sum financing of research (to ensure autonomy by a stable financial base), a funding formula based on research indicators (to provide *ex post* rewards for good performance) and an innovation-oriented aspect of the funding supporting future objectives in research excellence should be sought. Innovation funding should be oriented towards institutions or research groups/clusters.

4. Great attention must be paid to how the funding schemes are created, as there is a risk of the disappearance or deterioration of certain kinds of research. As recommended by one member country, governments should fund the whole spectrum of scientific disciplines, especially in basic research. Funding schemes should also incorporate a mix between 'exploitative' and 'explorative' research.

5. Greater transparency, the focused promotion of excellence and a strong future outlook are important factors that should be included when designing a funding instrument to promote research excellence. Emphasis should be placed on the further development of 'excellent group' instruments, in making the researcher profession more attractive and, for 'elite research', in targeting early career/young researchers as well as researchers abroad.

6. As funding is stated as a critical instrument for research excellence, efforts should be directed towards exploring the good practices that are currently being employed for funding. The design of financial instruments should have the highest priority within the policies of research excellence promotion (no matter which general strategy type is followed).

Observation 2: Assessments of importance and success of funding instruments

Incentive mechanisms through research funding, peer review based funding and funding of individual researchers are considered more important to promote research quality/ excellence in the funding approaches of the countries represented.

Description

On the whole, incentive mechanisms are considered generally important. The WG is specifically interested in the importance of incentive mechanisms to promote research quality/excellence; averages for both mechanisms referring to quality ('funding of institutions to build quality/excellence' and 'rewards for outstanding quality') earned values of 3 or above out of 5. Incentives through research funding, peer review based funding and funding of individual researchers are considered the most important to promote research quality/excellence. However, 'sanctions against underperformance' received particularly low values from member countries. A lower than average result can also be attributed to 'incentives through immaterial benefits' and 'income incentives for individuals'.

When further delineating between the incentive mechanisms, it is possible to categorise them between individual and institutional mechanisms. Taken as a cluster, those mechanisms considered to incentivise individuals reveal a wider variance between them and are generally considered of slightly lower importance

as compared with those mechanisms considered to incentivise institutions. The mechanisms potentially performing a dual role to incentivise either individuals or institutions fall within the upper-range cluster for individual mechanisms. The results of the analysis can be found in Table 5.

Interpretation

The variance between the levels of importance for incentive mechanisms is relatively low, suggesting that most of the named mechanisms are generally considered important. One nonetheless notices that the cluster of individually-oriented mechanisms is considered slightly less important than institutionally-oriented mechanisms. The reason for this may be that the kinds of incentive mechanisms geared towards the individual would likely have less of an impact than those geared towards institutions as a whole. Mechanisms that motivate whole institutions would also include individuals and, whereas the individual aspect lies more within the responsibility of the institution, it may be more difficult for individual researchers to move institutions forward. In addition, the aspect of autonomy further prioritises institutionally-oriented incentive mechanisms since governance policies that are geared towards supporting university autonomy tend to also be tied with competition between institutions. As performance largely depends on how an HEI does in comparison to other HEIs, certain incentives are used to increase performance, giving those institutions a degree of free reign to excel beyond what they normally would under more structured governance. What is missing in most countries is a mechanism to realise an *ex ante* funding of institutional plans to attain excellence in the future. The need for a balanced mixture between incentive mechanism types seems to be critical.

Researchers are often driven by recognition as well as by financial incentives or other reasons. Funding is of primary importance to researchers, though they also strive for the best research environment in terms of people and equipment. Incentives or sanction mechanism should be connected to these topics.

Interpretation

1. Incentives for promoting research excellence through funding instruments are important and should be implemented with a mixed balance of different kinds of incentives targeting different groups, extending to the use of both institutional and individual incentives. A dual system to motivate institutions/groups of researchers as well as the individuals who make up the institution would likely achieve strong results, versus a system that concentrates on a single level. However, the right balance or appropriate combination of funding mechanisms cannot be generally stated and will depend on the member country's national strategy.

2. An important mechanism which is missing in many countries and should be promoted is the competitive *ex ante* funding of institutional plans to develop research excellence.

3. Financial incentives have to be linked to funds for people and equipment; the motivation structure of researches enables stronger incentives through this mechanism compared with individual income.

4. Approaches such as contract management have a high preference in some member countries (for example, Belgium, Lithuania and Turkey); in these countries, this is also seen as a successful instrument. This makes it an important instrument for transnational learning effects; the analysis of good practice in funding should concentrate on indicator-based funding and innovation pool with competition, for example, because these instruments seem to be successful and well known in few member countries.

Observation 3: Funding models with peer review

All available funding allocation methods in the questionnaire were considered generally important and successful. However, peer-reviewed competitive funds rise above all methods in terms of both importance and success. The role of peer review in competitive funding and the possibilities to use different models of peer review is worthy of deeper exploration.

Description

Graph 2 illustrates the importance and success of allocation methods concerning research quality/ excellence in the surveyed countries. Despite a couple of cases with weaker success scores, the majority of allocation methods scored very similarly, again near the 3 to 3.5 range.

The clear 'star' of the allocation methods, both in terms of importance and success, is peer-reviewed competitive funds. Most methods are grouped closely together for importance level, hovering near the 3.0 range. In addition, several countries listed examples of peer-reviewed competitive funds as among the most successful case studies/good practices. In order to better understand the reasons and success factors behind this highly valued allocation method, Table 6 presents the reasons and proof of success offered by a few of the member countries.

Interpretation

On the whole, most methods are considered generally important and successful (2.5 or above in both aspects). No allocation method is considered unimportant and only two are considered slightly unsuccessful, compared with the other methods.

As noted, peer-reviewed competitive funds rise above the other allocation methods, are the major funding evaluation system for several countries, and enjoy a high reputation in many countries, namely due to the features of transparency, unbiased character and support for collaboration. For smaller countries, however, this method can lead to 'in-breeding' and the promotion of peers, etc. International participation can counteract these influences and countries noted certain advantages when the peer reviewers were an international group of scholars with specific knowledge in the field. Disadvantages were also mentioned, though, such as the high cost to obtain these peer reviewers and the risk that they are out of touch with the country's specific context.

Peer review combined with evaluation methods should be employed with care in order to avoid too much intuition and personal preferences. For example, hearings and interviews can be used as supplementary evaluation tools, especially for big budget project proposals. Different forms can emerge depending on the priorities of a member country's research strategy. Both universities and governments can benefit from a certain degree of indirect control by opting to choose peers with varied backgrounds. Different degrees of power can also be allotted to the groups in regards to the distribution of funds and roles assigned.

Interpretation

1. The success of peer review depends on the exact realisation of the instrument. Comparing the member countries' experiences, important success factors are maintaining transparency, securing competent and committed reviewers, including a mix of 'types' of reviewers (from different backgrounds, such as with an academic focus, policy focus, etc.), often including international reviewers, and combining peer review with other methods or complementary measures. Benchmarking based on good practice in peer review should be stimulated on the European level.
2. Peer-reviewed competitive funds are important and successful, but further attention should also be given to those allocation methods with the potential to further rise above the group as well, such as indicator-based funding and institutional funding of research capacities.

Observation 4: Strategy orientation of allocation methods

Allocation methods can be linked to the A/B/C typology of strategies.

Description

When considering the allocation methods often employed by member countries, they can be linked to the typology of strategies presented earlier. A number of the allocation methods can be employed in the context of more than one strategy orientation or can be emphasised by one strategy orientation in particular depending on the priorities of the country.

A summary of the likely allocation methods for the corresponding strategy orientation(s) is provided in Table 7.

Interpretation

The prioritisation-oriented strategy seems to have fewer instruments at its disposal than the other two types. Perhaps most relevant, the table shows which instruments are likely not suitable for certain strategies. Certain allocation methods support one specific strategy (or more), but the main findings indicate that a number of instruments are flexible in the kind of strategy to which they can be applied, such as peer-reviewed competitive funds. The varied use of peer review is witnessed by the promotion of autonomy/competition (demonstrated by Denmark's implementation of the UNIK initiative), or as part of a prioritisation-oriented strategy (such as the German *ExzellenzInitiative*). Lithuania provides an example of the use of individual research funding as an allocation method to foster capacity-building. Namely, it is putting in place a grant scheme providing funds for students and researchers.

Often seen as a tool for sustainability, full-cost funding deserves some special attention due to its growing importance and relevance for university research excellence. As can be noted, full-cost funding is not considered a main driver for strategy B, though this leads to the question as to whether it could be an instrument for an autonomy/competition-oriented strategy, whether it is a condition to achieve the strategy or both. In any case, only if universities are able to govern their finances as a whole and are accountable for it, can they establish a strategy that can be balanced between their diverse and complex goals.

Interpretation

1. There is a link between funding/incentive mechanisms and the three strategy types of capacity-building, autonomy/competition and prioritisation. Different strategy preferences induce certain preferences for instruments, examples of which were outlined by Norway and Latvia.

2. The use of instruments has to adapt to the priorities in national strategies.

Observation 5: New developments in funding

New developments for funding methods are occurring in a number of countries. In general, there is an increase in the diversity of funding sources across member countries. Specific developments have thus arisen to respond to this diversification, including the advancement of more complex and sensitive evaluations, the creation of national PhD schools, brain-drain prevention measures and international agreements, among others.

Description

As the ERA is in a constantly shifting and mutating mode, it is important to track new developments as closely as possible. This is particularly true in the policy context, as the results expected from measures being considered for implementation and those recently implemented may vary greatly from the current national situation. member countries were asked to identify the newest developments in funding methods of their university systems. Table 8 includes examples and descriptions of these developments in several countries.

Most new developments in funding methods have pertained to building upon or improvements to capacity (namely transparency methods), a movement towards competition and autonomy, and a trend towards funding with a focus on excellence or one that is specialised. In addition, external considerations (i.e. international aspects or links with the community and business sector) are also highlighted in funding scheme developments, though this should be understood as a trend that runs throughout all three strategy types, rather than a strategy type in itself. There have also been notable new developments in PhD funding at the national levels.

Two countries can be mentioned which stated high priority for a certain strategy and which gave high weights to certain funding mechanisms. The first example is the allocation of funds towards national centres of excellence in Norway, which support a strategy oriented towards prioritisation through the promotion of excellence research groups. A second example can be given for Latvia, which, as part of its capacity-building-oriented strategy, uses structural funds for the development of institutional infrastructure, focusing on the development of joint infrastructures.

Interpretation

As a general observation, there is increasing diversity of funding across member countries to foster excellence in research. Universities are obtaining funding from multiple sources and there is an increasing need to prioritise from which they request funding. Though the balance is not offered in a formulaic way, this balance is crucial for the sustainability and excellent performance of universities. An increase in the diversity of funding sources results in an increase in the diversity of funding instruments. This can be considered a largely positive development, though it demands certain conditions and greater attention to the development of those newer funding instruments. In light of this growing diversity, there is a need to find common ground.

A general pattern emerges based on the newest developments of funding methods: strengthening capacity (through transparency measures), fostering university autonomy and competition-based measures (through grant schemes and funding structures geared towards performance), and concentrating on specialised and excellence-related focuses (through the selection of globally competitive researchers and institutions). An additional aspect running through all strategies concerns measures for external aspects to build stronger ties that foster 'institutional and researcher networking', allowing for greater opportunities in the global higher education area and in the greater realm of society. A specialised measure, brain-drain prevention, is more relevant to some countries than to others as a way to ensure the sustainability and growth of the country's researcher base. In addition, similar to methods to promote research quality, funding methods can target individuals, research teams, institutions or a combination of all three. For the examples provided, most funding methods are geared towards institutions.

Although fostering competition is a compelling argument to increase university excellence, it should be noted that there is a risk that competitive-oriented systems *could* drive costs down and lead to a 'low-cost culture', if designed in a certain way that leads to this outcome. As a result, in the new developments of funding systems, there is a tension between low-cost culture and achieving excellence; the former could harm the latter, though for certain cases, it could foster it, such as when a university is forced to look elsewhere to maintain competitiveness. However, if instruments are employed that foster a low-cost culture, there should be careful attention paid to how this is impacting university research as a whole. The risk of heading down the low-cost route is reduced if certain instruments are implemented, for example a full-cost model. The low-cost culture is typically imposed upon universities; they are not the drivers of this system, but act in a way that is a response to this kind of system.

Interpretation

1. Due to the search for excellence, new mechanisms are being created and new forms of competition for funding are emerging. These new forms should be limited in their complexity by keeping some common elements (alongside more traditional ones), especially concerning the application procedures to apply for funds.

2. There are certain dangers that may be associated with competitiveness, namely the fostering of a low-cost culture. Great attention must be paid in order to avoid these kinds of negative outcomes that stem from what are initially meant to be positive pressures. As there are different forces in higher education and these forces are complex, there is a need to balance them, rather than applying an either/or solution or a formula. The great diversity between higher education systems further contributes to this complexity and requires flexibility in finding viable alternatives all the while maintaining a degree of consistency across member countries.

3. Future development of funding methods should be closely linked to and informed by the specific context and priorities of each country, with an awareness of who/what will be targeted and what the methods will promote.

3.2.2. Assessment tools for research quality

The objective in the context of this section on assessment tools for research quality is not to come to an assessment of quality in the member countries, but to reflect on the methods of assessment/measurement and their use.

Observation 5: Trends in assessment philosophies for research quality

Assessment philosophies of member countries are varied, yet balanced, following certain explicit trends, including the use of disciplinary versus institutional assessments, peer review versus indicators, both *ex ante* and *post ante* measurements, both qualitative and quantitative methodologies, output orientation, and some linking of goals and feedback loops.

Member countries converged in naming funding, accountability and transparency as the main ways of use in steering models to support the various assessment philosophies.

Description

Some clear tendencies can be identified regarding assessment philosophies.

- Both disciplinary and institutional level assessments are conducted, with particularly strong support for the former.
- Judgement of peers emerges more frequently than indicators, though the use of the latter is growing.
- About half of the member countries surveyed employ *ex ante* measurement methods and about half employ *ex post* measurement methods. In some cases, a combination of both kinds is employed or attempted. Fluctuations in the time frame to conduct these measurements can be noted.
- Qualitative and quantitative assessments are employed about equally.
- Output-oriented methods are prioritised more than input or process methods.
- The linking of goals/strategies and feedback loops are noted less often, though the linking of goals is predominant.

Member countries converged in naming funding, accountability and transparency as some of the main ways of use in steering models to support the various assessment philosophies. The latter is suggested by evaluations being publicly available.

Interpretation

Actual tendencies in member countries correlate to a certain degree with support expressed for certain assessment philosophies, but lag behind in some aspects. For example, despite the strong support and preference for disciplinary level assessments, institutional assessments are still employed quite often. Assessments based on indicators or a combination of methods are followed with great interest, but are still rated among the more innovative of practices. Lastly, the use of both *ex ante* and *ex post* measurements is most valued, though this is not practiced as commonly as might be expected.

The finding that funding, accountability and transparency are used most often confirms that member countries rely on funding mechanisms in their assessment philosophies, whereas the link between strategic planning and assessment is weak. Strategy orientation and feedback loops on goals are less common.

Interpretation

1. Assessments must support transparency and accountability. Public availability of these assessments further reinforces these features.
2. Strategy orientation including feedback loops from performance assessment to goals should be strengthened. The notion of excellence relating to goals should underlie the assessment.
3. Ideally, most assessment philosophies benefit from a combination of methods, such as the use of both *ex ante* and *ex post* measurements. Attention must be paid to time frames for *ex ante* and *ex post* measurements, which are most meaningful when enough time has elapsed to allow for development in quality to occur.

Observation 6: Trends in assessment instruments

Assessment methods can be divided into the disciplinary level, institutional level or a combination of both. These assessments and evaluations (peer review included) vary in the kinds of measurements employed (*ex ante* or *ex post*), methodology (quantitative or qualitative) and their orientation (input, process, or output). Some countries have also recommended innovative methods, including assessment based on indicators (Norway) and external evaluations with researcher *viva voce* (Malta).

Description

Regarding assessment methods, a number of trends can be observed. Assessments and evaluations are widely used in all countries; often they are linked with some form of peer review, often by international experts. Many of the success factors discussed in peer review for the case of competitive funding can also be extended to peer-reviewed assessments. It is generally agreed among member countries that peer review is an important and successful tool for both funding and assessment, but the fine details regarding how to make a good peer review are highly relevant and need further elaboration.

The target group of the evaluation also shifts dramatically between national systems, with evaluations concentrating on the entire institution, on disciplines or on combinations of these. The combination of methods is highly relevant in this context and supports the idea of balance and diversity across realms (from funding to assessment). An example includes peer review funding (including international experts) with crossing evaluation processes.

Based on the compilation of results presented in Table 9 'Tendencies of different assessment methods based on disciplinary or institutional level', some general observations can be ascertained.

Disciplinary assessments are mostly peer review based, employ *ex ante* measurement and enjoy wider support from policymakers than institutional assessments. Institutional assessments were noted with about equal use, but relied upon indicators more often than for disciplinary level evaluations (or a combination of both indicators and peer review). member countries also noted a handful of assessments that are (or can be) both disciplinary and institutional. As can be expected, there is a mix in each aspect. Countries tend to

use similar and standard assessment methods for research quality, though some countries are venturing towards alternatives, with relatively high success rates. In addition to having different targets, evaluation procedures show a variety of strengths and weaknesses.

Main strengths of disciplinary level assessments

- Directly aimed at the individual research departments and groups.
- Greater potential of expert evaluation and professional understanding of topic.
- Competition towards useful research activities can be encouraged.
- There can be differentiated assessment criteria for the selected disciplines.

Main weaknesses of disciplinary level assessments

- Can take too long and there can be a shortage of money.
- Sometimes *ex ante* assessments are made without strict *post* evaluation, but it is difficult to conduct *ex post* assessment on the level of excellence.
- May focus mostly on the scientific level of the projects and less on the financial aspects and valorisation.
- Challenge to ensure recommendations from the evaluations are followed up.

Main strengths of institutional assessments

- Can be conducted fairly and transparently in the scope of national-wide HEI assessments, in all fields of knowledge, independent of institutional or departmental boundaries, and are often legally established nationally.
- Tend to be more closely related to funding and to stimulating bottom-up research unit organisation.
- Greater likelihood that all indicators are ensured to be a part of the evaluation; provides quantitative data that can be utilised for future strategic planning.
- Commonly based on internationally accepted criteria, thus improving dissemination of scientific results of science and studies to institutions at an international level.
- Handling of the data is likely more centralised, ensuring a better chance of coordination and consistency.

Main weaknesses of institutional assessments

- Often too slow, creating difficulties concerning human resources and in keeping the scientific community motivated.

- Often, few qualitative criteria are included and there is no information about quality.
- Not always related to the heterogeneity of the research system and its elements.
- May be difficult to find suitable/unified criteria for different institutions and research branches.
- No reflection of real status of research fields, but is mainly connected to funding distribution.
- As a more distant kind of evaluation, it may not work as an incentive for individual departments to improve the quality of research.

Interpretation

The general trends in assessment tools for research quality are confirmations of themes that are also evident in research quality and funding.

- The large majority names peer review as a main 'good practice'.
- Peer review combined with qualitative data or other instruments is cited often.
- Romania and Turkey highlight the use of indicators, Romania specifically for HEI accreditation.
- Indicators are more successful when internationally recognised, valid and reliable.
- Time lapse between assessments is worthwhile to be noted. When this period is too short to produce (or measure) quality, the following evaluation diminishes in usefulness. It must be ensured that a sufficient amount of time has elapsed between one evaluation's findings, implementation of changes (or maintenance of status quo), the recording of the development (or lack of development) and the next evaluation.

Interpretation

1. A combination of 'standard' assessment methods along with more innovative options may offer a strong balance and greater success in assessing research quality. The good practices of Norway (indicator-based), Denmark (development agreements) and Malta (*viva voce* representation) in this area can be particularly noted for this. It depends on the national higher education system's priorities to determine which strengths are most important and which weaknesses can be fortified when developing or selecting a specific assessment method. This will largely depend on the size of the country and the structure of the system.

2. In disciplinary evaluations, strong research organisation and scientific leadership is crucial, as are effective institutional strategies for research. Evaluations must be open and transparent and include international/external evaluators with specific expertise. It is important to have a wide network of external examiners who can provide a reliable and effective input assessment. The use of indicators also strengthens the evaluation.

3. Even if an institutionally-oriented assessment is implemented, the methods of assessing should be at the disciplinary level, particularly as excellence means something different according to different disciplines. The creation of panels to assess multi-disciplinarism is gaining importance and the awareness of the differences between disciplines should not be underestimated.

4. Assessments should be designed so as to limit local bias but not be devoid of knowledge regarding the local context, be informed by and promote internationally benchmarked standards, and ensure careful selection of the assessment criteria (relying on experts, policymakers, etc.). In addition, attention should be given to proper execution. A team can be formed with the responsibility of overseeing this aspect.

When information is collected, it should include both quantitative and qualitative data and be carefully recorded, as it may serve other purposes to improve research excellence. Lastly, procedures for proper data verification and follow-through of the assessment recommendations should be built into the system as much as possible.

Observation 7: Focus on peer review as an assessment method

Peer review assessment is highly employed and valued in the EHEA. There are a number of strengths as well as weaknesses that are recognised by member countries.

Description

Although peer review is widely used, there are different forms or models of peer review, many of them incorporating other assessment methods, such as indicators, workshops or *viva voce* presentation. In short, evaluations do not come in just one packaged form. It is necessary to identify more specific success factors for an adequate implementation of different peer reviews. They can be highly nuanced and there are various evaluation procedures and experiences in the research context. For example, in the case of Malta, an external evaluation is combined with a *viva voce*/presentation of the researchers involved. Table 9 highlights the reasons for success noted for models of peer review assessment methods.

Interpretation

It is clear that peer review assessment is highly employed and valued in the EHEA. There are a number of strengths as well as weaknesses and although not exhaustive, some of the main arguments are included here.

Strengths: When using peer review from external sources (international teams), it is devoid of local biases; ensures standards are benchmarked at the international level; creates possibilities of objective comparisons and allows for differentiated assessment criteria to be applied depending on the kind of peer review. The method enjoys high legitimacy within the scientific community, has the advantage of allowing for the selection of excellent research projects, and is relatively objective. In addition, it can be directly aimed at the individual or institution; can be fair and transparent when properly executed; it is often legally established and recognised; and it can provide valuable qualitative data useful for other purposes.

Weaknesses: When external, evaluators may not be aware of the local situation, the respective research field or the specific context of the given programme; they may also not be provided with relevant information by granting authorities; peer review assessment can be costly; it may be difficult to find unified criteria; there are problems of data verification; there is a certain lack of objective comparability of data; it is difficult to determine the relationship between measurement and quality; it may be difficult to ensure follow-through of the peer review assessment and recommendations; and it can be too time-consuming and slow (especially in terms of human resources). In addition, peer review is not always transparent in the selection process; it may be biased or include nepotism; there is a narrow range of people involved with selection; there may be a lack of experience, a high expense, and a long preparation process. In addition, too much peer review can undermine the system. There needs to be a balance between the different kinds of assessment methods used in order to ensure sustainability of the system.

Outcome

Some desirable features of evaluations using peer review include that they should be aimed directly at the project or individual and that the experts evaluating the research have a high level of knowledge and

expertise. In addition, peer review should be balanced with other forms of evaluation and assessment so as to strengthen the sustainability of the system.

Observation 8: Indicators and their context

Aside from peer review, the use of indicators is highlighted as a good practice by member countries, although certain measures are recommended to increase their effectiveness.

Description

The use of indicators is mentioned as a key main lesson learnt in the assessment practices for research quality of member countries due to their internationally recognised nature, validity and reliability, as well as their character of fairness and comparability. Certain indicators are mentioned which reflect input, process and output-oriented aspects of research, the expertise of the researchers, and the success of research to reach across boundaries. When choosing indicators, the contextual aspect often shapes decisions. As member countries are striving for excellence from different angles, being aware of specific priorities or conditions of the higher education system is particularly important. In addition, the choice of indicators should reflect the specific goals of the system and of the stakeholders, with limited counter-activity.

However, there are also drawbacks to employing indicator-based assessments. Some of these include choosing the right indicators used for the resource allocation model, and knowing whether the right factors are measured and stimulated, and the challenge of ensuring that the (right) incentive effects are understood and absorbed at the 'research-producing' level. There is also the problematic use of bibliometric indicators in the social sciences and humanities (not a fair representation of research production in these fields) and the issue of data quality suffering from lack of availability and/or reliability. Existing databases may not be interconnected/interrelated and there is a challenge in determining the relationship between measurement and quality. Lastly, there can be difficulties finding comparable data and goals due to HEI differences (differing research intensiveness).

Interpretation

In order to curtail the potential problems associated with indicator-based assessments, there are a number of alternatives, such as discussion and engagement of different stakeholders to ensure that the appropriate indicators are chosen. The development of database systems to ensure data are available and reliable could help resolve some of the data quality and comparability issues. There also needs to be clear and agreed upon definitions so that indicators can eventually be compared across disciplines, institutions, countries, etc.

Member countries specified considerations that should be made regarding the use of indicators: internal committees for quality assurance and evaluation should take into account existing European guidelines and findings on research indicators, such as the Erawatch Research Inventory. Different practices in various disciplines and research fields regarding indicator preference must also be taken into account (in the natural sciences versus humanities, for example). There is a need for data beyond the standard indicators measuring third-party funding, publications and PhD students. The creation of a checklist of quality indicators approved by a national authority in higher education would be helpful. There is a generally common set of indicators used in the context of research excellence. Further development of effective indicators for research excellence should be supported. In the meantime, a useful source of information and extensive

list of indicators can be found on the Erawatch Research Inventory pages ([4]).

In addition, development agreements (Denmark) are worthy of serious consideration and represent an innovative practice as an assessment for research quality. In fact, they are less 'assessments' and more dialogues between the HEI and the Ministry. Strengths of this method include that there is no automatic link between the universities' results regarding the goals and funding, so that open communication can take place with the aim of improvement rather than fear of being automatically penalised. This provides a large degree of transparency regarding the goals, strategy and results for the individual university.

Interpretation

1. Peer review and indicator-based assessment are complementary and a proper combination can avoid disadvantages associated with using one single instrument. member countries suggest that in an evaluation process, some data analysis should always be part of a peer review ('informed peer review'). Outside the evaluation context, the two approaches need not necessarily be linked: funding and accountability or rankings might be satisfied with pure indicator systems, for example. Peer-reviewed funding of individual researchers can be made with 'pure' peer review. In contrast, in evaluation processes, a mixture is recommended.

2. Another suggestion is to link the choice of indicators more strongly and explicitly with goals in research, as goals deliver the rationale for indicators.

3. There is a general need for greater central coordination by both national systems and by the whole ERA to develop and establish indicators measuring research quality. Clear, agreed upon definitions of indicators should be established and maintained so that cross-HEI and cross-country comparisons are possible, particularly as some indicators can have different meanings for different member countries. There is an increasing interest to measure links with business and the larger society, though specific indicators for these topics are difficult to establish. Indicators on research quality also tend to address the quality of the researchers themselves and the quality of the input, process and output-oriented aspects of the HEI and of the HEI's research.

4. Indicators are contextualised measures and are affected by historical, geographical, social, developmental and cultural factors. A system of classification and consideration of special situations should be taken into account in order to better organise the range of indicators. In general, the issue of how to assess or measure the indicators in their contexts must be considered across national and European levels.

Observation 9: Measures to increase evaluation effectiveness

There are certain measures that can be taken to increase the effectiveness of assessments.

4 See http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.content&topicID=72&countryCode=AT&parentID=71. Erawatch is jointly carried out by the Commission's Directorate-General for Research and the Joint Research Centre's Institute for Prospective Technological Studies (IPTS) in collaboration with CORDIS.

Description

The main lessons learnt for assessments of research quality seem to address a handful of important themes. The main currents for these lessons touched upon databases, the linking of results, maintaining focus and considering innovative or alternative assessment methods. Effective, nationally-linked and updated databases are strongly recommended. The linking of results, both between financing levels and between objectives, is also noted as an important lesson to be learnt.

Other common and specific measures to enhance the implementation and follow-through of assessments for research quality include a greater emphasis on focus, the use of innovative practices and attention to the time lapse between evaluations.

Interpretation

- *Databases:* National database of all publications from the national HEIs is a good solution to overcome data problems, such as updated issues, or the mismatching of information provided directly by HEIs. National R & D databases must be kept updated at all times, including all publications and patent information of individual researchers.
- *Linking of results:* More direct correlation between the results of evaluations and real improvements in the HEI is needed. Comparison should be made between objectives and results, after a well-organised *ex post* evaluation.
- *Focusing on the top segment of research:* A segment of elite research is very important (encouragement of researchers to work towards a high international standard and quality). The international standard aspect is perhaps the newer element in the trend to become more focused. The rising global knowledge society is putting more pressure on countries to channel money and energy into a specified top segment of research.
- *Time lapses between evaluations* should be paid attention to and adjusted according to the needs of the system; some systems may require a longer time period between evaluations in order to accurately monitor changes.

Interpretation

1. Further consideration of the development of measures to improve the effectiveness of different assessment methods should be carried out. Along with the consideration of these measures, the major problems associated with each need to be noted and, when possible, measures taken to reduce or eliminate them.
2. Attention should be paid to the time lapse between evaluations and adjusted according to the needs of the system; some systems may require a longer time period between evaluations in order to accurately monitor changes.

Observation 10: Focus on rankings ([5])

Rankings should also be further considered in how best to utilise their outcomes to increase research excellence.

5 The term 'ranking' can incorporate a variety of methodologies beyond the traditionally limited scope of league table representations. Multi-dimensional rankings that organise results into general categories rather than assigning specific numbers are included in this definition.

Description

Member countries were asked to assess the reception, use and state of rankings in their countries. Aside from Denmark ([6]), there is no explicit use of rankings at the national level. Universities often pay attention to them, but policymakers do not typically use them directly to inform their decisions. A main effect of rankings is the creation of a climate of excellence.

Interpretation

The European Commission policymakers have a stake in the future use and plans for the future multi-dimensional assessment. member countries offered their main impressions on rankings in regards to the promotion of excellence in research.

- Rankings should not be relied upon exclusively. However, if a ranking is well developed (at the disciplinary, not the institutional level), it can inform a decision.
- Rankings can be used as a transparency tool. Rankings on the disciplinary level create more relevant information than institutional rankings. However, a sound methodology is needed.
- Rankings can be a driver to promote research excellence, though it should be considered as to whether the EU wants 'silos of excellence' with corresponding areas of lack. Some rankings can promote massive concentration in certain areas, making what is already good even better and what is not as good, perhaps even worse. This should be kept in mind when adopting certain rankings.
- Despite being major drivers of excellence, rankings do not appear explicitly as instruments in the member countries' policies.
- As a strength of the ERA is its diversity, different rankings should be incorporated that focus on different kinds of institutions and different target groups.
- Rankings are also important for controlling reputation and they have a large influence on the public. Policymakers are therefore very attentive to them.
- More basic research on ranking as a policy tool needs to be conducted. As of now, it has remained largely politically-oriented. Desirable would also be a forum to exchange views and opinions about rankings.

Regarding rankings, their use is still largely debated, but it is recognised that they are becoming an increasingly important tool for universities and policymakers alike. The importance of supporting and developing rankings with robust methodologies and orientation towards a disciplinary and multi-dimensional analysis should be emphasised. There may be a variety of possibilities as to how to use rankings as supplementary tools to foster research excellence.

Interpretation

The Commission should create a forum where the issue of ranking can be deepened and ideas exchanged in a positive manner. It should also be attentive to the possible uses of rankings, the impact they have on universities, on students, on policymakers and on other stakeholders. Careful attention must be paid to the

6 Since 2008, Danish students have been able to finance study abroad in full or partly through a study abroad grant scheme, which awards students abroad with a grant equal in size to the Danish state's subsidy to equivalent education programmes in Denmark. The scheme applies to students studying at a number of foreign universities, which meet one of four criteria set by the Danish state, one of these being a place among the 100 best in The Times higher education ranking.

methodology and how the ranking is developed. Ranking on the disciplinary level is a major methodological requirement.

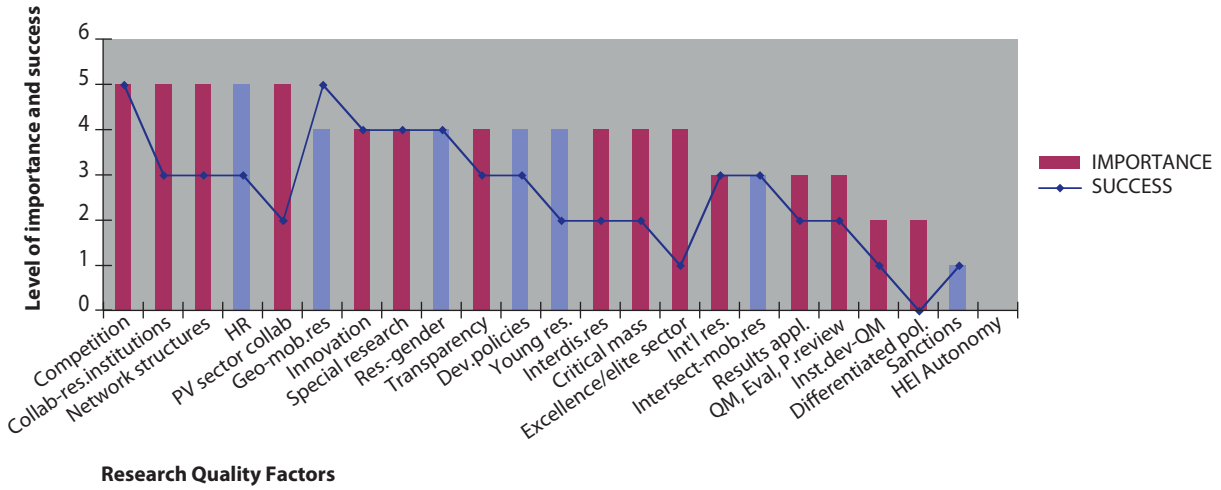
Annexes

Annex I — Identification of contextually relevant instruments

The choice of certain strategies and target groups depends greatly on the country's context. Special 'policy packages' and strategies targeted at specific situations could be developed based on distinct needs and priorities. The questionnaire used by the WG gave an overview of a number of relevant factors which promote research quality and the experts were asked to assess the importance and the success of the factors in their countries on a scale from 1 for 'low' to 5 for 'high' (see Graph I.1 below: Romania) ([7]). Analysis of the data collection shows the status quo of the implementation of research promotion policies in a country, depending on the national context.

Graph I.1

Romania – Country Profile: Research Quality Factors



(*) The blue coloured bars in the graph correspond to the factors which promote research quality that are specific to the capacity-building-oriented strategy.

The information presented in Graph I.1 may be of use for member countries in identifying a course to follow based on their current situation and according to their specific strategic goals. To support decision-making, the graph could be used and developed further in the ways below.

- The importance profile could be analysed from the perspective of the three strategy types in order to identify if the country focuses on strategy A, B or C. This allows one to reflect whether the factual strategy priorities coincide with the intended strategies.
- From intended national strategies an ideal importance line could be derived and benchmarked with the factual importance. It can be shown which shift in importance of a certain factor that promotes research quality is necessary in order to reorientate the research strategy. This also enables an analysis of measures to adapt the current importance to the intended one. When used in

7 The research quality factors are: degree of competition in research funding; autonomy of HEI in research issues; existence of development policies for research infrastructure; promotion of collaboration with private sector in research; measures for human capacity-building in research (human resources development); promotion of young researchers (including access to funding sources); promotion of internationally organised research; promotion of collaboration among research institutions; promotion of researchers in the gender context; promotion of interdisciplinary research; geographical mobility of researchers; stimulation of network structures; policies to ensure application of research results; state systems of quality management, evaluation, peer review in research; intersectoral mobility of researchers; measures to ensure critical mass in research; establishment of an excellence/elite sector in research; incentives and regulations for institutional development of quality management; focus of national policies on special areas of frontier research, newly emerging research fields; degree of innovation-oriented ex ante funding of research projects; measures for transparency of research performance; differentiated policies regarding institutions with different levels of research quality; sanction mechanisms for 'underperformers'.

conjunction with the typology table (Table 1), the table below helps to guide the analysis.

- The gaps between success and importance could be identified and it could be asked which measures should be taken to close the gaps and enhance success of a certain factor. Once a factor to be improved upon is identified, a corresponding instrument related to the strategy type can be considered. Concrete examples of such an instrument may be found in Table 1, highlighting existing member countries' instruments.
- National profiles of success and importance could be compared with certain other member countries as benchmarks or with the average of all responses. This helps to identify national specialities or areas of high success, making it worthwhile to analyse the instruments used in these areas.

Research factors categorised into strategy types

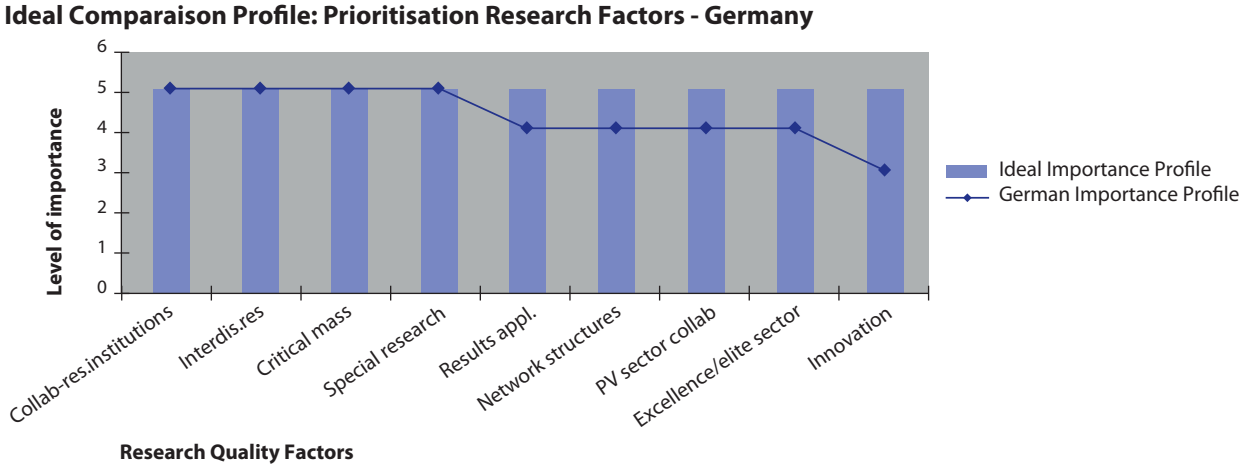
Capacity-building	Autonomy/competition	Prioritisation
Development policies for research infrastructure	Competition in funding	Application of research results
Human capacity-building in research	Autonomy of HEI	Interdisciplinary research
Promotion of young researchers	Internationally organised research	Establishment of an excellence/elite sector
Promotion of researchers in the gender context	State systems of quality management, evaluation, peer review	Focus on special areas of frontier research, emerging research fields
Geographical mobility of researchers	Incentives/regulations for quality management institutional development	Stimulation of network structures
Inter-sectoral mobility of researchers	Measures for transparency of research performance	Innovation-oriented *ex ante* funding
Sanction mechanisms	Differentiated policies for institutions with different levels of research quality	Collaboration among research institutions
		Collaboration with private sector
		Measures to ensure critical mass

This makes clear that a kind of toolset could be formed out of the data provided in the report. To better elaborate upon these uses, we will present three concrete examples (Sweden, Romania and Germany) to demonstrate how the tool may be employed.

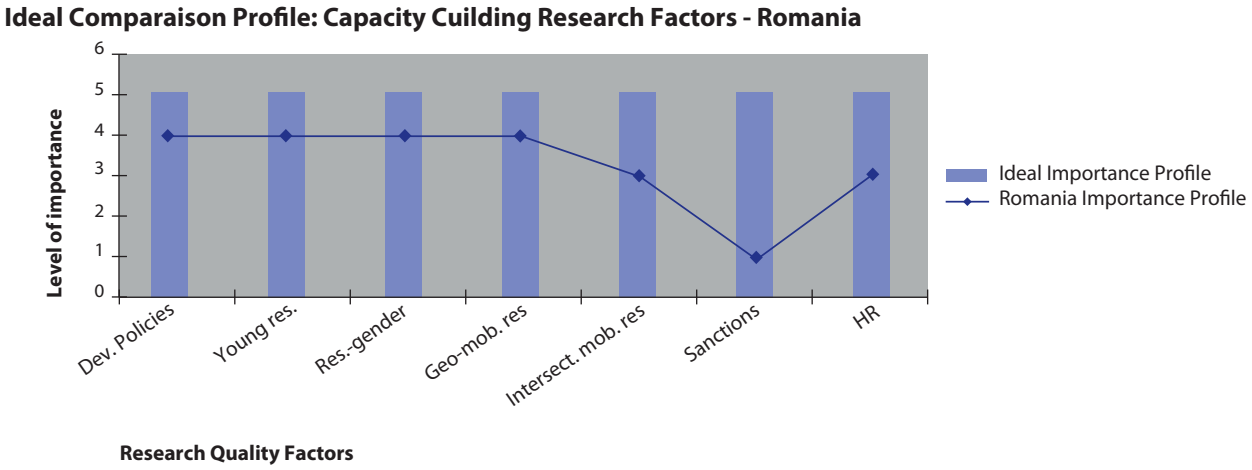
A hypothetical ideal profile can be derived based on the selection of the research factors corresponding with a particular research strategy. In the following graphs (I.2.1 to I.2.3), we took out the factors relevant for the three strategy types and gave the factors corresponding to the strategy the ideal value of 5. For each strategy type we give one country example which is quite close to the ideal one; it can be seen that the prioritisation profile best fits with Germany's responses, the capacity-building profile matches very well with the responses of Romania, and the autonomy/competition profile aligns best with Sweden's responses. (In Graphs I.2.3 to I.2.5 following this section, we provide an example representing all three profiles of one country — Sweden.) Thus, two conclusions are possible.

- The degree of correspondence in factual and ideal importance could allow for the detection of the main strategy focus of a certain country.
- This ideal importance line could be compared against the current importance line of the three countries highlighted in Graphs I.2.1 to I.2.3. This would allow for recognition of the needed shift in importance of a certain research factor in order to reinforce or reorientate the research strategy. At this juncture, the policymakers of the countries would need to consider if this coincides with their intended strategies and stated goals.

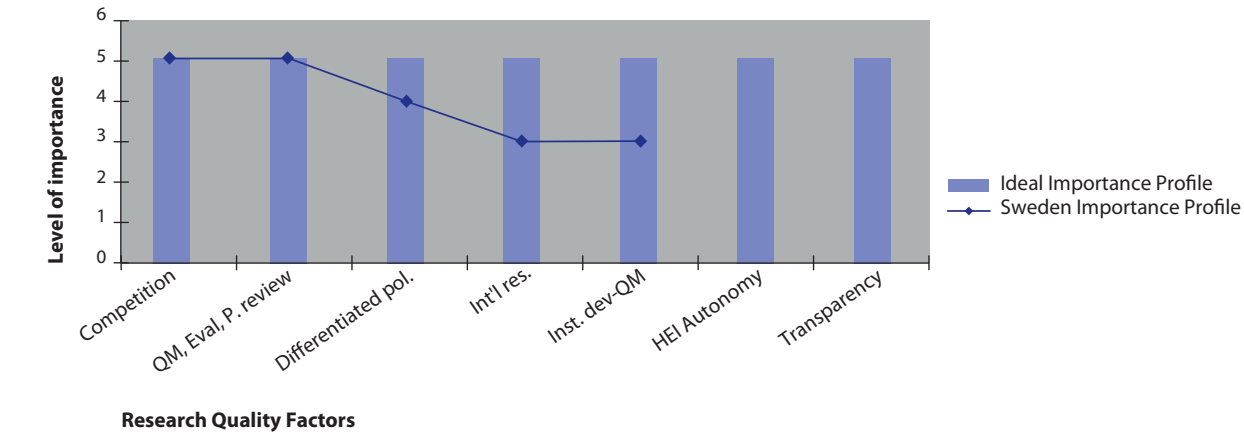
Graph I.2.1



Graph I.2.2



Graph I.2.3 ([8])



(*) No rating was offered for HEI autonomy and transparency.

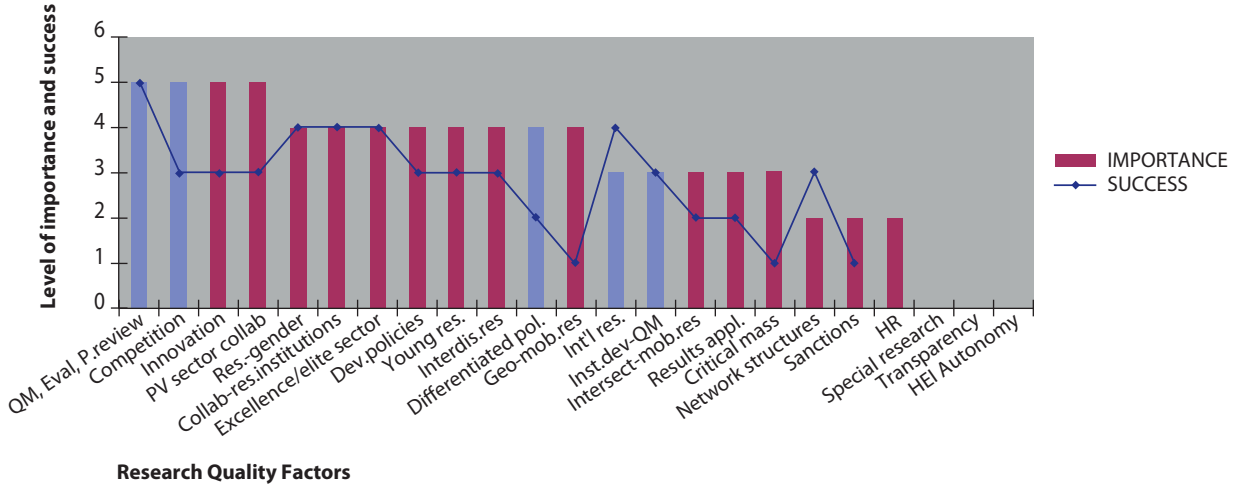
8 Level of importance values were not given to the factors related to HEI autonomy and transparency in the Swedish questionnaire.

It should be mentioned that some factors relate to more than one strategy. In addition, the interpretation of which factors are relevant for which strategy can vary greatly from one context to another. Therefore, each country would need to consider with which strategy (or strategies) their selected research factors best correspond in the specific case of their national research policy.

In respect to analysing research strategy and instruments, it is also interesting to compare the scores on importance and the scores on success of the factors which promote research quality. We did this for the three abovementioned countries in Graph I.1 for Romania, Graph I.3.1 for Sweden and Graph I.3.2 for Germany.

Graph I.3.1

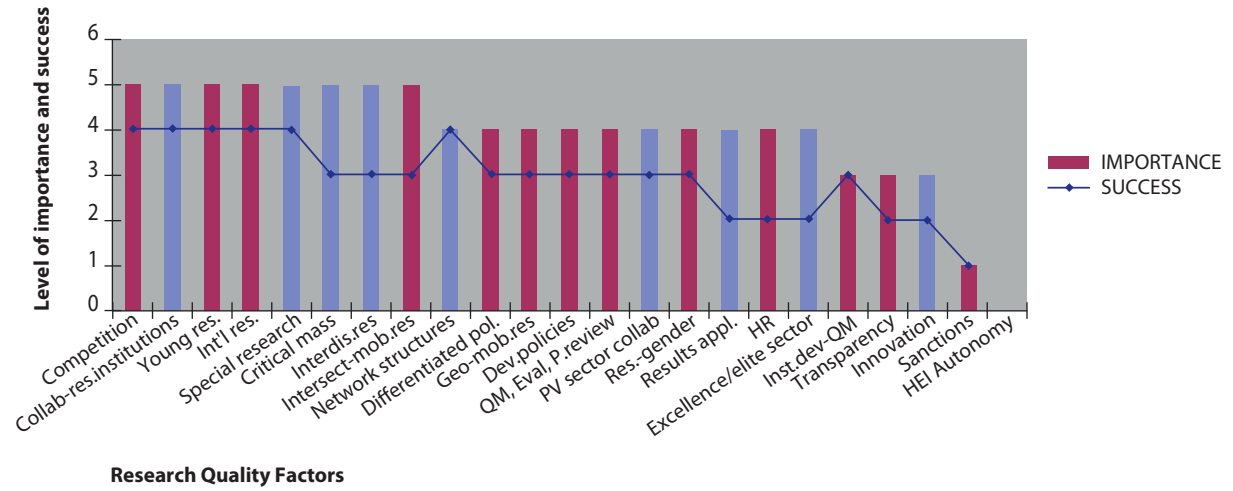
Sweden – Country Profile: Research Quality Factors



(*) The blue coloured bars in the graph correspond to the factors which promote research quality that are specific to the autonomy/competition-oriented strategy. In the instances where the importance bars or the success line do not continue, ratings were not offered.

Graph I.3.2

Germany – Country Profile: Research Quality Factors



(*) The blue coloured bars in the graph correspond to the factors which promote research quality that are

specific to the prioritisation-oriented strategy. HEI autonomy was not rated in this instance.

It can be noted that most of the countries gave certain factors higher scores for importance than for success. Assuming policymakers for national higher education systems are interested in raising the success of a relatively important factor which promotes research quality, it would be worthwhile to consider which instruments may best assist towards this endeavour. To improve the performance of a certain research quality factor, policymakers can consider successful instruments abroad corresponding with the selected research quality factor. The choice for certain instruments depends on which target group(s) policymakers are interested in and the specific context of the country.

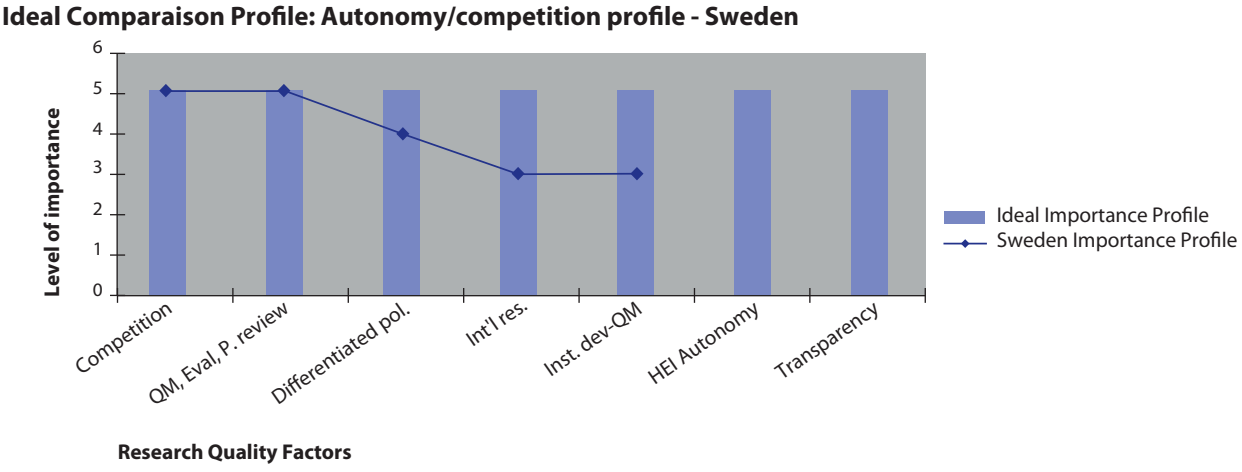
For example, if the degree of competition is the research quality factor and the institution is the main target group, policymakers may look to Ireland's PRTLI programme, designed to offer financial support in key areas of research, particularly regarding institutional strategy, programmes and infrastructure ([9]). If they are interested in promoting more competition at the individual level, policymakers may look to what the French-speaking community of Belgium is doing in their peer review system. In this way, policymakers can compare their country's specific situation and context, taking into consideration their priorities and goals, to arrive at a concrete measure that has been tested by at least one other member country.

More in general, information on the disparity between the importance score and the success score allows policymakers to identify main weaknesses across all research quality factors. If they want to tackle this weakness, they can look at other countries which might offer successful tools for this purpose.

In conclusion, these tools allow for complete freedom to modify an instrument according to one's needs, and offer a glimpse of possible options to fortify or reorientate a research strategy. Clearly, the tools depend greatly upon the assessment of the importance and success of factors which promote research quality, but once results with general acceptance and accuracy are obtained, it can be a powerful way to help make informed research policy choices and to assist in finding the most appropriate instruments to obtain related goals. The analysis is in line with the basic concepts of quality and excellence: both are goal-dependent; there is no possibility to find one-size-fits-all instruments to promote research excellence. But the analysis presented here is a step towards analytical rationality and therefore improved policymaking.

Ideal profiles for research strategies: Importance comparison — Sweden

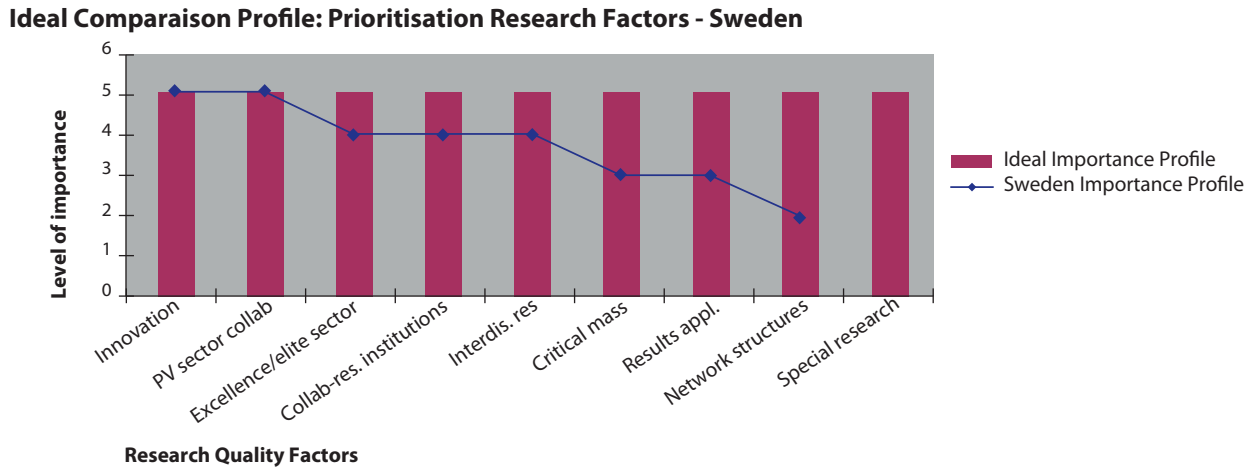
Graph I.2.3: Autonomy/competition profile — Sweden



(*) HEI autonomy and transparency were not rated in this instance.

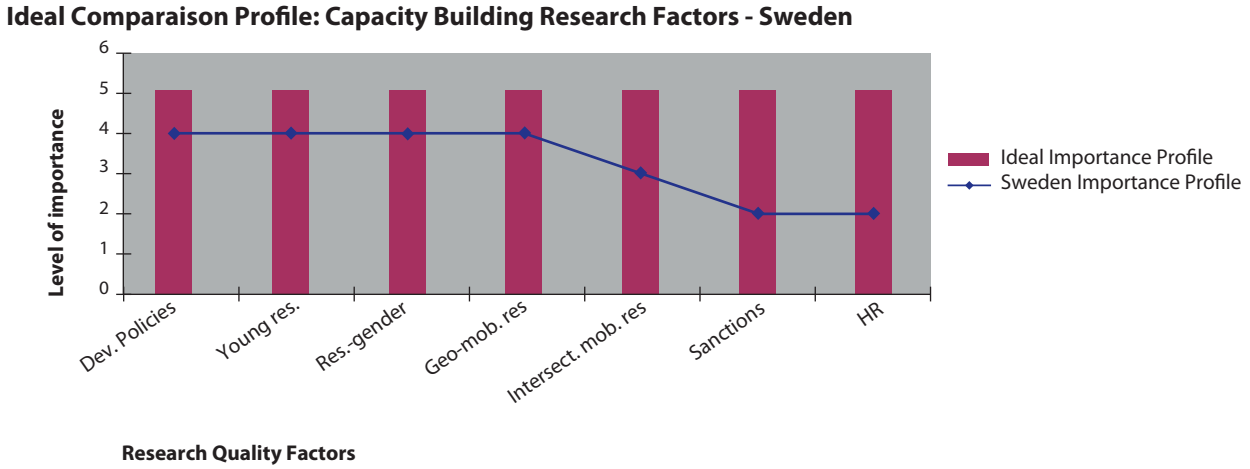
9 For more information on Ireland's PRTLI programme, consult their website at: http://www.hea.ie/en/prtli

Graph I.2.4: Prioritisation profile — Sweden



(*) Special research was not rated in this instance.

Graph I.2.5: Capacity-building profile — Sweden



Annex II — Tables and graphs

Table 1: Typology of research strategies and instruments connected with the types

Research strategies → Target groups ↴	Type A: Capacity-building instruments	Type B: Autonomy and competition instruments	Type C: Prioritisation instruments
Individual	Human capacity-building of young	Systems of quality management, evaluation, peer review in research	Targeted use of EU Structural Funds to support researchers and doctoral students by providing grants in science, engineering and medicine
	Career development of researchers	International peer review	Individual research award aiming at research excellence
	Promotion of geographical mobility of researchers	Self-evaluation of academic staff	Measures for attracting top researchers from abroad as well as for bringing back the talent
	National researchers' information system	Individual research grants from state research councils	
	Funding programmes for linking research groups/researchers to industry	Yearly grant to individual young elite researchers in order to build up research environment	
	Measures for inward mobility		
Institutions	Measures for transparency of research performance	Central organisation and institutional features of high-performance research institutes	'Pooling' of research strategies of multiple institutions
	Measures to ensure critical mass in research	Systems of quality management, evaluation, peer review in research	Policies to ensure application of research results

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Research strategies → Target groups ↴	Type A: Capacity-building instruments	Type B: Autonomy and competition instruments	Type C: Prioritisation instruments
Institutions	Financial support for alliance-building and mergers between universities	International peer review	Stimulation of network structures
	Set-up of 'liaison commercialisation offices' at universities	Legal framework: autonomy of HEIs to decide their own priorities	Introduction of 'strategic research areas' of particular potential or importance
	Measures to ensure internationalisation	Development agreements for universities	National coordination office to promote EU framework programmes
	Development of research infrastructure (also development of joint infrastructures)	Promotion of collaboration among research institution	UNIK
	Linkage of large competitive programme awards (incl. infrastructure) to track record in quality research and strategic focus by HEIs (alone or in a collaboration)		Definition of priority areas in applied research for four-year periods by the government
		Research assessment exercise	
	Block funds	Promotion of collaboration with the private sector in research	
	Reform of the institutional structure — mergers of research institutions, i.e. universities, governance structure and organisation of doctoral programmes	Funding based on bibilometric indicators	
	National researchers' information system	Evaluation of large research programmes (e.g. food science, etc.)	
	'Excellence' programmes for long-term support of strong centres or departments	Evaluations of policy instruments by research councils	

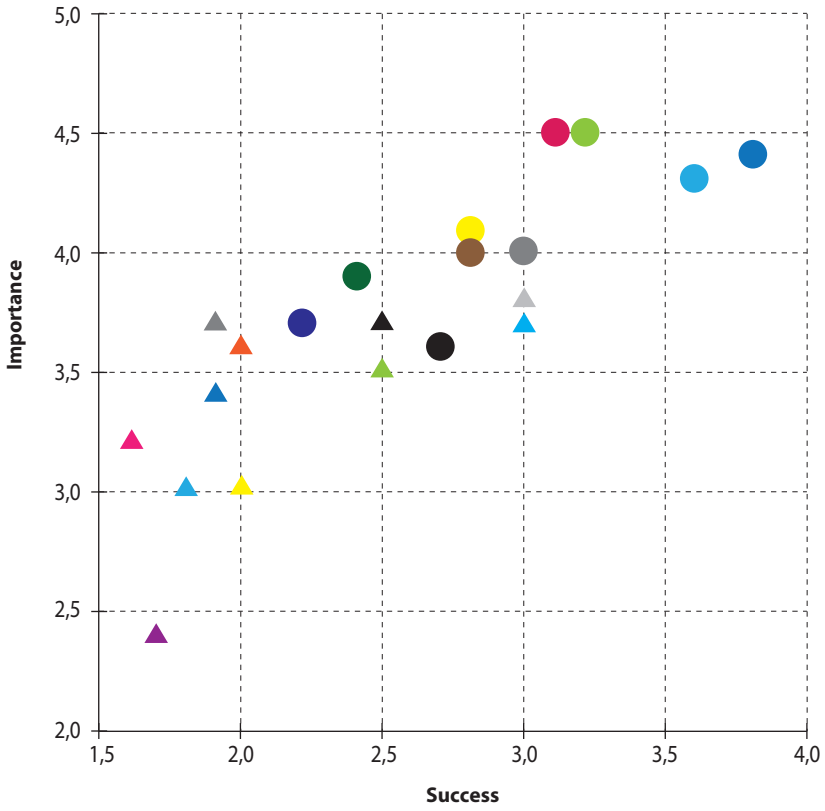
Research strategies → Target groups ↴	Type A: Capacity-building instruments	Type B: Autonomy and competition instruments	Type C: Prioritisation instruments
Research groups	Funding programmes for linking research groups/researchers to industry	Systems of quality management, evaluation, peer review in research	'Pooling' of research strategies of multiple institutions:
	Use of institutional resources and EU Structural Funds for the development of new research groups, applied research projects, centres of competence	International peer review	Policies to ensure application of research results
		Research assessment exercise	Promotion of excellence research groups
		Promotion of internationally organised research	Stimulation of network structures
		Promotion of the research groups who are successful in international grant competitions	RESEARCH2015 — Basis for prioritisation of strategic research
		Grants from national research councils by excellence	Strategic grants from national research councils by excellence or relevance
		Grants to centres of excellence	Grants to centres of excellence
			National research programme based on competitive funding
			Prioritisation of the development of transdisciplinary doctoral schools for the sake of concentration of the research resources planned

Table 2: Overview of advantages and disadvantages of important instruments to promote research excellence

Instruments	Target group: individual/ institutional	Main advantages	Main disadvantages
Funding based on results or indicators Institutional	Institutional	Promotes fact-based management. Relatively hard and cheap indicators. Focus on competition. Common criteria for measuring all scientific fields, thus making comparisons possible. Increases visibility of research areas not previously visible in international research databases. Ensures continuity in research school development.	Less incentives for cooperation. Strong focus on quantification. What about the less quantifiable factors? Can be difficult to find precise indicators. Different ways of measuring quality within different areas of research. Difficulty of taking into account different publication patterns for different research areas. Difficult to measure new, transdisciplinary and developing research areas. Results are 'counted' more than 'weighted'; risk and endeavour may be punished.
National funding competition for researchers	Individual	Directly rewards researchers or research groups. Different themes could be dimensioned to stimulate research in important disciplines or areas. Research in new fields could be stimulated. Supposed to ensure that the quality of the research universities (HEIs) become proactive in searching for external funding, thus enlarging their autonomy. New fields of research can receive funds. Younger researchers can receive funds. May help to develop an academic culture.	When there is a shortage of personnel in certain areas, there is no competition possible. When no international peers are used for the review of proposals, the selection could be unfair and not transparent. The costs of evaluation are rising. When a bottom-up approach is used: hard to select topics and steer on certain areas. Different impact in different fields (social sciences and humanities could be marginalised). External priorities influence internal priorities, and thus may lead to less autonomy for the HEIs. Difficult for traditional fields of research. Funds to individual research groups can undermine the board of director/rector's strategic planning and, more generally, the institution's autonomy. Cost of system writing applications. Use of local peers in smaller countries cannot ensure objective evaluation.

Instruments	Target group: individual/ institutional	Main advantages	Main disadvantages
Evaluation (peer review) of disciplines	Institutional	Specific advice for research groups or a sector. International acceptance. International dimension possibility to identify true excellence. Ability to capture innovative results of research efforts. Acceptance among researchers (legitimacy). Information about the research profile and quality of specific research groups within a discipline.	These peer reviews are time-consuming for the researchers and costly (even though the direct costs may be low compared with other evaluative models). Difficult to bring together groups of objective and involved panels of peers. Difficult to follow up the results of the evaluation. Highly dependent on the competence and acceptability of the reviewers.
Systems for quality management of institutions	Institutional	More responsible management. More tailored solutions, institutional autonomy in quality management. International acceptance. Use of good EU practices. External actors may be involved, e.g. in periodicals, who are interested in making ranking tables of HEIs.	Difficult to find universal criteria for different institutions and research branches. Could lead to excessive focus on indicators. Costly. Problem of verification of submitted data. Problem of appropriate selection and weighting of the criteria.
National top-down strategy with a focus on selected areas	Institutional	Stimulate excellence through focus. Able to compete internationally/more visibility. Attracts more resources for these priority areas. Pooling of limited funds. Improves societal acceptance and alleviates accountability.	Hard to select the right areas (on what bases: excellence, economic needs?). Not enough attention/funding for basic research or certain disciplines (social sciences and humanities). Tendency to focus on 'the usual suspects', e.g. the big themes such as energy, environment, etc. Overlooks the research needs of small actors. Risk of losing focus because of a shift in paradigm. Risk of undermining the autonomy of the university/institution. Possibly exposed to political instability and short-term goals of decision-makers.

Graph 1:
Magnified view of the importance and success of factors which promote research quality



- Degree of competition in research funding
  Autonomy of HEI in research issues
  Existence of development policies for research infrastructure
  Promotion of collaboration with private sector in research
  Measures for human capacity-building in research (human resources development)
  Promotion of young researchers (including access to funding sources)
  Promotion of internationally organised research
  Promotion of collaboration among research institutions
  Promotion of researchers in the gender context
  Promotion of interdisciplinary research
  Geographical mobility of researchers
  Stimulation of network structures
- Policies to ensure application of research results
- State systems of quality management, evaluation, peer review in research
- Inter-sectoral mobility of researchers
- Measures to ensure critical mass in research
- Establishment of an excellence/elite sector in research
- Incentives and regulations for institutional development of quality management
- Focus of national policies on special areas of frontier research, newly emerging research fields
- Degree of innovation-oriented *ex ante* funding of research projects
- Measures for transparency of research performance
- Differentiated policies regarding institutions with different levels of research quality
- Sanction mechanisms for 'underperformers'

Table 3: Examples of tools which promote research infrastructure in the member countries

Member countries	Infrastructure tool
SE	**Alliances and mergers to strengthen the research base** Research policy increasingly focuses on pushing academic research at the universities to the international forefront, and critical mass and physical scale of the research milieus is seen as, if not a precondition, at least fundamentally positive. In 2006, three groups of smaller universities received a minor sum (approx. EUR 0.5 million per group) from the government to intensify cooperation within the group regarding higher education, research and research training of their own choice. In one of these cases, an alliance was formed, called Akademi Sydost (South-East Academy). In 2008, this alliance, now consisting of only two universities, decided to initiate the work towards a merger, and received additional support from the government during three years of in total approx. EUR 8 million. In one of the other groups of universities, cooperation remains intensive and the idea of forming an alliance or even to merge is alive and kicking. There is a trend towards alliances and in a few cases even mergers among Swedish universities, supported to some extent by the government as a way of strengthening the research base at smaller universities. Such policy and support money can be regarded as a new infrastructure tool with the purpose of strengthening the research base through increased scale and combined resources at the institutional level.
NO	**Equipment/infrastructure projects based on HEI selected priority lis**t Smaller infrastructure (value of less than NOK 2 million/EUR 250 000) is the responsibility of the institutions themselves. Equipment/infrastructure from NOK 2 to 200 million (EUR0.25 to 25 million) is funded through Research Council Norway (RCN). Running costs of the equipment funded by RCN used to be the responsibility of the institutions. From 2009, running costs of already existing equipment funded by the RCN will be included in the project grants. This will hopefully provide the institutions with a more financially sustainable equipment regime. The most costly equipment/infrastructure (value of more than NOK 200 million/EUR 25 million) will be directly funded by the government.
RO	**Cooperation funding for large-scale facilities** The Romanian Commission for Infrastructures Research (CRIC) is responsible for ensuring the evaluation of the long-term needs of research infrastructures. There are currently nine approved large-scale facilities linked to nine of the proposals on the ESFRI 2006 list and supported by France for the development of cooperation in high-density lasers. Romania is currently intending to host the 'Extreme light infrastructure (ELI)' laser facility, as are four other countries, including France.
DE	**Building and construction expenses for tertiary education (*Hochschulbau*)** In the framework of the reform of the federalism system in Germany, the common task of 'extension and construction of higher education buildings and facilities including the one of university hospitals' was completed in December 2006. To compensate for the shift of responsibilities in this sector, the regions (*Bundesländer*) received from January 2007 until December 2013 an annual contribution of EUR 695.3 million from the federal government budget. These resources are appropriated for this specific common aborted task. Until the end of 2013, it will be checked to which extent this sum will still be appropriate and necessary. From January 2014 until December 2019, there will be a predetermined sum for a fixed, defined purpose. Additionally, the federal government is offering from January 2007 to December 2013 an annual amount of EUR 298 million for research-oriented investments in the higher education system of supra-regional importance. Eligible investment projects for university research must prove outstanding scientific quality and national relevance. The infrastructure of a new construction must serve primarily research purposes; as a rule, it must demonstrate an innovative, interdisciplinary concept. Evidence for a successful realisation of such a concept can be graduate schools, excellence clusters, research centres funded by the German science foundation, collaborative research centres, research units funded by the German science foundation, fundraising from the German Ministry of Education and research sources, European research funds or another outstanding research funding institution, publication activity or renowned awards. This will be examined at the end of 2013 to see how far a prolongation of this financing tool is necessary.

Member countries	Infrastructure tool
DK	**National programme for research infrastructure** As part of the political agreement of November 2006 concerning the allocation of the globalisation pool and follow-up on the Danish welfare agreement, it was decided to establish a special programme of DKK 600 million to be used in the years 2007–09 for investment in research infrastructure at national and international levels. The aim of this Danish programme for research infrastructure is to support investments which are of strategic and scientific importance to Denmark and contribute to ensure that Danish researchers have access to the very best research infrastructure — both nationally and internationally. Furthermore, the expansion and funding of research infrastructure is considered necessary, if Denmark is to be able to attract talented researchers from all over the world. The Danish national programme for research infrastructure primarily supports investments which are generally utilised by several institutions jointly, due to their large scale. Therefore, as a general rule, a research infrastructure should be established with active contribution from several institutions and research teams in order to achieve a coherent and concentrated effort built up around strong environments. In 2008, funding from the national programme for research infrastructure has been available for the following purposes: • establishment of major national research infrastructures; • Danish membership or participation in major international research infrastructures. In the first two rounds of the programme in 2007 and 2008, the amount of requested funding far surpassed the available funds, thus showing a significant interest and need for investments in research infrastructure. This highly competitive situation delimited funding to research infrastructures that form a basis for scientific research at the highest scientific level with a significant degree of both topicality and relevance. Furthermore, the prerequisites of the call have led to a satisfactory cooperation between Danish universities and research institutions to ensure that all relevant research teams/researchers working in a given field participate in the formation of national consortia. This secures a close relationship between the funded project and the institutions' own strategic priorities and specific plans for research activities that involve the research infrastructure in question. For more information on the programme please visit: http://en.fi.dk/apply-for-funding/calls/calls-2008/the-national-programme-for-research-infrastructure/the-national-programme-for-research-infrastructure
TR	**TR-GRID — Service for sharing computer power and data storage capacity** The TR-GRID is a service for sharing computer power and data storage capacity over the Internet. The grid goes well beyond simple communication between computers, aiming ultimately to turn the global network of computers into one vast computational resource. The Turkish Academic Network and Information Centre (ULAKBIM) has been leading and coordinating grid activities representing the TR-GRID National Grid Initiative (TR-GRID NGI) since 2003 in Turkey. As part of its work, TR-GRID NGI carries out application development and infrastructure necessities for end-users. The main aims of TR-GRID NGI are to: • give information to the national user community about grid computing, infrastructure, applications and projects; • build up the national grid infrastructure; • support the development of grid applications; • actively put in place international grid projects; • provide sustainable and progressive grid e-infrastructure with the collaboration of government, academic and industrial participants. TR-GRID e-infrastructure has been supported and maintained by the Turkish national grid e-infrastructure project (TUGA). The TUGA project was financially funded by TÜBITAK TARAL and the project aims to combine national computing resources under the TR-GRID e-infrastructure and to collect and expand the national grid community in Turkey.
IT	**Participation in the roadmap of research infrastructures launched by ESFRI** The Italian roadmap is supposed to be the means for planning investment in research infrastructure and it will be included in the three-year research plan (2009–11).

Table 4: Successful examples of public–private cooperation

Member countries	Example: Description of the initiative	Benefit for universities
DK	Industrial PhD programme An industrial PhD project is a special, company-focused PhD project. The project is conducted in cooperation between a private company, an industrial PhD student and a university. The industrial PhD programme strengthens research and development in Danish business communities by educating scientists with an insight into the commercial aspects of research and development and by developing personal networks in which knowledge between companies and universities can be disseminated. Instead of a private company, a public institution or organisation can participate in an industrial PhD project. This supports the focus of the public sector on improvement through focused, practical and research-based projects as part of the government quality reform. Public industrial PhD projects are not eligible for subsidy. The student is employed by a company, and the student's time is shared 50/50 between the university and the company. Approximately 50 % of the company's expenses are reimbursed by the Ministry of Science, Technology and Innovation. The student is enrolled in a PhD graduate school at a university, with the same requirements as for an ordinary PhD plus a business course and a business report. The obligations regarding the distribution of knowledge are the same as for an ordinary PhD, except the fact that the student will do no teaching. The universities are in favour of the industrial PhD programme. They broaden the PhD education, increase collaboration between industry and universities, increase private funding possibilities and provide access to the study of cases otherwise not available. *Innovation consortia* Innovation consortia enhance innovation in Danish firms by fostering collaboration between firms, research institutions and technological service institutes Through innovation consortia firms, research institutions and technological service institutes collaborate and develop new technology and knowledge that can be the outset for innovation in Danish firms in the coming 5 to 10 years. The consortium must include at least one research institution, one technological service institute and two firms. Innovation consortia should last two to four years. The public grant for the consortia is reserved for the research institutions and the technological service institutes. The intention behind innovation consortia is that: • high-level public research is focusing on knowledge needs in firms and will be used to develop new products, processes and services; • new skills and services will be developed in the participating technological service institutes, which are relevant for Danish firms, especially small and medium-sized firms; • firms increase their level of research and innovation.	In a recently published evaluation of innovation consortia, the microeconomic effects of the consortia were analysed (*Effektmåling af forsknings- og innovationssamarbejder — focus på innovationskonsortier, Forsknings- og Innovationsstyrelsen*, 2008). The evaluation aimed to identify the effects on salaries for the employees directly involved in the consortia. The intention was to identify an objective effect that is directly linked to economic benefits of the consortia instead of the traditional indirect effects normally identified in evaluation of this type of programme. The evaluation identified all persons involved in more than 80 consortia between 1995 and 2002. The evaluation shows that persons involved in the consortia experienced on average an increase of salary compared with similar persons not involved in this type of cooperation. The increase was between DKK 70 000 and 90 000 in 2004. The increase in salary is primarily identified for persons employed in universities, technological institutes and other public institutions. The employees in private firms experienced a positive but insignificant increase in salaries compared with similar employees in private firms not involved in innovation consortia.
RO	In order to solve a particular problem, research projects on contractual bases and on clear topics are given to research teams formed by skilled personnel from the universities (e.g. Orange and Politehnica University Bucharest; Renault and Technical University of Pitesti and University of Craiova).	The benefit for universities is the link with the economic area, enhancing their usefulness for the community.

Member countries	Example: Description of the initiative	Benefit for universities
LT	In the framework of the 'Common national research and science-business cooperation programme' five integrated research, study and innovation centres ('valleys') were established in Lithuania. The valleys correspond to the prioritised R & D and breakthrough sectors of the economy, such as: • physical and technological sciences; • life sciences, innovative medicine and natural research; • sustainable chemistry and biopharmacy, mechatronics and related technologies; future energy and environment engineering; ICT; • agro-biotechnology, bio-energy and forestry; safe and healthy food technologies; • maritime sector. Integrated research, study and innovation centres (valleys) are considered to be complex infrastructures that realise and reinforce the strengths of regionally concentrated, sustainable research and innovation networks with clear and long-term commitments by universities, state institutes and companies. A pre-condition for a valley is that the major research activities of the participating institutes must be concentrated locally. Public support focuses on specific infrastructure as well as project support for new forms of sustainable strategic and operational science–industry cooperation. It is intended to combine resources of EU Structural Funds (a major part of the Structural Funds' budget earmarked for research and innovation), the state and municipal budgets and institutions themselves, with additional business funds once the valleys are up and running. The overriding aim is to create conditions for a more effective interaction of scientific capacities with business and reinforcing its international competitiveness.	The nucleus for a valley is formed by a research university (-ies) and research institutes together with research-intensive businesses. The programmes for the development of individual valleys match national integrated programmes developing breakthrough sectors of the economy created in collaboration with existing technology platforms. The Ministry of Education and Science and the Ministry of Economy coordinate the implementation of the valleys.
TR	The R & D infrastructure in Turkey is mostly in universities and public research institutions and most of the research activities are carried out by these institutions. An effective working network could not be established among the institutions that perform R & D and firms that commercialise the research outputs. Therefore R & D activities cannot be put into practice and, in addition, the conducted researches are generally far from meeting the needs and demands of the industry. In order to overcome these obstacles, policies and programmes are being adopted to increase industry–university collaboration. **Different initiatives aiming to increase industry–university collaboration in Turkey** • Support programme for the initiative to build scientific and technological cooperation networks and platforms • Evaluation process applied in TÜBITAK industrial grant programmes • TÜBITAK EU FP support programme for multiple partnership from Turkey • Research infrastructure development projects • Technology development zones and incubators • University–industry research centres' programme • Industrial thesis (San-Tez) programme • Technology transfer offices (TTOs) **Support programme for the initiative to build scientific and technological cooperation networks and platforms** This programme is built to support the establishment of cooperation networks and platforms between national and international corporations, units and groups from both industry and universities in the areas of basic sciences, engineering, and health and social sciences, especially in order to align and develop Turkey with science and technology foresights.	

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Member countries	Example: Description of the initiative	Benefit for universities
TR	**Turkish–German research and development projects involving science and industry (2+2 projects) within the framework of Turkish–German scientific and technological cooperation** This is a new funding programme for Turkish–German research and development projects involving science and industry (2+2 projects) in selected scientific fields within the framework of Turkish–German scientific and technological cooperation. The term '2+2 projects' refers to R & D projects with the participation of at least one German and one Turkish research institution or university as well as one German and one Turkish industry partner. The funding will be provided jointly by the Federal Ministry of Education and Research (BMBF) and the Scientific and Technological Research Council of Turkey (TÜBITAK). **Evaluation process applied in TÜBITAK industrial grant programmes** TÜBITAK, the Technology and Innovation Funding Programmes Directorate, runs several programmes to organise and regulate state funding support to encourage research and technology development (RTD) activities of the industry. In this context, academics are requested to evaluate project applications in terms of the following: (a) industrial R & D content, technology level; (b) company resources; (c) economic and national income. They make on-site visits to the applicant companies, during the evaluation of the application and for the evaluation of technological progress. With these on-site visits, academics are kept very close to the real problems in the industry. **TÜBITAK EU FP support programme for multiple partnerships from Turkey** This programme provides support to the successful framework programme projects prepared by the industry and/or SMEs having partners from university and/or public organisations. **Research infrastructure development projects by state planning organisation** Centres of excellence in strategic areas and large-scale central research laboratories are established in several universities within the context of this programme. These central laboratories have two basic objectives. First, they will foster research activities through well-established research infrastructures, which are open to all qualified researchers and, second, they will contribute to industry–university collaborative activities. Thus, support is given first to the universities which design the laboratories together with the primary local industries and/or local administrating units. **Technology development zones** The first two 'techno-parks', which were later changed to 'technology development zones', were established in 1998. The number of techno-parks has increased to 31, as of August 2008. Number of firms operating in the active zones is around 800, most of which are operating in software development, informatics and electronics sectors. **Incubators (technology development centres)** The aim of the technology development centres, which were established specifically to improve the research potential of SMEs, is to bring SMEs and universities together in research activities. There are currently 23 centres.	

Member countries	Example: Description of the initiative	Benefit for universities
TR	**University–industry research centres programme (USAMP)** This programme was run by TÜBITAK between 1997 and 2007 and several 'university-industry research centres' were established within the framework of this programme. These centres realised several research projects and contributed significantly to the cooperation between industry and research centres. The programme was selected as one of the best practices by the *European Trend Chart on Innovation* report in 2006. **Industrial thesis (San-Tez) programme** The industrial thesis (San-Tez) programme was initiated by the Ministry of Industry and Trade (MoIT) in 2005 to facilitate industry–university collaborative research. This programme aimed to direct some of the masters' or PhD theses towards the needs of the industry. In order to be eligible to participate in this programme, a firm and university should make an agreement such that a graduate-level student in that particular university will prepare his or her thesis on a defined problem of the firm. **Technology transfer offices (TTOs)** These offices are basically aimed to handle patent activities. TTOs are planned to be disseminated to all universities and the scope of their support areas is planned to be enlarged beyond patenting activities.	
IE	Ireland has a number of different funding supports to encourage collaborative research between HEIs and the private sector. These include the following Enterprise Ireland initiatives. **Commercialisation Fund** Funding of publicly-funded research organisations for industry-focused research. Also provides expert support to researchers that want to set up a company or license a technology to industry partners. **Campus incubation centres** Enterprise Ireland's 'Campus incubation' programme offers space and support to entrepreneurs across the country who want to develop their projects within the supportive structure of a college campus. **Commercialisation expertise** Teams of commercialisation experts in the areas of biotechnology, industrial technologies and informatics that work with researchers who are interested in seeing their research work put to commercial use. **Patent Fund and advice** Assistance with patent costs and supply advice on all aspects of the patent process. **Applied research enhancement (ARE) programme** This programme has been created to enhance the applied research capabilities within the institutes of technology.	The benefits of each to the HEIs are different. a) In the case of the small-scale projects, the benefits to the HEIs relate to: • the improvement of their regional impact; • development of various industrial contacts to support work placement of students and/or graduate recruitment; • encouragement of private sector to contribute to the HEI's philanthropic endeavours; • improvement of HEI's public image through perception of 'giving back' by the HEI to the community; • possible revenue generation for HEI through IP development, etc.

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Member countries	Example: Description of the initiative	Benefit for universities
IE	**Technology transfer strengthening initiative** This EUR 30 million initiative supports technology transfer professionals in third-level institutions to increase the level of intellectual property (IP) transferred to industry from research in higher education institutions (see weblinks at: http://www.enterprise-ireland.com/ResearchInnovate/Research+Commercialisation/). In addition to the above, there is also funding for a number of large-scale industry–academic research initiatives through the **Science Foundation Ireland CSETs and Strategic Research Clusters** schemes (e.g. EUR 5 to 25 million/five years) (see web links: http://www.sfi.ie/content/content.asp?section_id=189&language_id=1 & http://www.sfi.ie/content/content.asp?section_id=706&language_id=1).	b) In the case of large-scale initiatives, the benefits to the HEIs relate to: • improved commercial focus of research leading realistic IP; generation/commercialisation options etc.; • access to commercially sensitive information; • access to state-of-the-art facilities (e.g. pilot/full-scale production facilities); • improved awareness by HEI researchers of the commercial business case for various research end products; • leverage of private sector matching funds and/or personnel in research projects; • real and effective (and often long-term) collaboration between the HEI and commercial partner; • greater impact of research; • development of university reputation especially among business community; • development of private sector contacts for placements/recruitment, etc.
IT	In Italy a dedicated Fund for Applied Research (FAR) was open to the participation of universities, and special incentives were settled for project proposals, including universities and firms. The measure was extremely successful. Indicators on the number and amount of projects funded by FAR show that both grew up significantly in the last five years, with the involvement of both small and large firms as well as universities with a significant commitment to research.	Collaboration with the private sector is considered a factor that enhances the quality of universities' research in the case of co-development of knowledge.

Table 5: Importance of different funding instruments for research quality/excellence (1 = low to 5 = high)

Funding mechanism	Scored importance (average)	Target group: institutional or individual
Incentives through research funding	4.3	Institutional
Peer review based funding	4	Individual or institutional
Funding of individual researchers	3.9	Individual
Funding of institutions to build quality/ excellence	3.7	Institutional
Indicator-based funding	3.5	Institutional
Rewards for outstanding quality	3	Individual or institutional
Incentives through individual income	2.7	Individual
Incentives through immaterial benefits	2.7	Individual
Sanctions against underperformance	1.8	Individual

Graph 2: Allocation methods: importance and success

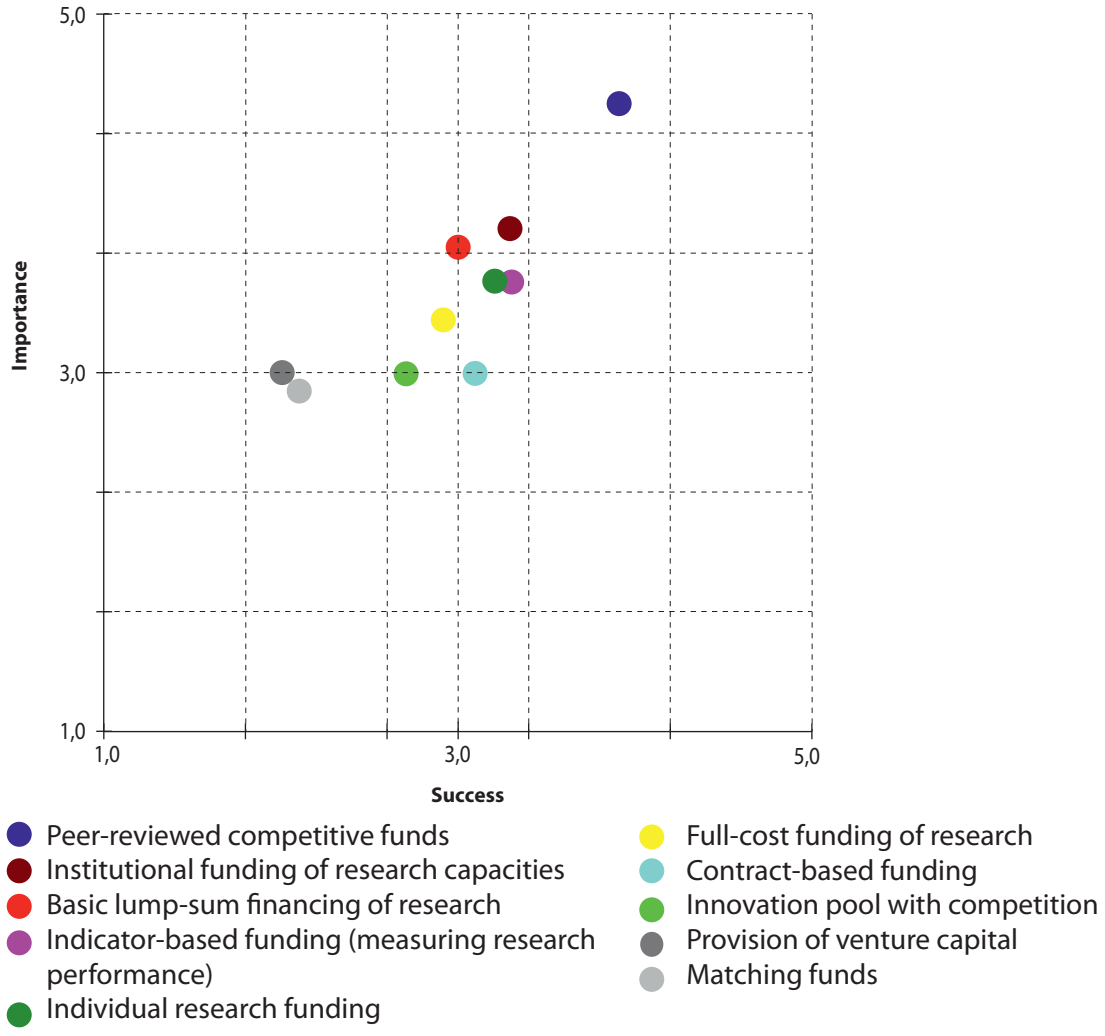

Table 6: Focus on a successful practice: peer-reviewed competitive funds — reasons for, and proof of, success

Member countries	Reasons for success	Proof of success
BE (French-speaking)	It supports collaborative basic 'intra-university' research between Francophone, Flemish and foreign university research teams.	Francophone university rectors remain very attached to this instrument.
PT	Fairness, openness and comprehensiveness of analysis	Increasing number of applications. Improvement of results (quantitative and qualitative)(*).
IE	Fairness and transparency — Improved and internationally recognised research quality standards being employed throughout the funding system.	Improved quality of proposals and research being funded. Confirmed in independent PRTLI programme impact assessment.
RO	PRCF changed the paradigm towards the utility of research and entrepreneurship. It is also bridging the gap between the European criteria of performance and competitiveness. Useful training courses both for evaluators and applicants fostered the demand for know-how in project management.	Increasing number of international applications of the Romanian partners.
SE	Complementary measures, such as hearings or interviews, alongside the peer review system, offer a promising combination of methods and a more intuitive type of evaluation at the hearings and interviews.	
IT	Panels with a mixed composition (academics and experts) for competitive funding of both basic and applied research.	Increasing participation of research groups in competitions. Enhanced quality of research project proposals.
TR	Well-structured and transparent panel system with a regular rotation of experts.	More regional variety in distributing research funds to the HEIs in the country. Decrease in the rate of redress procedures.
DK	A multi-stakeholder combination of peer reviewers ensures legitimacy and quality in research council financed projects and in creating a sense of co-ownership across the research sector (**).	Increasing allocations, increasing number of applications, high degree of competitiveness.
UK	The use of peer review by UK research councils is agreed widely within the university sector to be a legitimate and trusted method for the allocation of responsive-mode research funding. The balance of the impacts of research desired by the various stakeholders can be reflected appropriately through the structures of expert review within (and increasingly across) the seven research councils.	Continued high ratio of applications to funds available. Strongly voiced approval of peer review as transparent and fair component of funding decisions.

(*) See http://www.umic.pt/index.php?option=com_content&task=view&id=3141&Itemid=221

(**) In Denmark, a system of review of research applications built around research councils with members from across the university sector, other public research institutions and also private enterprise has proved successful. The Danish Council for Independent Research is made up of researchers from across the universities and across the subject areas targeted by the councils, with all applications discussed and prioritised by the council members themselves. Applications over a set economic threshold are reviewed through international peer review. The Council for Strategic Research provides funding to strategic research — top-down — but the peer-reviewing principles are similar as for the Council for Independent Research. The Danish National Research Foundation supports centres of excellence. Applications are being peer reviewed by international peer review panels.

Table 5: Importance of different funding instruments for research quality/excellence

	Type A: Capacity-building	Type B: Autonomy and competition	Type C: Prioritisation
Peer-reviewed competitive funds	X	X	X
Institutional funding of research capacities	X		X
Basic lump-sum financing of research	X	X	
Indicator-based funding		X	
Individual research funding	X		
Full-cost funding of research	X		X
Contract-based funding		X	
Innovation pool with competition		X	X
Provision of venture capital	X	X	
Matching funds		X	

Table 8: New developments in member countries' funding mechanisms to promote excellence/quality research — by target group and type of strategy

Type of strategy	New development	Examples of actions from member countries	Target group		
			Individual	Research team	Institution
Type A: Capacity-building (mainly based on the improvement of transparency)	Evaluation advancement	• Major funding bodies have started advancing the process in accordance with a 2008 four-year government plan (not at the national level) (SE). • Institutional research evaluation: following previous five years of funding diversification (LV). • The peer review based on international teams covers all the research centres (three years) and associate labs (five years). The centres and labs may cut across university borders and may be rearranged every three years (PT) (*).		X	X
	Accreditation/certification	• To assess the capability of institutions to perform research activities, ending with accreditation (required to compete for public funds) or failure. This is believed necessary for RD&I (research, development and innovation) leading to a better identification of those fields with added value (RO).			X
	Use of Structural Funds to develop institutional infrastructure	• Research funding incentives should be matched with structural optimisation of the research institutions (and governance support) (LV).			X
Type B: Autonomy and competition	Performance-based funding structure	• This kind of structure has gained prominence and will be shaping the current system (DK). • To be introduced in the national research programmes, for the centres of excellence, for the projects initiated by teams of high-level researchers, for post-docs, PhD students, scientific works of students (MA level), for reintegration (researchers working abroad and high-level researchers) and for attraction of researchers to the business sector (LT). • Indicator-based quality assessment used when qualifying the-research centres in the universities as 'centres of excellence' (RO).			X
	Competitive funding	• Plans to fully implement national research programmes based on this (LT). • Legally established (and then mandatory) indicator-based quality assessment in an (also) legally established institutional framework (ARACIS and CNCSIS) focusing on the influence of research quality upon the higher education process (RO).		X	X

Type of strategy	New development	Examples of actions from member countries	Target group		
			Individual	Research team	Institution
	Grant scheme	• New funding structures for grants (LT). • Special grant schemes for young researchers introduced for promoting research capability in the government competitive funding schemes (IT).	X	X	X
Type C: Prioritisation	National PhD schools	• To ensure a research education of higher quality for PhD students in small and dispersed research milieus (NO; UK — Scotland). • Incentives for doctoral schools to improve the quality of research training and to reduce the fragmentation of doctoral courses. PhD schools (should) also promote the internationalisation of the doctorates (IT).			X
	Flexible specific grants and incentives for research	• Those which cannot be assessed in advance by concrete metrics will play a more important role (anticipated) (DE).	X	X	X
	Financing of excellent institutional research initiatives (to prioritise research areas)	• To promote activity and competition across institutions (and trans-disciplinarism) (element of *Exzellenzinitiativ*, DE). • Grants given directly to universities instead of researchers and of a size that enable major institutional initiatives (UNIK, DK; *Exzellenz-initiativ*, DE). • To create regional structures to enhance excellence in disciplines and multi-disciplinary areas across several universities (Research Pooling, UK — Scotland).		X	X
	Ex ante institutional financing of excellence plans	• To target specific HEIs and create an excellence sector within the higher education landscape (element of *Exzellenzinitiativ*, DE).			X
	Signposting of priority areas	• Directing of research support into priority areas of individual disciplines or across disciplines (cross-council research programmes, UK).		X	
External considerations	International medium-term agreements	• Agreements with European and non-European countries including a more committed partnership and longer view (PT). • International partnerships (PT).			X
	Broader and deeper collaborations	• Internationality, interdisciplinarity, collaborations across sectors (DE; Science Bridges, UK).		X	X
	New sources of funding	• Health and biotech sector considering opening new sources of funding (MT).	X	X	X

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Type of strategy	New development	Examples of actions from member countries	Target group		
			Individual	Research team	Institution
	Brain-drain prevention and measures	A draft programme foresees the recruitment of researchers from abroad and efforts to encourage the return of scientists. Reintegration subsidies, visits from researchers from abroad and development of a post-doc system are included (LT). • 1 000 fellowships to hire PhDs between 2007 and 2009, open to residents and non-residents. A simplified legal procedure was implemented to obtain visas for researchers (PT).	X		
	Economic impact of excellent research	• Member countries–industry collaboration in research funding: the creation of a new research council part-funded by commercial business (The Technology Strategy Board, UK).	X	X	X

(*) Portugal: Evaluation advancement: All units are assessed by international teams and vary a lot in size, but (especially the larger ones), are frequently inter-university based and may be reconfigured, mainly as a result of weaknesses or opportunities identified during the assessment process. Accreditation/certification: Access to funds is open and not based on an accreditation process. Performance-based funding structure: The base funds depend upon the institutional evaluation. At an individual level, the government fellowship programme is very extensive. In 2007, about 2 100 new PhD and 900 post-doc fellowships were awarded (in a population of about 12 000 PhD researchers). National PhD schools: Although there are no government initiatives in this sense, several inter-university PhD programmes have been developed. There are talks among universities to institutionalise their common involvement in PhD schools.

Table 9: Tendencies of different assessment methods at the disciplinary or institutional level

Assessment methods at the disciplinary level

Assessment methods	Way of use	Institutional/disciplinary level	Peer review/ indicator based	*Ex ante/ post ante* measurement	Qualitative/quantitative assessment	Input/ process/ output oriented	Link to goals, strategies (yes/no)	Feedback loops (yes/no)	Strengths	Weaknesses
Science and technology project assessments (PT)	Funding	Disciplinary	Peer	*Ex ante*	Qualitative	Output	Yes	No	Assessment is fair and transparent	Assessment normally takes too long. There can be a shortage of money. Mostly *ex ante* assessments without very strict post evaluation.
Evaluation of project funding — PRIN/ FIRB (IT)	Funding	Disciplinary	Peer	*Ex ante*	Qualitative	Input	No	No	Encourage competition towards quality of research.	Peer review process to be improved.
Evaluation of proposals for competitive programme-based funding (incl. national research programmes) (LT)	Funding; accountability; strategic planning	Disciplinary	Peer	*Ex ante*	—	Output	Yes	—	—	—
Peer-reviewed competitive funds for operational quality assessment (RO)	Funding; transparency	Disciplinary	Peer	*Ex ante*	Qualitative	Process	Yes	Yes	Encourages competition oriented towards useful research activities.	Focuses mostly on scientific level of the projects and less on the financial aspects and valorisation.

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Assessment methods	Way of use	Institutional/disciplinary level	Peer review/ indicator based	*Ex ante/ post ante* measurement	Qualitative/quantitative assessment	Input/ process/ output oriented	Link to goals, strategies (yes/no)	Feedback loops (yes/no)	Strengths	Weaknesses
Evaluation of disciplines (NO; UK)	Quality management; strategic planning	Disciplinary	Peer	*Ex post*	Qualitative, but often based on quantitative input	Combination of input, process and output	Yes	Yes	Directly aimed at individual research departments and groups.	It is challenging to ensure that recommendations from the evaluations are followed up. Challenging to ensure comparability of scales of results between disciplines.
Evaluation of national centres of excellence (LT)	Funding; R & D activities acknowledged internationally; visibility (citations); productivity (publications); activity in international projects	Disciplinary	Peer and indicators	—	Quantitative and qualitative	—	Yes	—	Differentiated assessment criteria for physical, biomedical and technological science; criteria for social science and humanities. Planned to be the basis for introduction of the grants for national centres of excellence.	Difficulty in conducting the *ex post* assessment on the level of excellence.
Pilot study for research rating (DE)	Quality management; transparency; strategic planning	Disciplinary	Peer and indicators ('informed peer review')	*Ex post*	Qualitative (five-step scale) based on quantitative and qualitative data	Input and output (efficiency oriented)	Yes	Yes	(Too early to say.)	(Too early to say.)

Assessment methods	Way of use	Institutional/disciplinary level	Peer review/ indicator based	*Ex ante/ post ante* measurement	Qualitative/quantitative assessment	Input/ process/ output oriented	Link to goals, strategies (yes/no)	Feedback loops (yes/no)	Strengths	Weaknesses
Fellowship programme: individual applications, assessed on a disciplinary basis by national panel (PT)	Transparency	Disciplinary	Indicators	*Ex ante*	Quantitative	Input	Yes	Yes	All the talented students that are able to gain a position in a good PhD programme are awarded a scholarship.	—
Evaluation of research excellence within universities and public research organisations (IT)	Strategic objective; transparency of the management process	Disciplinary	Peer and indicators	*Ex post*	Qualitative and quantitative (planned)	Output	Yes	Yes	Good involvement and information from HEIs about the design of the evaluation criteria; focus on research quality, which is largely recognised by academics, policymakers and stakeholders as a strategic objective for HEIs; reliability of the peer review process; transparency of the management of the process.	Need to improve the linkages between results of evaluation and resource allocation (in cases where this is a priority).

Assessment methods at the institutional level

Assessment methods	Way of use	Institutional/disciplinary level	Peer review/ indicator based	*Ex ante/ post ante* measurement	Qualitative/quantitative assessment	Input/ process/ output oriented	Link to goals, strategies (yes/no)	Feedback loops (yes/no)	Strengths	Weaknesses
Assessment by international teams — report analysis and site visits/every three years; five years for associate labs (PT)	Transparency; funding	Institutional	Peer	*Ex post*	Qualitative	Output	Yes	Yes	Fair and transparent in national scope, in all fields of knowledge, independent of institutional or departmental boundaries; related to funding, stimulating bottom-up research unit organisation.	Too slow, creating difficulties concerning human resources and keeping the scientific community motivated.
Peer review and evaluation by public councils/foundations (DK)	Funding; strategic planning	Institutional	Peer	*Ex ante* and ex post	Qualitative	Input, process and output	Yes	Yes	Ensures that all indicators are part of the evaluation.	—
Report analysis — administrative and scientific (TR)	Funding; quality management; accountability	Institutional	Peer, but indicators part of assessment	*Ex post*	Qualitative and quantitative	Input and output	Yes	Yes	Provides quantitative data that can be utilised for future strategic planning.	—
Institutional evaluation (LT)	Funding; accountability	Institutional	Peer and indicators	—	Quantitative and qualitative	—	—	—	—	Few qualitative criteria included.

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Assessment methods	Way of use	Institutional/disciplinary level	Peer review/ indicator based	*Ex ante/ post ante* measurement	Qualitative/quantitative assessment	Input/ process/ output oriented	Link to goals, strategies (yes/no)	Feedback loops (yes/no)	Strengths	Weaknesses
Counting the sum of third-party funding PhD students (DE)	Funding; accountability	Institutional	Indicators	*Ex post*	Quantitative	Input and output	Yes	Yes		No information about quality; not always related to heterogeneity of the research system and its elements.
Institutional quality assessment: certification for RD&I (accreditation, attestation) (RO)	Funding; transparency; quality management; accountability	Institutional	Indicators	*Ex post*	Quantitative	Process and output	No	—	Legally established at national scale.	Since granting the certification is mandatory for competing for public financing, attestation imposes an entry barrier to the private companies.
Block grants (DK)	Funding (one quarter of public funding); predictability; strategic planning	Institutional	Historical based distribution level	—	—	—	No	No	Predictability for the individual university.	This allocation method does not work as an incentive for universities to improve the quality of research.
Indicator-based assessment (NO)	Funding; transparency; growing importance in quality management and strategic planning	Institutional, but to some extent disciplinary	Indicators	*Ex post*	Quantitative	Output	Yes	Yes	(To be evaluated.)	A challenge is to ensure that the (right) incentive effects are understood and absorbed at the 'research-producing level.

Assessment methods at the disciplinary and institutional level

Assessment methods	Way of use	Institutional/disciplinary level	Peer review/ indicator based	*Ex ante/ post ante* measurement	Qualitative/quantitative assessment	Input/ process/ output oriented	Link to goals, strategies (yes/no)	Feedback loops (yes/no)	Strengths	Weaknesses
Three-year evaluation exercise (IT)	Funding; transparency; quality management; accountability; strategic planning	Disciplinary and institutional	Peer and indicators	*Ex post*	Qualitative	Output	Yes	Yes	Good involvement and information of HEIs in the design of evaluation and good level of information on criteria; focus on research quality, which is largely recognised by academics, policymakers and stakeholders as a strategic objective for HEIs; reliability of the peer review process; transparency of the management of the process.	Need to improve the linkages between results of evaluation and resource allocation (in cases where this is a priority). Need to improve the quality of quantitative data used.
External evaluation and viva voce/ presentation by researchers for the final evaluation (MT)	Transparency; accountability; quality management	Disciplinary and institutional	Peer	—	Quantitative and qualitative, depending on fields	Input and output	—	Yes	Provides an assessment devoid of local biases Ensures that standards of research benchmark with those at the international level.	International evaluators often not sufficiently aware or sensitive to the local context and their decisions and feedback often raise some concerns. Cost is substantial.

Assessment methods	Way of use	Institutional/disciplinary level	Peer review/ indicator based	*Ex ante/ post ante* measurement	Qualitative/quantitative assessment	Input/ process/ output oriented	Link to goals, strategies (yes/no)	Feedback loops (yes/no)	Strengths	Weaknesses
Assessment by special committee (diplomas, research, inner management) (FR)	Transparency	Disciplinary and institutional	Peer	*Ex ante*	Qualitative	Process	Yes	Should; unable to say at this time	Transparent research evaluation in the global context of the HEI.	(Too soon to analyse.)
University report and visit — every four years (FR)	Transparency; strategic planning; accountability	Disciplinary and institutional	Indicators	*Ex ante*	Qualitative	Process	Yes	No	—	—
Formal assessment of research/artistic production of research and higher education institutions (LT)	Funding; accountability	Institutional and disciplinary (focused on institutional level, however SHS are evaluated separately from physical, biomedical and technical sciences)	Combined	*Ex post*	Qualitative and quantitative	Combined	Yes	—	Based on internationally accepted criteria, thus improving dissemination of research results of research and higher education institutions at the international level.	Does not reflect the real status of any field of research (focused on identification of research/artistic production of the institution), but is mainly connected to the distribution of basic research funding. The funding is based only on assessment of production achieved during former activities.

Annex III — Identification of good practices

Criteria for choosing good practices

Member countries selected one or two good practices from each of their particular contexts, sharing the overall aims, lessons learnt, target group and other details of the practice. We would like to note that other good practices exist and the practices selected reflect the choice of the WG members. Included here is a set of criteria for the selection of the good practices and the (standardised) description of the good practices chosen by the member countries.

The following five criteria were the basis for the WG in the selection of good practices.

- *Unique practice/unique elements*

The good practice should be unique or should contain unique elements. There are several instruments which are used by many member countries (for example, competitive funding). Potential learning effects are limited if a common practice exists in the majority of countries. For mutual learning, there should be at least one unique element in a common instrument, or a completely innovative practice.

- *Representative*

The good practice must cover a wide range of topics/different types of systems.

- *Implemented*

The good practice must have been implemented for some time, so the member country is able to say something about the effects (the member country must be able to assess how the instrument is working).

- *Recommended by the member country*

It must be a good practice in the sense that the member country is convinced that the instrument has added value (also for other countries).

- *Adaptability*

The good practice must be flexible and able to adapt to different contexts within reason so that it can be implemented in another system with relative ease. A practice that is based wholly on the country context is not as useful for the whole European context.

Description of good practices

From the questionnaires, the member countries selected the following instruments that could be seen as good practices. The WG commented on the proposed list of good practices and/or came up with (other) suggestions for good practices. Differentiation of type of instrument and target groups was taken into consideration for the selection. The WG decided to select about one or two good practice examples per country represented. The table below presents an overview of the selected good practices.

General recommendations

1. The good practices mentioned should be used as references for comparisons with the practices in the member countries. Looking at the practices could help a member country to analyse its own policies and might help to find new directions.
2. To advance and facilitate further steps in the mutual learning among member countries, the collection of good practices identified in this exercise should be a starting point to develop a benchmarking initiative between interested countries. The benchmarking effort should deepen the knowledge on instruments

to foster research excellence and should work on a flexible instrumental toolkit adaptable to specific strategies.

Overview of selected good practices

Member countries	Good practice	Target group
SE	Evaluation procedure in Linneaus grant programme	HEIs
SE	National support to rejected ERC applicants	Individuals
NO	Results-based redistribution	HEIs
NO	Centres of excellence	Research groups/HEIs
RO	Policies to ensure application of research results	SMEs
PT	International partnerships in research and postgraduate studies	HEIs/research groups
PT	Associate laboratories	HEI (top-level research institutes)
DE	Initiative for excellence	HEIs
DE	Excellence Cluster Competition	Clusters
DK	Reform of the institutional structure	HEIs and research institutes
DK	Development agreements	HEIs
LT	Researchers' career development programme	Individuals
TR	Online application system/national researchers' information system — ARBIS	Individuals
IE	Linkage of large competitive programme awards to track record in quality research and strategic focus by HEIs	HEIs
IE	Research infrastructural priority planning	HEIs
IT	Three-year research evaluation exercise (VTR)	HEIs and public research organisations
IT	FIRB Futuro in ricerca	HEIs, public research institutes
NL	Innovational research incentive scheme (for young talent)	Individuals
NL	Rubicon	Individuals
BE	Programme of excellence	Research groups/HEIs
UK	Concordat to support the career development of researchers	Individuals
LV	Complementary grant schemes for the development of new research groups in universities	Research groups
FR	No good practice offered at this time	
ES	Six-year research evaluation	Individuals

A more detailed description of the selected good practices (in random order) is given below.

Evaluation procedure in Linneaus grant programme (Sweden)

Aim

The purpose of the Linnaeus grant is to create environments for basic research which afford synergic effects and are characterised by excellent scientific quality and potential for scientific renewal.

It is important that the Linnaeus grant not only benefits established researchers and areas of research, but also scientific renewal through new and creative research groups with great potential. The most important assessment criteria, however, should be the environments' ability to perform research of the highest international quality.

Instruments

Each research environment will be assessed by international experts in the subject area concerned with respect to the scientific quality of the research achieved by the environment to date and proposed future research as well as the potential for renewal in relation to the international research frontline. High visibility and influence on research, both nationally and internationally, are particularly important. An environment with many established researchers must be able to show flexibility and dynamism in initiating and pursuing new lines of research. A strong research environment is also characterised by a good capacity to communicate and disseminate research findings to various stakeholders.

The research environments for which the higher education institutions apply for support will be assessed on the basis of the following criteria:

- scientific quality, both of research carried out previously and of the proposed research;
- scientific renewal; the synergic effects on the proposed environment of the support applied for will also be assessed;
- gender equality is an additional criterion which can be used in cases where the criteria above result in the same priority.

Expert panels

For the scientific evaluation, four international expert panels, each comprising seven experts, in the subject areas of humanities, social sciences and educational science (HSU), medicine (M), natural sciences (N) and engineering sciences (T), have been appointed by the Board of the Research Council. The Board has also appointed a fifth, general expert panel, comprising the chairs of the four subject-specific panels and, in addition, four international experts with particular experience of wide-ranging initiatives. One of the latter four experts will be appointed as chair of the general expert panel. The others serve as observers in two subject-specific panels each, in addition to their role as members of the general panel. Staff from the funding agencies will give general support to the panels and act as panel secretaries.

The general expert panel distributes the applications to the four subject-specific panels. Applications that do not naturally fall into the subject categories covered by the four subject-specific panels may be evaluated by the general panel. The rankings of the expert panels are based on reviews carried out by special experts for the individual applications as well as the panel members' own reviews.

Evaluation process

Applications are evaluated in several stages. They are first reviewed by international experts and individual panel members. Every application is assessed by three international experts, as well as by three panel

members. The chair is responsible for appointing these three members, one of whom (the lead evaluator) presents the research application concerned at the panel meeting. The lead evaluator, in turn, is responsible for nominating three international experts for each application. The chair should then approve these nominations. Before the panel meets, the lead evaluator should also present a draft evaluation to the panel. This draft evaluation should be based on the independent assessments of the external experts, as well as by the panel members who have also assessed the application. At the meeting, the lead evaluator leads the discussion concerning the applications assigned to him or her.

The chair is responsible for approving the final written evaluation of each application, which is compiled by the panel secretary after the applications have been ranked by the panel. The panels rank, according to the criteria above, the applications that they have been allocated.

Lessons learnt

After the application round of 2008 was completed, the Swedish Research Council undertook an internal review of the application and evaluation procedures, and published reflections and suggestions for future calls within the programme. The various stages in the call and the evaluation of applications is highlighted in the review: announcement of the call, guidelines for evaluators, selection of panel members, panel meetings, external reviewers, approvals/rejections, communication of the decision, etc. Wherever relevant, concrete suggestions on how to proceed in the future is given. Most suggestions regard details such as how to arrange certain meetings, how to communicate the guidelines to the reviewers, who should be included in the panels and in which order things should be done.

It is hardly of any value to list all the suggestions in the review and translate them into English, as their level of detail is not applicable to other programmes with a different administrative set-up.

To summarise, many suggestions deal with the importance of being clear about what mandate a group or an individual has, providing correct information in due time, and communicating information in a functional way, during meetings, through web-based channels, in steering documents and via contact persons.

Related link

Description of the Linnaeus grants on the Research Council's website:

http://www.vr.se/mainmenu/fundinggranted/linnaeusgrants.4.41c4c50b1195b50750780009428.html

National support to rejected ERC applicants (Sweden)

Aim

Out of the approximately 430 applicants to the European Research Council's first round of starting grants that were regarded as 'excellent,' about 300 were awarded a grant. Some 130 applicants were rejected despite having been labelled as excellent. Several countries felt that these young and highly talented individuals had undergone a very extensive evaluation process, and their qualifications were beyond doubt.

Instruments

In the Swedish case, the seven applicants who were rejected were invited to hand in all application documents to the Swedish Research Council.

Budget

There was an adjustment of the project to a downsized budget of approx. EUR 100 000 per year during five years. By doing this, they were in principle guaranteed this support from the Council.

Target group

Individual researchers

Lessons learnt

A good handful of other European countries undertook similar actions. Although this was a single initiative by the Swedish Research Council, the idea of a similar action will probably be raised regarding the second round at the ERC. A few studies have recently been published which compare the merits of rejected and 'approved' young researchers, and compare their achievements after having been rejected or approved. To generalise, there seems to be a significant proportion of rejected applicants who have just as good or better qualifications and potential as the approved ones; there is an indication in the literature that these kinds of initiatives can prove to be both of great value to the community and simply fair to the applicants.

Results-based redistribution (Norway)

Aim

A White Paper for the Norwegian Parliament in 2001 addressed the need for a quality reform of higher education in Norway. The main diagnosis for research was a clear potential for increasing both the volume and quality of research in the higher education institutions. The answer to this challenge was to introduce results-based funding in the budgeting of the institutions.

Instruments

The new funding model for the universities introduced in 2002 consisted of three components: basic funding (60 %), education (25 %) and research (15 %). The latter was divided into a strategic part, mainly used for capacity-building in PhD education, and a part for results-based redistribution (zero-sum game). This description will focus on the results-based redistribution, and the publication indicator in particular. This indicator was not established until 2006, due to lack of good publication data. The other result indicators in the redistribution are: funding from the EU framework programmes, funding from Research Council Norway and the number of doctoral degrees.

The publication indicator is innovative in the way that it covers all disciplines and all scholarly publication forms, not only 'hard' sciences and research articles in journals. To sustain the quality of Norwegian scholarly publications, the publication channels are divided into two quality levels. The highest quality level (level 2) consists of the publication channels regarded as the leading and most prestigious in their field by the scientists themselves. Level 2 should cover approximately 20 % of the publications in its discipline(s) worldwide.

Based on a combination of weights per publication form (journal article, book chapters, scholarly monographs) and weights per quality level, so-called publication points are calculated. Data show that the outcome is quite balanced across disciplines. The publication points are then used directly in the budget to redistribute money between the higher education institutions based on their relative score. Normally the institutions have their own internal allocation models, which in one way or another 'reproduce' the incentive to publish. In some cases the economic incentive is even taken down directly to the individual researcher.

Timeline

The existing funding model was first implemented in 2002, while the publication indicator was introduced in 2006. The model will undergo evaluation in 2009.

Budget

The budget for results-based redistribution in 2009 is NOK 1.35 billion (approx. EUR 170 million). This is approx. 5.8 % of the direct government funding of HEIs in Norway. Of this, the publication indicator counts for 30 % (EUR 50 million)

Executives

Norwegian Ministry of Education and Research

Target group

Norwegian HEIs. The universities produce approximately 80 % of the results on the indicators included in the redistribution model.

Lessons learnt

We have some empirical evidence of the effect of the publication indicator. From 2004 to 2007, the Norwegian share of ISI articles grew by almost 10 %, while most other OECD countries lost shares in the same period. It also seems like the relative citation of Norwegian articles remains stable at about 25 % above the world average. This indicates that relatively small economic incentives have a strong effect: There has been a significant growth in the volume of publications, without a decrease in quality. Inside the HEIs we see that encouraging a culture of scholarly publishing has become much more of a strategic focus for management at all levels than before the indicator was introduced. The publication indicator developed for the HEIs has recently been introduced in the funding model for independent research institutes in Norway. Denmark is considering using a similar indicator. This indicates that the model is transferable and adaptable across sectors and nations.

Centres of excellence (Norway)

Aim

The Norwegian 'Centres of excellence' (CoE) scheme is designed to stimulate Norwegian research groups to set up centres devoted to long-term basic research. The intention is to raise the quality of Norwegian research and bring more researchers and research groups up to a high international standard. The scheme is open to long-term basic research without immediate application or social relevance, as well as to research with such relevance.

Instruments

A programme for centres of excellence has been established by Research Council Norway (RCN). The programme is funded by the Fund for Research and Innovation. The first call for proposals took place in 2001. After an application and evaluation process divided into two phases, 13 centres of excellence were selected and started their activity in 2002 and 2003. The evaluation of the proposals was carried out by an international peer review panel. The second call for proposals and selection process took place in 2005–06, leading to the appointment of eight new centres from 2007. The centres may receive funding for a maximum of 10 years. Midway through their period the centres undergo evaluation, and if they do not meet the required standards the centres may be discontinued.

Timeline

The 13 CoEs from round one were appointed for the period 2003–12; the eight from round two for the period 2007–16.

Budget

The annual budget for the CoE scheme (21 CoEs) is, in 2009, NOK 256 million (EUR 32 million). This represents approximately 4.5 % of the total RCN budget.

Executives

Research Council Norway

Target group

The programme is open to all research groups doing long-term basic research regardless of institutional/sectoral affiliation. Although not exclusively aimed at universities, in practice most of the centres are hosted by universities, due to their heavy engagement in long-term basic research.

Lessons learnt

From the midway evaluation report of the first 13 centres: 'From a 3.5 year perspective, the CoE programme has been very successful, and most centres have established a dynamic research programme. Through the formation of a CoE, the centres have become attractive partners for national and international collaboration, and they have in general been able to markedly further enhance their funding from universities, foundations and/or industry. They have also been able to increase their post-doctoral and PhD training and

attract international senior scientists as staff members and visiting scientists. The international visibility and status of Norwegian science has been markedly improved.

Our overall ranking of the different CoEs were based on their research achievements, the research plans for the next five-year period, and the organisation and leadership of the CoE. The different CoEs were evaluated and ranked, using the description of terms defined by the RCN. Most centres were evaluated as exceptionally good, whereas a few were ranked somewhat lower, primarily due to concerns regarding the organisation of the CoEs.

The overall impression of the evaluation committee is that the CoEs have had a very positive effect on the research environment in which they have been formed. They have generally created collaboration and interaction across disciplines, departmental and faculty borders. Important characteristics of the most successful centres are:

- scientific vision and clear strategic focus;
- willingness and ability to exploit cross-fertilisation between different disciplines;
- strong and dynamic leadership in terms of both intellectual/scientific direction and team management;
- ability to attract the very best scientists at all levels from all parts of the world.

These characteristics promote scientific excellence and international visibility.

A particular concern at this stage is the urgent need for planning by the host institutions for the CoEs at the end of their term. This is vital for the recruitment of new, and maintaining existing, staff and high-profile activities at the different CoEs during their last period.'

Policies to ensure application of research results: Innovation programme (project competition), support for innovative SMEs (Romania)

Aim

Support innovation (emphasising technological innovation), in order to increase the competitiveness of the national economy and to improve the quality of life.

Instruments

1. Support the innovation capacity of enterprises and consolidate their contribution to creating new goods based on valorising the results of knowledge
2. Stimulating in-house research, partnership and technology transfer
3. Implementing the strategic agendas elaborated within the technology platforms
4. Creating and developing the appropriate innovation infrastructure
5. Developing the quality of management

The role of universities in this programme is in partnership-building, technology transfer, scientific training and management consulting.

Executives

The executive body is the Managerial Agency for Scientific Research, Innovation and Technology Transfer (http://www.amcsit.ro), established inside the campus of the 'Politehnica' University of Bucharest; moreover, its key personnel comes from the university.

Timeline

Yearly project competitions 2007–10, approx. 100 projects/year (average).

Budget

Approx. EUR 530 million for seven years.

Lessons learnt

Major challenges

1. Appropriate and fair eligibility criteria for SMEs and the correct a priori impact assessment of the innovative aspects that the projects are embedding.
2. To the extent that the programme is intended to be a boot-strap for launching in-house research, there is still a small base of selection.

Strong points

The programme is a signal for the private undertakers to establish their own research activity and to promote the whole innovation cycle 'from mind to market' in order to gain economic autonomy and to achieve sustainable development.

Recommendations for improvement

More effort to target the competition rules and benefits towards the segment of innovative SMEs involved in high-technology sectors and therefore to raise their awareness concerning the project calls.

Related links

National plan for RD&I, 2007–13:
http://www.mct.ro/img/files_up/1188313586PN2 %20eng.pdf
National strategy for RD&I, 2007–13:
http://www.mct.ro/img/files_up/1188316504strategia %20eng.pdf

International partnerships in research and postgraduate studies (Portugal)

Aim

The purpose of these international partnerships is to promote joint PhD programmes in specific areas of interest with leading universities and, in some cases, executive/professional master programmes (these are not MSc programmes; they are the equivalent, for engineering and technology, of business MBAs, and are taken only after completion of a second-cycle Bologna MSc degree). So far, partnerships with three American universities, namely MIT, CMU and UTexas at Austin, are in their second years, and other programmes are being established with American and European universities. In some cases, this was an opportunity to start up areas of doctoral studies that did not exist before in Portugal (this is, for instance, the case of engineering systems with MIT and engineering and public policy with CMU).

Instruments

The areas in which these joint programmes were started were selected on the basis of national interest together with the particular fields of expertise of the international partners. Up to now, these are as follows:

- with MIT, bio-engineering, sustainable energy systems, transportation systems, engineering design and advanced manufacturing;
- with CMU, information processing and networking, critical infrastructures and risk assessment, technology, innovation and policy, and applied mathematics;
- with UT Austin, digital media, advanced computing, mathematics and technology, and a university technology enterprise network (UTEN) to accelerate processes of science and technology innovation and commercialisation focusing on US market access.

Starting in the second year of each programme, competitive calls for joint research projects were opened in novel specific areas of research. They required that project teams include researchers from the American university in the programme, at least two university institutions in Portugal and at least one company.

Executives

For each programme there is a management team appointed by the Minister for Science Technology and Higher Education integrating professors of the various Portuguese universities involved and that work in close connection with the ministry.

Timeline

The programme started two years ago and has an initial duration of five years.

Target group

The programmes involve all the Portuguese major universities and research institutes/centres in the relevant areas. An important feature of these programmes is a strong involvement of companies both national and transnational, ranging from telecoms to auto industries, software, etc. that joined the programmes as industrial affiliates and that contribute financially to the programmes and benefit from them for advanced training and pre-commercial research. The postgraduate programmes were developed to become truly international, attracting students from third countries and, indeed, a significant share of the students enrolled come from other countries. So, they have been instrumental in internationalising third-cycle training at Portuguese universities, as well.

Lessons learnt

Major challenges

To increase the number of top-quality international students; to create a stable collaboration platform among the Portuguese institutions involved; to get a real and sustained engagement of the industrial affiliates; to guarantee the programmes' stability and sustainability.

Strong points

To promote a real internationalisation of the best Portuguese R & D and higher education institutions both through joint international programmes and projects; to confront them with goals and practices of top-ranked universities.

Related links

http://www.cmuportugal.org/

http://www.utaustinportugal.org/

http://www.mitportugal.org/index.php

Associate laboratories (Portugal)

Aim

The reinforcement and consolidation of R & D institutions, with the goal of expanding scientific productivity, technological development and innovation in Portugal, has been a top priority of government policy for science and technology.

Some R & D institutions, either private (albeit not-for-profit and recognised as being of public interest) or public, that have been evaluated as 'very good' or 'excellent', may be associated in a special manner in order to pursue a number of government policy objectives for science and technology. They may be granted, upon request, the statute of 'associate laboratory', by the Ministry of Science, Technology and Higher Education (MSTHE), for a period not longer than 10 years.

Instruments

Each associate laboratory signs a contract with the MSTHE that provides a detailed description of the activities and objectives to be carried out, as well as the methods to achieve them and the timetable to be followed.

In order to provide the means to support the activities, two types of funds are provided: basic funds, which are awarded taking into account the scientific assessment and the number of PhD researchers of the unit through an algorithm that is common to the other research centres, plus a share that is explicitly intended to hire new PhD researchers, according to a predefined plan.

Executives

The creation of these research units is bottom-up and they are frequently interinstitutional (as across different schools and, sometimes, even among different universities). However, there are a certain number of rules to be followed: there must be a director and a board; the role of the Scientific Council, where all the PhD researchers are present, must be well defined, the unit must appoint an international Scientific Advisory Board that has to formulate a yearly report about the activities, strategy and plans of the research unit.

Timeline

The first four associate laboratories were launched in 2000. Currently 25 have been established, involving approximately 60 research institutions and close to 3 000 PhDs. The process is not closed and continues to be implemented at a slow pace, as far as new labs are concerned. Furthermore, independent high-quality research centres are invited to join associate labs in their areas of expertise, in order to promote critical mass.

Target group

Top-level research institutions, in all scientific areas (science, engineering, life sciences, humanities, etc.).

Lessons learnt

Major challenges

To expand the system without impairing quality.

Strong points

The associate lab statute ensures a greater institutional stability since it is awarded for a maximum of 10 years, and renewed if the assessment is positive (there is also a mid-term assessment), while tying the institution to specific activities and goals.

Associate labs must also be consulted by the government regarding the definition of science and technology programmes and instruments and they have a seat on the National Board for the Coordination of Science and Technology Policy.

The social recognition of their role attracts new research groups and has been a very positive incentive towards excellence.

Initiative for excellence (Germany)

Aim

By promoting top-class university research within the framework of the 'Initiative for excellence', the Federal Government and the Governments of the *Länder* (Federal States) aim to enable the universities to:

- develop internationally visible and internationally competitive research priorities;
- become more attractive to top scientists and students from abroad;
- strengthen cooperation with non-university research institutions and industry.

Instruments

In order to do so, the 'Initiative for excellence' involves three project-oriented approaches.

1. Research schools for young scientists provide structured PhD programmes within an excellent research environment and a broad area of science.
2. Internationally visible and competitive research and training institutions, so-called excellence clusters, are to be established at universities and will cooperate with non-university research institutions, universities of applied sciences and industry.
3. The promotion of 'Future concepts for top-class research at universities' heightens the profile of a few selected universities. A precondition for funding is that an institution of higher education should have at least one excellence cluster, one research school and a convincing overall strategy.

The institutions of higher education are evaluated by independent experts consisting primarily of scientists from abroad; the final funding decision is taken by a committee of scientists (majority) and representatives of the Federal and *Länder* Governments. The selection is made under the direction of the German Research Foundation (DFG) and the Science Council by an independent jury. The selection is made in two steps. First, a selection is made from the project outlines submitted; those projects selected can then be developed further into a full application.

Timeline

Two rounds of funding during the period 2005–11.

Budget

EUR 1.9 billion (spread over two rounds). The Federal Government will contribute 75 % of this amount.

Executives

German Research Foundation (DFG) and Science Council (*Wissenschaftsrat*)

Lessons learnt

In the first round, about 580 preliminary proposals were submitted. This overwhelming number of applications indicates that it is a prestigious programme and that there is a need for this kind of initiative. The

huge number of applications allows for the selection of only the very best proposals, thereby meeting the goals of the initiative. In general, the initiative caused a wave of fresh air in the German higher education landscape: it gave an impulse to university research and gave universities a perspective to reinforce their research to international standards. It also forced universities into a new strategic orientation towards research (inducing a discussion about the danger of neglecting teaching excellence).

The initiative was highly controversial from the beginning because its aims were to select only the very best. These aims conflict with the principle of equality. Or in other words: some parts of the country and some universities felt locked out and doubted the selection procedure. It was very important that those responsible, however, stood firm and stuck to the aim to select those institutions that already have high quality to enable them to excel internationally. It is also important that there is a long-term perspective and, therefore, this kind of initiative should last for at least 10 years. Thus, the Ministers for Science of the Federal and State Governments intend to continue the programme after 2011.

Related link

http://www.bmbf.de/en/1321.php

Excellence Cluster Competition (GERMANY)

Aim

Research results with innovative potential must be identified and placed on the market quickly and successfully in order to secure growth and employment. At the same time, forward-looking research topics must be formulated and solutions to the identified problems developed. This requires close cooperation between science and industry. Clusters in which businesses, universities, science institutions and policy-makers join forces provide an excellent platform for such cooperation. Clusters can bring together different expertise at an early stage. They uniquely combine the following factors that are crucial for success:

- support for young researchers at a high scientific level and with a strong practical focus as well as attractive teaching and continuing education programmes;
- long-term research strategies;
- technology development close to the market;
- favourable conditions for business start-ups;
- strategic development of international collaborations.

The Excellence Cluster Competition of the German Federal Ministry of Education and Research (BMBF) has been designed to strengthen the innovative capacity of the highest performing science/industry clusters and support them on their way to international leadership. The aim is to further increase their competitiveness and make them even more attractive for talented people and investors.

Instruments

The competition will include three rounds that will take place at intervals of about 12 to 18 months. Up to five excellence clusters will be selected in each round; they can be funded with up to EUR 200 million over a maximum period of five years. Compliance with thematic criteria is not required: The applicants offering the best strategies for future markets in their specific sectors will be selected.

Applicants

Applicants are eligible for funding if they pursue a joint strategy which builds on the strengths of the individual clusters and aims to exploit untapped development potential. The strategy must cover the entire innovation chain — from the idea to commercialisation. When selecting the strategies to be funded, consideration will be given to their development potential, the creativity and innovativeness of the approach, and the progress which the cluster has already made.

The strategies should be implemented by means of suitable projects which the partners involved in the cluster will carry out in such areas as research and development, support and qualification of young researchers, recruitment of experts and executives, and cluster management.

Funding criteria

The following criteria are of prime importance for funding.

- The cluster has the necessary critical mass, the required potential and great development dynamics.
- The strategy enables an increase in innovative capacity, the development of unique features relevant for competition, and the achievement and/or consolidation of international leadership.

- The planned activities build on the strengths of the cluster and lead to sustainable change. The cluster strategy is implemented with major financial participation by industry and private investors.
- The preconditions for strategy implementation are fulfilled. The cluster strategy is characterised by economic viability; instruments are available for securing sustainability after funding has stopped.

Related link

http://www.hightech-strategie.de/en/116.php

Reform of the institutional structure (Denmark)

Aim

With the purpose of strengthening the institutional configuration of the Danish research and university education sector, a merger process was initiated at the beginning of 2006.

Each potential merger was considered on the basis of projected synergies in the form of:

- stronger international research positions;
- strengthened education;
- increased business collaboration and innovation;
- increased ability to attract international research funding, including EU funding;
- enhanced services for public authorities.

Instruments

Government research institutions and universities were asked to consider relevant partners for a potential merger in a coordinated process. On the basis of the responses a process of negotiations between institutions and between the ministry and institutions took place, resulting in a set of mergers.

As a result of this process, 25 government research institutions and universities were reduced to a total of 11 institutions; 97 % of the activities (counted in turnover) have been concentrated in seven universities. The remaining 3 % are now divided between four smaller institutions. All universities — independent institutions — merged on a voluntary basis.

As a consequence of the mergers, Denmark now has three large universities, four medium-sized universities and one small single university.

Timeline

No extra funds were given to the involved institutions.

Budget

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Executives

Danish University and Property Agency, Ministry of Science, Technology and Innovation

Lessons learnt

From the beginning the idea of a merger process was controversial, because the process would inevitably end up with a reduced number of institutions. But soon after the process was launched, the institutions also began to see the opportunities lying in merging with strong colleagues in order to form even stronger new institutions. Some of the universities also used the occasion to change their internal organisational structure, both in the academic and administrative fields.

In general the process made the Danish universities consider their *raison d'être* and their research priorities and research areas of highest international quality. It also forced universities into a new strategic orientation towards a combination of traditional research areas and links with business and industry.

In 2009, an independent evaluation of the status of the mergers will be undertaken.

Related link

http://www.ubst.dk/institutioner-og-okonomi/universitetssammenlegninger (only in Danish)

Development agreements (Denmark)

Aim

Approximately every third year the Ministry of Sciences, Technology and Innovation enters into a 'development agreement' with each university. The development agreements include the universities' specific profiles and their overall strategy.

The aim of the instrument is to:

- improve the dialogue and secure a mutual understanding between the university and the Danish Ministry of Science, Technology and Innovation regarding the objectives of the university in the medium to long term;
- render visible each university's visions, goals and priorities within the fields of education, research, dissemination of knowledge and research-based services for the authorities;
- improve the ambition levels at the universities.

At an institutional level the contracts are also used by the university management as an internal management and development tool.

Instruments

For most of the universities, the first set of development agreements was entered for the period 2000–03. The next set of agreements was entered for a one-year period, 2005, and the third set of agreements was signed for the period 2006–08. Due to a series of mergers between the universities and other intense research institutions, a new set of development agreements have just been entered for a new, slightly overlapping period, 2008–10.

The development agreements focus on goals and results (not means and internal processes at the universities). The agreements include quantitative indicators to the extent possible. The goals relate to the universities' four main objectives: research, education, dissemination of knowledge, and research-based services for the authorities.

In the 2008–10 agreements, these goals are measured by a number of quantitative indicators. These are quite precise — examples are the employment rate for graduates and the student withdrawal rate.

Schedules for benchmarking exercises with other universities can also be included in the agreements. Most of the data required for the quantitative goals are provided by the universities themselves.

Timeline

The agreements are entered for three-year periods.

Budget

The goals from the agreements will be fulfilled within the university's existing funding framework.

Executives

Danish University and Property Agency

Lessons learnt

In their annual reports, the universities have to report on their goals and the specific quantitative indicators. There is no direct link between the universities' results regarding the goals in the development agreements and their funding. If the universities fail to achieve their goals, they will have to account for this in their annual reports in order to improve their future performance. But there will be no immediate financial consequences.

The development agreements work very well as an instrument of dialogue. Hence the instrument is not specific enough regarding the level and the quality of research results.

Related link

http://www.ubst.dk/institutioner-og-okonomi/udviklingskontrakter-resultatkontrakter (only in Danish)

Researchers' career development programme (Lithuania)

Aim

The researchers' career development programme (hereinafter RCDP) is aimed at increasing the opportunities for the development of the academic career of researchers in Lithuania. The programme covers all stages of researchers' careers: promotion of students' research activities, doctoral residency studies, improvement of qualifications and competences of scientists and other researchers, post-doctoral training, financing of foreign scientists' visits, grant schemes provided to Lithuanian scientists and aimed at attracting and reintegrating high-level researchers from abroad, as well as employment (state aid for the loan) of highly qualified personnel in enterprises, and working in knowledge and innovative technology intensive economic subsectors. RCDP will also be used to finance other activities related to the improvement of access to databases of scientific publications, promotion of science, etc.

Instruments

— General subsidy for scientists.

Purpose: promote international research in Lithuanian institutions of science and studies; promote research activities of young scientists; facilitate mobility to Lithuanian institutions of science and studies.

Activities: grants to researchers for scientific research and acquisition of equipment.

— Post-doctoral training

Purpose: develop researchers' competences in all areas of science; facilitate scientific research work in Lithuanian institutions of science and studies; promote mobility of young scientists between Lithuanian institutions of science and studies

Activities: research conducted during post-doctoral training; financing of post-doctoral studies covering all academic competences: those of researchers, lecturers and supervisors.

— Short-term visits of foreign scientists

Purpose: strengthen relationships between high-level scientists working abroad with members of the Lithuanian system of science and studies.

Activities: short-term visits of foreign scientists to the institutions of science and studies for the purpose of enhancing academic links.

— Promotion of scientific work among students

Purpose: develop students' competences enable them to carry out scientific research works; promote their mobility; interdisciplinary aspects; stimulate interests of academic youth in scientific research; highlight the prospects of a researcher's profession and career; facilitate presentation of modern research equipment, devices and software during academic practice; provide access to databases.

Activities: short-term scientific research; advanced training; conferences and studies.

— State aid for employment (for the loan) of highly qualified personnel in enterprises, working in knowledge and innovative technology intensive economic subsectors

Purpose: promote business research; increase the number of researchers in business enterprises; facilitate employment of researchers in business; increase the application of research and studies in business.

Activities: assistance for employment of researchers in knowledge and research intensive enterprises for research and development works.

— Upgrading qualifications and competences of scientists and other researchers in observance of the needs for basic and professional skills

Purpose: promote continuous professional development of scientists and other researchers in all stages of their career; develop R & D skills of human resources in qualitative and quantitative terms.

Activities: upgrading qualifications and competences of scientists and other researchers; development, renewal and implementation of doctoral and residency programmes; non-formal education of scientists and other researchers.

— Ensuring access to databases of periodicals and other scientific publications

Purpose: ensure access of the Lithuanian institutions of science and studies to databases of periodicals and other scientific publications.

Activities: subscription to databases; training scientists and other researchers to use databases; publishing activities; advanced training of librarians — database administrators.

— Analyses of e-versions of Lithuanian scientific publications and dissemination of information about accumulation

Purpose: facilitate the development of researchers' skills using the resources of the Lithuanian academic e-library and of the database of Lithuanian research publications.

Activities: accumulation of e-versions of Lithuanian academic publications; improvement and development of the international scientific database Lituanistika.

— Improvement and dissemination of knowledge about research, technology and innovations among schoolchildren and youth and promotion of gender equality in science

Purpose: establish and implement a system of identification and education of young researchers (pupils); promote gender equality in science.

Activities: creation of an information system (IS) that is easily accessible to teachers and pupils (young researchers) and acquisition of mobile and stationary research equipment; assistance to scientists supervising young researchers; initiation and development of the national non-formal movement of young researchers; motivation of talented pupils to participate in scientific research activities; promotion of gender equality in science.

— Enhancing activities of R & D thematic networks, associations and research organisations

Purpose: strengthen thematic networks, associations of researchers, national technology platforms and valley management organisations.

Activities: strengthening activities of associations of institutions of science and studies, scientists and other researchers' organisations; building institutional skills; development of employees; information maintenance of public information portals and databases or their content; feasibility studies.

— R & D quality and expert training

Purpose: design and implement internal R & D quality systems; develop expert and personnel skills and essential competences.

Activities: training of experts and expert staff of coordination institutions of science and studies; courses; development of activities of the Lithuanian Scientists' Mobility Centre; development of scientists' and researchers' skills to participate in international scientific research programmes.

Executives

Ministry of Education and Science of the Republic of Lithuania and Science Council of Lithuania

Timeline

Two rounds of implementation: 2008–10 and 2011–15.

Target groups

Scientists, researchers, students of study levels I to III (bachelor, master, doctoral and residency students), scientists of international level working in Lithuania and scientists residing abroad engaged in scientific research work, highly qualified personnel (scientists, researchers, designers, engineers and marketing managers with tertiary education degree and at least five years of relevant professional experience), librarians — database administrators, teachers, pupils, employees of organisations of scientists and researchers, employees of associations of institutions of science and studies, employees of expert institutions of science and studies.

Budget (total funding)

EUR 144.462 million from EU Structural Funds of which 15 % from national budget.

Reasons for success

The programme covers the continuous professional development of scientists and other researchers in all stages of their career and includes increasing qualifications and competences of researchers, stimulating their mobility, increasing the number of researchers and reducing their average age in Lithuania. It is implemented on a competitive basis. Therefore the funding is provided only for the best applicants, thereby stimulating the excellence of researchers, research groups and science and study institutions as well as relevant actors in the sphere of R & D.

Related link

http://www3.lrs.lt/c-bin/getgr?C1=bin&c2=312951&c3=25625 (only in Lithuanian)

Online application system/national researchers' information system — ARBIS (Turkey)

Aim

The Turkish national researcher information system (ARBIS) is a web-based application designed and developed by the Scientific and Technological Research Council of Turkey (TÜBİTAK) in order to:

- establish a continuously updated researcher database of Turkey;
- provide an effective online application system for proposal submissions;
- collect statistical data about the research profile of Turkey;
- allow researchers to search and contact other researchers in a specific area;
- provide a pool of referees for project proposal evaluation.

Instruments

All researchers applying to TÜBİTAK research funding programmes are required to have ARBIS accounts. The online application system of TÜBİTAK retrieves the researcher's information from ARBIS while the researcher is filling in the electronic application form. The ARBIS server is maintained by TÜBİTAK. All new ARBIS accounts and updates in the accounts are subject to TÜBİTAK's approval in order to ensure the consistency and correctness of the information provided by the researchers. Each researcher is asked to provide/update his/her information in ARBİS in the following areas:

- contact address (institution, organisation, department, e-mail, etc.);
- work experience;
- education (academic degrees obtained);
- research (publications, research fields interested).

Timeline

Since 2004, ARBİS has been maintained and improved. There is not a timeline for ARBIS.

Budget

Human resources and technical resources used by ARBIS are provided by TÜBİTAK.

Executives

Scientific and Technological Research Council of Turkey (TÜBİTAK)

Lessons learnt

Today ARBIS has more than 50 000 approved researchers, mainly from academia or industry. This project provided a self-updating researcher database for Turkey, which is vital for research-related strategic decisions. Although, in general, people are reluctant to spend time providing information about themselves

during online registrations, this problem is solved by integrating ARBIS with an online application system. Currently, new users are enrolling in ARBIS and existing users are updating their information, so that their updated information is reflected in their applications for TÜBİTAK's research funding programmes.

Before developing a researcher database, it is important to design the system taking into consideration several issues. First of all, it is critical to decide which information to collect, because, as the number of researchers increases, it becomes more difficult to add extra information fields in the database. Another issue is providing an incentive for researchers to register in the system. TÜBİTAK solved this problem by integrating ARBİS with an online application system. Thirdly, the system should be flexible enough to contain researcher information from several sectors. ARBIS is designed to hold researcher information from different sectors, which can be public or private or from the academic world.

Related link

http://arbis.tubitak.gov.tr

Linkage of large competitive programmatic awards to track record in quality research and strategic focus by HEIs (Ireland)

Short description

The programme for research in third-level institutions (PRTLI) aims to strengthen national research capabilities via investment in human and physical infrastructure across all disciplines.

Aim

The key objectives of the programme are to:

1. enable a strategic and planned approach by HEIs regarding the long-term development of their research capabilities;
2. promote high-quality research capabilities in HEIs, so as to enhance the quality and relevance of graduate output and skills.

Instruments

Funding of the HEIs by PRTLI is via a competitive, internationally peer-reviewed process in which HEIs justify proposals in a national context on the basis of research performance and strategic appropriateness for that institution/centre, alone or in collaboration with other entities, establishing a particular programme. A key aspect of the competition is the review of the track record in research of the key individuals leading the initiative. To date, there have been four cycles of the PRTLI competition and a fifth cycle is expected in 2009.

Executives

Higher Education Authority (responsible to the Minister for Education and Science)

Timeline

	Year of competition	Time frame of funding
Cycle 1	1999	2000–03
Cycle 2	2000	2001–04
Cycle 3	2001	2002–06
Cycle 4	2007	2007–10
Cycle 5 (next call)	2009	2009–13

Budget

EUR 865.7 million research funding committed since 1999.

Target group

All HEIs in the Republic of Ireland. Some funding also available to promote international alliances.

Lessons learnt

Much of PRTLI's success rests on the fact that the competitive process itself was judged to be very fair and its integrity is widely respected by the HEIs.

Major challenges

When PRTLI was first implemented, HEIs had not approached the planning of their research programmes strategically. Thus, the development of effective strategic plans by the HEIs was a major challenge to the initial implementation of the instrument. In addition, HEIs did not have a significant track record of working collaboratively in the interests of a national research agenda. Independent assessment of PRTLI now suggests that real collaboration between HEIs has been achieved.

Strong points

1. PRTLI promotes the linkages between teaching and research which strengthens the entire higher education sector.
2. PRTLI is unusual in its emphasis on the HEIs' prioritisation of research investments and its support for HEIs working together to create a more competitive critical mass of research effort. This has greatly enhanced the quality, scale of operations and critical mass of Ireland's research efforts.

Recommendations for improvement

In initial rounds of PRTLI, it was found that the long-term sustainability of PRTLI-funded research initiatives was a potential issue for the future. Consideration of this has been (and will continue to be) included in PRTLI Cycle 4 and future competitions. In addition, some concerns were raised about the extent to which PRTLI supported enterprise and industrial policies. Again, this has been (and will continue to be) addressed in PRTLI Cycle 4 and future competitions. PRTLI Cycle 4 and future competitions will focus on the development of coordinated and structured national graduate research programmes to improve the quality of training at postgraduate level which is in line with national strategic objectives.

Related links

http://drupal.hea.ie/en/prtli

http://drupal.hea.ie/files/files/file/HEA %20Impact %20Assessment %20- %20Vol %20I.pdf

http://extranet.hea.ie/PRTLI/

Research infrastructural priority planning (Ireland)

Short description

State investment in research infrastructure has been informed by the HEA/Forfás review of research infrastructure ('Research infrastructure in Ireland — Building for tomorrow') which was published in 2007.

Aim

The key objectives of the review were to:

(1) examine the research infrastructure in Ireland and internationally benchmark it in the higher education sector in particular;

(2) identify gaps in the national platform of research infrastructure which could be addressed in the short to medium term.

Instruments

The review included the preparation of a database of the existing infrastructure in the higher education sector. Inputs were received across the spectrum of national research activity and across a wide range of stakeholders.

A key feature of the process was the appointment of an independent international steering committee, which had oversight of the process. In addition, international experts conducted visits across a sample of research infrastructures in the higher education sector. These visits provided the independent international benchmark for the research infrastructure. A special workshop was organised to obtain inputs from the business and enterprise sector with knowledge of the existing research infrastructure base.

Executives

Higher Education Authority (responsible to the Minister for Education and Science) and Forfás (Ireland's national policy advisory body for enterprise and science)

Timeline

The review was conducted during 2006 and published in 2007. This document has already, and will continue to, inform the investment decisions of PRTLI Cycle 4 and the forthcoming PRTLI Cycle 5 funding calls.

Budget

The review itself does not allocate funding. However, it supports/validates the strategic decisions underpinning future research infrastructural investments (either by PRTLI or other funding agencies).

Target group

All HEIs in the Republic of Ireland.

Lessons learnt

This review ensured that gaps and weaknesses in the HEI research infrastructure were clearly identified,

so that research funding could best be directed to support priority infrastructure projects. In addition, the review highlighted the need to:

- consolidate the research infrastructure investments made so as to ensure their full and effective exploitation;
- broaden the base of research in the Irish higher education sector;
- invest for rapid development in specific, high-priority areas.

Major challenges

Prior to this review, and during the initial years of PRTLI funding, collaboration between Ireland's HEIs and the strategic planning of research infrastructure investment by HEIs were major challenges to the effective development of world-class research infrastructures in Ireland. HEIs also did not have a significant track record of working collaboratively in the interests of a national research agenda. Independent assessment of PRTLI investments now suggests that real collaboration between HEIs has been achieved and most HEIs are now part of strategic alliances with partners.

Investments in infrastructures must be viewed in a national, as well as an institutional, context. Thus, issues of access, sharing and transparency, nationally and internationally, need to be more formally addressed than in the past, including access to existing national databases.

Although particular institutions or groups of institutions host particular infrastructures and national databases, they should not be given exclusive or proprietary rights to the infrastructures themselves or to their products.

Strong points

This review underpins a much more strategic approach at a national level to the planning of and investment in research infrastructures. The review encourages both a top-down and a bottom-up approach to the investments by inviting proposals from the HEIs for an 'open element', and a 'targeted element' which would be allocated on a competitive basis. The 'targeted element' is reserved for certain HEA/Forfás-nominated infrastructures or disciplines, such as access to and replenishment of databases, IT systems, computing, etc. and will also be allocated on a competitive basis.

Recommendations for improvement

1. In initial rounds of PRTLI, it was found that the long-term sustainability of PRTLI funded research infrastructures was a potential issue for the future. Consideration of this has been (and will continue to be) included in PRTLI Cycles 4 and 5 and future competitions.
2. As the research infrastructure investments of successive PRLTI cycles continue to completed, it will be necessary to put in place (a) a 'maintenance programme' to ensure the upkeep of this PRTLI research investment, and (b) a 'renewal programme' to ensure obsolete equipment and/or facilities can be renewed.
3. A current inventory of Ireland's research infrastructure and equipment should be maintained to support ongoing investment decisions to ensure a minimum of duplication and a maximum of investment impact.

Related link

http://drupal.hea.ie/webfm_send/1639

Three-year research evaluation exercise (VTR) (Italy)

Aim

Italy wants to define a practice for assessing the quality of the research effort of organisations under the control of the Ministry of Education, University and Research (MIUR) (universities and public research institutes). VTR was aimed at: (a) suggesting reference rules and procedures for evaluating the national research system; (b) improving institutional correlation among evaluation results, programme selection and resource allocation; starting systematic comparison procedures between national and international research bodies; (c) favouring the spread of research results.

Instruments

VTR involved three types of actions:

- Peer evaluation of research outputs submitted by the Universities. The outputs submitted for evaluation should not exceed 0.5 of the FTE researchers working at the universities. Panels were organised into 14 scientific areas and 6 thematic areas, and they were composed by peers from academia, from public and private research institutions and from abroad.
- Collection of indicators on the performance of universities and research institutes under evaluation (funding, mobility, PhDs, patents and spin-off, equipment).
- As a third phase, the National Committee for the Evaluation of Research (CIVR) integrated the outcome of the panels' analysis with its own analysis of the data and information collected, thereby writing the final report that includes a comprehensive assessment by institution and by scientific area.

Executives

CIVR is responsible for implementing the VTR. CIVR is composed of seven experts appointed by the government. CIVR is in charge of: (a) organising the entire evaluation process; (b) defining (in agreement with external observers nominated by the scientific community) the criteria for setting panels and choosing their components; (c) evaluating the university reports; (d) assessing the panel reports of each disciplinary area; (e) producing the final report for each single university;(f) proposing linking modalities between evaluation results and resource allocation.

Timeline

One first round was carried out in 2004–05; a second five-year round is planned for 2009.

Target group

Universities (public and private), public research institutes under MIUR control, other public or private research organisations on a voluntary basis (and after payment of a fee).

Budget

EUR 3.500K for the first round; EUR 7.500K for the second round (planned).

Lessons learnt

VTR is an *ex post* national research assessment of the quality and excellence of universities and public research organisations, aimed at ranking universities according to their excellence in research performance. Rankings derive from a combination of quality assessment and performance indicators. A reliable international peer review process was adopted for the assessment of research outputs, paired with the use of indicators on university performance. VTR was characterised by: the large involvement of academic representatives in the design of the evaluation criteria; a focus on research quality and excellence largely recognised as a strategic objective for universities; robustness of the peer review process; transparency of the process management. The major challenge at the beginning was to overcome the strong resistance of academics to an evaluation of university research. Universities participated in the exercise on a voluntary basis. The large acceptance of the evaluation results, the marginal criticism of the contents of the final report, the implementation of the VTR model at the university level for internal evaluation purposes and further exploitation of results for funding allocation were all signs of the large acceptance of the VTR practice. Further developments of VTR could go towards a larger use of the bibliometric indicators, in conjunction with peer evaluation, in order to strengthen the peers' outcome credibility as well as to enhance its use for research policy purposes.

Related links

http://www.civr.it

http://vtr2006.cineca.it/index_EN.html

FIRB Futuro in ricerca (ITALY)

Aim

Italy wants to support the research efforts of young, brilliant researchers (PhD holders) operating in universities and public research institutions. A special granting scheme *Futuro in ricerca* ('Future in research') was launched in 2009 under the FIRB (Fund for Investment in Basic Research) framework.

Instruments

FIRB Futuro in ricerca involved two types of project funding.

Line 1 is directed at supporting a three-year research project coordinated by early researchers (PhD holders, up to 32 years old, who do not yet have a permanent job position). The project can involve up to three research groups, which must also be lead by early or young researchers. Universities and public research institutions must provide a three-year contract to the early researchers, who could win the competition.

Line 2 is directed at supporting a three-year research project coordinated by young researchers (PhD holders, up to 38 years old, who have a permanent job position). Even in this case the project can involve up to three research groups, which must also be lead by early or young researchers. Early researchers responsible for a research group will be hired with a three-year contract (if the project succeeds).

Executives

The Ministry of Education, University and Research (MIUR) is responsible for *FIRB Futuro in ricerca*. A specific committee composed of peers (both national and international) will evaluate the project proposals with the support of experts in the disciplinary fields.

Timeline

The programme has just been launched. The deadline for applications for the first round was March 2009.

Target group

Universities (public and private), public research institutes.

Budget

EUR 50 000 for the first round.

Lessons learnt

FIRB Futuro in ricerca is a very new instrument, which has just been implemented. It is difficult at this stage to make an assessment of lessons learnt. Nevertheless, the large participation of both early researchers and young researchers in the first round should be mentioned. This fact indicates that *FIRB Futuro in ricerca* is related to a very important issue not yet addressed by policy initiatives.

Related link

http://www.miur.it

Innovational research incentive scheme (for young talent) (the Netherlands)

Aim

The aim of the scheme is to promote innovation in the academic research field. The scheme is directed at providing encouragement for individual researchers and gives talented, creative researchers the opportunity to conduct their own research programme independently and promote talented researchers to enter and remain committed to the scientific profession.

Instruments

Veni grants: for researchers who have recently taken their PhD, to allow them to continue to develop their ideas; a maximum of EUR 250 000.

Vidi grants: for researchers who want to develop their own innovative line of research and appoint one or more researchers; a maximum of EUR 800 000.

Vici grants: for senior researchers to build their own research group; a maximum of EUR 1 500 000.

Executives

Netherlands Organisation for Scientific Research (NWO)

Timeline

In 2009 there will be one application round for each of the subsidy types Veni, Vidi and Vici.

- The deadline for the Veni round in 2009 is 8 January.
- The deadline for the Vidi round in 2009 is 3 March.
- The deadline for pre-proposals for the Vici round in 2009 is 31 March. The deadline for the full proposals based on the pre-proposals is 1 September 2009.

Target group

Excellent researchers (male/female) who are among the best 10 to 20 % of their age group. Researchers from abroad may apply.

Budget

Award of EUR 150 million for the Veni, Vidi and Vici grants on a yearly basis. Financed by the Ministry of Education, Culture and Science (OCW) via NWO.

Lessons learnt

There are no major challenges at this moment. The strong points or added value of this instrument is that it focuses on the talent of the individual researcher instead of the research institution or university. There are no recommendations for improvement at this moment.

Related link

http://www.nwo.nl/NWOHome.nsf/pages/NWOP_5TTCVA_Eng

Rubicon (the Netherlands)

Aim

The aim of the programme is to encourage talented researchers at Dutch universities and research institutes run by KNAW and NWO to continue in academic research after gaining their PhDs. It offers them the opportunity to enhance their career prospects by spending up to two years gaining relevant knowledge, skills and experience outside the Netherlands. The mobility of the researcher plays an important role in this process.

Rubicon also offers Dutch researchers the option of using the grant to conduct research in the Netherlands. The preference lies, however, with awarding grants to researchers to spend time outside the Netherlands, as international research experience is likely to be an advantage at a later stage in the applicant's academic career and in applying for other NWO grants. The Rubicon programme also offers talented researchers from abroad the opportunity to obtain grants to spend one year conducting research in the Netherlands.

Instruments

Candidates can apply for a Rubicon grant for a period of up to two years at an institution outside the Netherlands or a period of one year at a Dutch institution. If the period is to be spent abroad, the minimum duration is six months. If it is to be spent in the Netherlands, the duration must be neither more nor less than one year. Standard awards have been set both for periods spent abroad and for periods spent in the Netherlands.

Executives

NWO

Timeline

There are three selection rounds a year for Rubicon grants. The deadlines for 2009 are 1 April, 1 September and 1 December.

Target group

Postgraduates who are currently engaged in doctoral research or who have been awarded a doctorate in the 12 months preceding the relevant deadline. Applicants who are still engaged in doctoral research may only apply if their supervisor provides a written declaration approving their thesis. Women especially are urged to apply.

Budget (total funding)

The total annual budget for Rubicon is approximately EUR 5.3 million, the equivalent of approximately EUR 1.7 million per selection round. The Dutch Ministry of Education, Culture and Science contributes EUR 4 million a year and NWO adds the resources previously allocated to the Talent programme.

Strong points

The instrument focuses on the talent of the individual researcher and the mobility of the researcher instead of focusing on a research institution or university.

Related link

http://www.nwo.nl/nwohome.nsf/pages/NWOP_6H2G7R_Eng

Programme of excellence (Belgium)

Aim

The 'Programme of excellence' has a dual objective. First, it is meant to favour poles of competitiveness development and, second, to support inter-university and inter-sectional collaboration to reinforce the knowledge triangle 'research–innovation–education'.

Instruments

Since 2006, the Walloon region supports one excellence programme each year. Up to a five-year fixed contribution can be devoted to a specific theme.

The first step consists of determining the scientific domains that could be related to an excellence programme through FNRS (National Fund for Scientific Research) and DGEER (DG Economy, Employment and Research) Committee.

The second step is a selection process. Financed programmes are selected on the basis of the following criteria:

- inter-university character;
- reputation of the research team;
- potential economic effects;
- potential partnership with private companies;
- capacity to generate spin-off and patents.

Three excellence programmes already exist:

- Neoangio: study on cancer treatment; launched by the University of Liège in collaboration with the Free University of Brussels and the Catholic University of Louvain (2006);
- CIBLES: study on treatment of diseases related to inflammation, the central nervous system and cancer thanks to functional genomique identification; launched by the Free University of Brussels in collaboration with the Catholic University of Louvain (2007);
- DIANE: study on inflammatory disorders in neurological affections; launched by the Catholic University of Louvain in collaboration with two companies, UCB and EAT (2008).

Timeline

One programme is launched every year for five years.

Budget

EUR 5 million/year/programme (total: EUR 25 million)

50 % from the Walloon region (EUR 12.5 million)

50 % from research institute (EUR 12.5 million)

Executives

DGEER and FNRS

Evaluation process

A scientific and technical evaluation committee composed of two experts from the academic environment and two experts from companies are in charge of project evaluations on the basis of two indicators:

- scientific (research project numbers, publications, etc.);
- economic (patents, spin-offs, etc.);

Lesson learnt

- This programme allows reaching more easily the critical mass essential to develop high-quality research.
- Evaluation by international experts is very positive.
- Real economic impact.

Related link

http://recherche-technologie.wallonie.be/fr/menu/acteurs-institutionnels/service-public-de-wallonie/departement-des-programmes-de-recherche/direction-des-programmes-regionaux/les-programmes-d-excellence-marshall/index.html?PROFIL=

Concordat to support the career development of researchers (United Kingdom)

Aim

The 'Concordat to support the career development of researchers' has been adopted by the principal funders and employers of researchers in the UK to codify the principles by which the employment and development of researchers should be carried out. This has been developed, in part, in response to the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers.

It aims to increase the attractiveness and sustainability of research careers in the UK and to improve the quantity, quality and impact of research for the benefit of UK society and the economy.

The Concordat will ensure today's researchers are nurtured and supported during their career development. By setting out clear expectations for researchers, research managers, research institutions and funders of research, the Concordat aims to enhance the research workforce and thereby sustain research excellence in the UK, bringing benefits to the economy, health and well-being.

Instruments

The Concordat consists of a set of key principles for the future support and management of research careers, and under each principle, an explanation of how it may be embedded into institutional practice.

Target group

The Concordat to support the career development of researchers sets out the expectations and responsibilities of researchers, their managers, employers and funders.

Lessons learnt

The research Concordat was signed in June 2008 so its usefulness as an instrument for promoting human capital in the context of research excellence is to be established over the coming years.

Related links

http://www.researchconcordat.ac.uk/

http://ec.europa.eu/eracareers/pdf/am509774CEE_EN_E4.pdf

Complementary grant schemes for the development of new research groups in Latvian universities (Latvia)

Aim

The aim of the activity is to strengthen the human potential and international networking of universities.

Instruments

The following grant schemes for doctoral students, post-docs and immigrating researchers have been implemented: (a) Latvian Council of Science grants for excellent doctoral students; (b) university grants for new research groups established by immigrating researchers; (c) university grants for completion of doctoral thesis; (d) EU Structural Fund programme for the development of doctoral studies; (e) EU Structural Fund programme for the development of new research groups; (f) EU Structural Fund programme for the support of applied research projects.

All the grant applications in the aforementioned schemes are peer reviewed. The selection criteria include: (a) proficiency or excellence in research proved by scientific publications; (b) development of human potential of the institution through involvement of young researchers; (c) demonstration of synergies with other grant schemes; (d) evidence of the participation of re-immigrated or immigrated scientists — in grant schemes (b) and (e). Grant scheme (f) is focused on priority research areas, which are approved by the order of the Cabinet of Ministers.

Executives

Latvian Council of Science: grant scheme (a); university research councils: schemes (b) and (c); Ministry of Education and Science: schemes (d), (e) and (f)

Timeline

Most of the schemes were initiated in 2005. Call and application periods are two to six months; grant duration is three years, one year for scheme (c).

Target group

Doctoral students, post-docs, scientists who have left Latvia and worked in research institutions abroad, scientists from other countries who have developed research contacts with Latvia and expressed interest to work in Latvian universities.

Budget

Annual budgets are EUR 5 000–15 000 per person in schemes (a), (c) and (d); EUR 50 000–80 000 per grant in schemes (b) and (f); up to EUR 600 000 per grant in scheme (e).

The total volume of funding through all the schemes is variable from year to year. It was approx. EUR 8.5 million in 2008; the expected value for 2009 is approx. EUR 12 million if the new grants through schemes (d) and (e) are implemented as initially planned.

Lessons learnt

Major challenges

Identification of eventual beneficiaries and targeted advertising of funding possibilities for scheme (b); coordination of schemes to emphasise human resource development in priority areas, while securing research in all fields, which is necessary for university learning.

Strong points

Concerted actions targeting the development of human potential have resulted in an increase of the number of research personnel in the universities by 42 %; an increase of awarded doctoral degrees by 55 %; and an increase of publications in peer-reviewed journals by 33 % since 2005.

Recommendations for improvement

More points for networking (one grant, two or more institutions), multidisciplinary research and publishing could be given at the stage of the evaluation of grants. Possibilities for cooperation among institutions, necessary to create critical mass in specific research areas, are impeded by bureaucratic hurdles.

Related link

http://www.esfondi.lv

Six-year research evaluation (Spain)

Aim

The purpose of this research evaluation is to assess both the quality and quantity of research in higher education institutions (public universities and national research institutes).

Instruments

Every individual researcher can voluntary apply for a six-year period evaluation. A positive evaluation has a direct economic effect and brings a salary complement to the researcher.

The National Commission for Research Activity Evaluation (CNEAI) was created in 1989 to perform this evaluation. The CNAEI composition is as follows:

- President: General Director of Programmes and Knowledge Transfer;
- 12 academic representatives of the ministry in charge of research;
- 1 representative of each Autonomous Community (17).

One of those members is designed as General Coordinator and is responsible for guaranteeing the evaluation process, solving all the procedural questions, defining the evaluation criteria focused on research quality, proposing to the CNEAI the components of the expert committees, etc.

Expert committees: For the scientific evaluation, the CNEAI has 11 committees, one for each of the following scientific fields:

1. Mathematics and physics
2. Chemistry
3. Cellular and molecular biology
4. Biomedical sciences
5. Natural sciences
6. Engineering and architecture
7. Social, political and behavioural sciences
8. Economic sciences
9. Law sciences
10. History and art
11. Philosophy and philology

Evaluation process

Individual applications are evaluated by the committee members in the relevant scientific field. The computer application allows the experts to evaluate remotely and the president to review all the evaluations and look for matches and mismatches.

The procedure is a secondary evaluation, based on bibliometric indicators of publication's quality (impact factor of the journal, quality of the editorials, etc); it is not a peer review.

Timeline

This evaluation was performed for the fist time in 1989 so its usefulness has been well established.

Target group

Staff teachers of public universities and staff scientists of national research institutes.

Other researchers working in public or private research organisations and non-staff scientists working in public research institutions upon request (and after payment of a fee).

Lessons learnt

The programme has been responsible of increasing the quality and quantity of research especially at universities. It has proved to have a good impact on productivity research.

This evaluation has become a very prestigious one and it is an important requirement for job promotion. It is also taken as an indicator of the quality of the university.

At the end of each evaluation, the CNEAI receives a list of suggestions for each committee, with reflections and suggestions for future calls.

Related link

http://ciencia.micinn.fecyt.es/ciencia/jsp/plantilla.jsp?area=cneai&id=501

France

Concerning France, it is important to note that two very recent laws have been promulgated. The first one deals with research and the second one with universities. These two laws have enabled the setting up of several tools to increase the excellence of research in universities. Even if the current process is expected to have a good impact on research, it is too early to define it as good practice for the purposes of this report.

However, we can already mention some new frameworks such as the French Research Agency, the Agency for Higher Education and Research Evaluation, the Regional Higher Education and Research Clusters, the Networks for Advanced Thematic Research, the Carnot Instituts, and the reinforced autonomy of the universities.

Annex IV — Composition of the Working Group

Chair
Ziegele, Frank — CHE

Rapporteurs
Carr, Diane — CHE
Zuijdam, Frank — Technopolis

Members of the Working Group
Merlin, Göran — Sweden — Ministry of Education and Research
Johanessen, Steinar — Norway — Ministry of Education and Research
Scarlat, Eugene I. — Romania — Ministry of Education, Research and Innovation
Guedes de Oliveira, Pedro — Portugal — University of Porto
Angilletta, Salvatore — Germany — EU-Bureau of BMBF
Buelens, Christel — Belgium — Université Libre de Bruxelles
Jensen, Anita Damsgaard — Denmark — Ministry of Science, Technology and Innovation
Muizniekis, Indrikis — Latvia — University of Latvia
Babelyte, Kristina — Lithuania — Ministry of Education and Science
Level, Pascal — France — Conférence des Présidents d'Universités
Adli, Mehmet Arif — Turkey — TÜBITAK
Tabone, Matthew — Malta — National Commission for Higher Education
Davis, Ruth — Ireland — Higher Education Authority
Reale, Enmanuela — Italy — CERIS CNR
Hensing, Janna — The Netherlands — Ministry of Education, Culture and Science
Rybinsky, Henryk — Poland — Ministry of Science and Higher Education
Fancey, Stuart — United Kingdom — SFC
Lago, Santiago — Spain — Universidad Pablo de Olavide
Tzezakis, Emmanuel G. — Greece — University of Thessaloniki
Vesselinov, Kamen — Bulgaria — Technical University Sofia
Krücken, Georg — Germany — Deutsche Hochschule für Verwaltungswissenschaften Speyer

Observers
Smith, John H. — European University Association
Elena-Pérez, Susana — IPTS — JRC
Wobbe, Werner — Research DG — 'Economic analysis and monitoring of national research policies and the Lisbon strategy'

Support from the Commission
Delgado, Luis— Research DG — 'Universities and researchers'

European Commission

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This report presents the main findings, rationale and recommendations for regional, national and Community policies to improve research excellence in universities. It summarises the results of the work done throughout 2008 by CREST OMC Working Group (WG) on 'Mutual learning on approaches to improve the excellence of research in universities'. The report offers a great variety of information: analysis tools, good practices, comparisons of certain instruments used at the national level, such as, inventories of new developments, and existing policies and instruments.

The overall objective of the Working Group was to carry out a mutual learning exercise on the scope, objectives and measures of national policies to improve research excellence in universities, to learn more about the effect of these policies, to identify good practices, and to develop recommendations for improving the policies and their impact on research in universities.

This report is available online on the webpage: http://ec.europa.eu/research/era/index_en.html

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