Indicators of Internationalisation for Research Institutions: a new approach

A report by the ESF Member Organisation Forum on Evaluation: Indicators of Internationalisation

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- Development of best practices and exchange of practices on science management, to benefit all European organisations and especially newly established research organisations.
- Harmonisation of coordination by MOs of national programmes and policies in a European context.

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Executive Summary

Internationalisation is a strategic issue for research institutions and, at the same time, is highly relevant for the meaning and the objectives of the European Research Area (ERA). Although internationalisation is becoming a key issue on the science policy agenda, there is still little empirical evidence as to the level of internationalisation of research institutions, and the development of evaluation tools deserves special attention. Following a recommendation of the former ESF Member Organisation Forum on Ex-Post Evaluation of Funding Schemes and Research Programmes, the Forum on Indicators of Internationalisation was established in 2010 in order to design a common set of indicators to support strategic thinking of research institutions. The aim was to develop a set of indicators that closely match the needs of the member organisations (MOs), be they funding agencies (FAs) or research performing organisations (RPOs).

Experts in science policy, indicator design and bibliometrics were invited by ESF to contribute to the work in all phases of the project. The forum allowed a participatory process with close interaction between twenty participating MOs from eleven countries, three experts and ESF scientific officers.

The forum developed a conceptual framework for the description and the analysis of internationalisation processes of research institutions, showing the rationales for internationalisation and the main processes where an internationalisation strategy can be implemented. Within this framework, two comprehensive sets of indicators have been selected based on MOs' criteria and on data availability.

Seventeen indicators have been proposed (eight for FAs, nine for RPOs). The MOs have provided examples of data for these indicators, confirming their feasibility. At the same time, the descriptions of the indicators have been specified in more detail. Depending on the experience of MOs in collecting and analysing such data, the proposed indicators have different status: seven indicators are *mature* indicators. They require the development of guidelines for data collection in order to test their quality and to address the issue of comparability. Seven other indicators *in development* have a sound conceptual basis but traditional data collection is necessary to confirm feasibility and comparativeness of the measures. Three *blue sky indicators*, which are relevant to describe specific aspects of internationalisation, still have to be conceptually developed in order to find a relevant measure connected to the unobserved reality.

This study shows that it is possible to assess the internationalisation of a funding agency or of a research performer through its different activities. It also suggests that future work would be valuable, aimed at producing common indicators of internationalisation of research institutions in Europe. Apart from the development required for the production of indicators, it would be useful to continue to debate the meaning of internationalisation and to further explore the way internationalisation of research and of research institutions is presently assessed in practice.

1. Rationale

1.1 The context of the pilot study

During the ESF Member Organisation Forum on Ex-Post Evaluation of Funding Schemes and Research Programmes (2007-2009), the purpose of which was to identify the main topics that are encompassed within the issue of ex-post evaluation, indicators was strongly noted as a major topic. At the same time, the *EUROHORCs and ESF Vision on a Globally Competitive ERA and their Road Map for Actions* (ESF, 2009) acknowledged the work of the Forum which may help to implement activities within Action 6 of the Road Map: Develop common approaches to ex-post evaluation of funding schemes and research programmes. It was decided to develop a common set of indicators that is closely related to the needs of the member organisations (MOs) and would contribute to fruitful exchanges between them on some important strategic issues. At the April 2009 workshop[1] of the Forum on Ex-Post Evaluation of Funding Schemes and Research Programmes, the topic of internationalisation of research institutions was selected because it was considered as particularly important for all member organisations, be they funding agencies (FAs) or research performing organisations (RPOs). It is also fully relevant regarding the meaning and the objectives of the European Research Area (ERA) to organise research in Europe in ways that lead to strengthening cooperation within Europe to better compete and collaborate at the international level.

In autumn 2009, the ESF Governing Council accepted the proposal for a new forum on Indicators of Internationalisation, bringing together 19 MOs and one observer. It was then supported by ESF for three years, from January 2010 to December 2012.

The objective of this forum was to develop a pilot study to design a set of indicators that could account for assessing the internationalisation of European research activities and programmes and be useful for MOs' policy and piloting processes and in their relationships with the European Commission as well as their governments for benchmarking and policy evaluation. The development of such a set of indicators aimed at enhancing the development of a common strategic analysis of internationalisation among the institutions that are gathered within ESF. It is a permanent concern of ESF to help and foster the convergence of strategic analysis among its MOs. Though they do not have exactly the same objectives and therefore do not use the same set of indicators, internationalisation is a common issue for the different institutions and the project of designing a common set of indicators was considered as fully relevant.

The action plan of the forum included: i) an analysis of the literature; ii) the design of a common framework to depict internationalisation objectives and activities of each organisation; and iii) the selection of a common set of indicators which would help MOs to position themselves within the R&D system at national and supranational level. These indicators were to be chosen for their coherence with the framework and either drawn from existing sets of indicators or newly designed by the experts involved in the project.

1. Budapest Workshop, 27-28 April 2009

1.2 The issue of Internationalisation and the need for indicators

Internationalisation and international standing are increasingly major issues for research institutions and for governmental R&D policies. Many factors are behind the need to enhance recognition and reputation at a supranational level, the most important being strong competition for both human and financial resources, the globalisation of the economy influencing also research and development in different institutional contexts and, finally, new forms of knowledge dynamics within traditional and emerging new fields, increasingly taking place in the supranational arena.

More specifically, the literature highlighted several rationales for public policies toward internationalisation, which can be summarised in the following items: a) strengthening research excellence and innovation performance through enlarging the set of actors for collaboration and/or for getting complementary expertise (critical mass, complementarities); b) enlarging the attractiveness of the R&D system in order to better the capability to compete in the global market (enlarging the innovation network); c) responding to global problems, positioning the country in the wider community fostering common ideas and values (global coverage).

Changing meanings of internationalisation is another issue challenging research institutions, be they funding organisations, research performing organisations or organisations combining different missions relative to research. In the last decade, research priorities went from internationalisation of researchers and research groups to embedment of institutions and individuals in international networks, and capability to attract foreigners (researchers, clients) as well as to localise and fund research activities abroad (researchers and units).

From 2000 onwards, policies developed at European level have played a major role in setting and disseminating internationalisation as a policy objective to be achieved. European Framework Programmes, the Lisbon strategy and the new concepts toward the ERA are all factors pushing toward internationalisation, generating different effects, such as driving national government R&D allocation, setting specific schemes of project funding and incentives, changing the political rhetoric in terms of rationales and justifications for public investment in R&D, but also modifying the awareness of research institutions toward the relevance of the non-national level of governance.

This gave rise to a distinction between the concept of internationalisation and the concept of Europeanisation, the latter being a restricted form of international standing, which is strongly affected by policies aimed at integrating at the European level of different national research agendas. Distinguishing between internationalisation and Europeanisation implies focusing specifically on changes that can be related to the policies developed at European level, linked to priorities and objectives related to an effective integration of Member States (ERAWATCH, 2009; European Commission, 2001 and 2007). More recently, the shift in motivations, rationales and policy instruments of European-level policy and organisation has been outlined as one of the most important processes able to impact the science system in no predictable ways (Nedeva and Stampfer, 2012); other changes involving actors and measuring of research performance are in place, whose effects are still to be explored.

As to the relevance of evaluation of research institutions' internationalisation, we can recall evidence coming from a recent OECD work (OECD, 2009), which carried out a comparison of recent evaluation exercises of research institutions, taking into account 12 cases in 6 countries (Austria, Czech Republic, Greece, The Netherlands, Sweden, UK). This study shows that internationalisation does not emerge as a key issue in the evaluations.

Although internationalisation is becoming a key issue on the political agenda, there is still little empirical evidence as to the level of internationalisation of research institutions, and the development of indicators still needs dedicated work. As pointed out by CREST (WG 2007) and by Edler and Flanagan (2011), desirable metrics and databases are rarely available as "a systematic and well-established set of indicators to measure the state of international activities and the effectiveness of these activities in the strategies of research funding organisations does not exist yet".

The recent work developed by the High Level Expert Group (Barré and Régibeau, 2009), under the mandate of promoting and contributing to "the development of an evidence-based monitoring system on progress towards the ERA and a knowledge based economy", suggested indicators that are to some extent related to internationalisation. These indicators are defined at the scale of the countries but many of them are also relevant for research institutions. These indicators were therefore considered as potential choices and included in the first large set from which the final indicators were selected.

More details and references can be found in Reale, Inzelt, Lepori and van den Besselaar (2012) and Van den Besselaar, Inzelt and Reale (2012) where parts of our work have been published.

2. Methodology

2.1 Indicator use and properties

Indicators are increasingly used by policy makers for decision making and are relevant for public debate concerning research policy. Moreover, as the organisation of the research system has become more complex, governance tools are needed for the different actors of the system. Among them, scientific organisations, be they research performers, funders or coordinating bodies, which develop their own trajectory and strategy need indicators to evaluate their positioning (identity, relationships, complementarities and immaterial assets) and to support their strategic decisions. Indicators can therefore help to improve the autonomous coordination of the system in feeding the collective debate and mutual understanding (Lepori, Barré and Filliatreau, 2008).

Indicators are to be designed to answer specific evaluation questions. Unlike statistics, which aim at measuring facts, indicators refer to conceptual models coming from science, technology and innovation studies. They embed normative choices. In this sense, they are proxies of the phenomena they represent (Barré, 2001).

Therefore, the first point is that indicators are based on some stylised definition of what they want to represent. But this representation can be different from the perception that organisations have of their role and their positioning within the R&D system at national and supranational level, and the discrepancy between the different perspectives impacts on the selection and the use of indicators. This is, for example, the case with funding agencies which have different missions, objectives and strategies according to their positioning among other political actors at the national and supranational levels. The framework for selecting the indicators should therefore refer to the different rationales for internationalisation, as well as to the different activities that are impacted by an internationalisation oriented strategy.

Besides the fact that indicators are intrinsically dependent on a representation within a specific context, and that this representation must be explicit, they have to fulfil other quality criteria such as feasibility in terms of data quality and availability (cost and time), and users should be able to understand the indicators as well as their limitations. Methodological and procedural rules have to be respected concerning:

- Specification of data, treatments, classifications;
- Opportunities for criticism of the indicators: the underlying assumptions, proxies, questioning the classifications;
- Opportunities for alternative approaches.

Having all these requirements in mind, the pilot group and ESF decided that the study could not be achieved without sound expertise in indicator design and that the first step should be a pilot study to show the interest and the feasibility of designing internationalisation indicators at the scale of research institutions (funding agencies and research performing institutions). The study aims also at preparing a further project to develop and produce the indicators; this project will need another decision on allocation of support and resources.

2.2 A participatory process

The process was based on the management experience of the MOs and their need of evaluation tools. MOs are currently producing indicators to describe

as appropriately as possible their embedment in international (European and global) cooperation and competition. Therefore the proposed pilot study was definitely a bottom-up process, which is the rule for ESF to support joint activities.

Nevertheless, designing relevant indicators needs a sound understanding of European research systems and professional skills in indicator design. ESF invited experts in science, technology and innovation policy studies and in bibliometrics to provide the knowledge required for identifying the conceptual background and suitable indicators for the assessment of internationalisation.

The process was a typical user-producer-designer interactive approach, where actors and indicator specialists with different roles and expertise worked in close cooperation to design appropriate, robust and feasible indicators. The different steps included:

- Topic choice and design of the study;
- Overview of MOs' international policy and instruments and an analysis of relevant literature;
- Design of a conceptual framework;
- Collection of a large set of existing or desired indicators;
- Production of samples of data, selection of feasible indicators and description of the indicators;
- Conclusions and recommendations.

In this process, 16 MOs from 11 European countries were involved along with three experts. Among MOs, there were nine FAs: AKA (Finland), DNRF (Denmark), DFG (Germany), FPS (Poland), FWF (Austria), FWO (Belgium), RCN (Norway), RCUK (UK), SNF (Switzerland); six RPOs: CNR (Italy), CSIC (Spain), INFN (Italy), Inserm (France), INRA (France), MPG (Germany); and one hybrid organisation: TÜBITAK (Turkey).

The first step was to create agreement on why internationalisation should be addressed through evaluation. This has been achieved by comparing two approaches:

- The participating MOs sent information about their internationalisation policy and instruments. Nine contributions were received and analysed and presented at the first workshop.[2]
- At the same time, the experts provided a conceptual framework including the national and European actors (funders and performers) of the research system and their interactions. These interactions correspond to three main processes: funding, networking and knowledge production. The actors are represented as the vertices of a graph and their interactions as edges of this graph.
- From the institutions' point of view, internationalisation may also be represented through its impact on three main processes: i) funding flows from/to international agencies; ii) collaboration

2. Stockholm Workshop, 10-11 May 2010

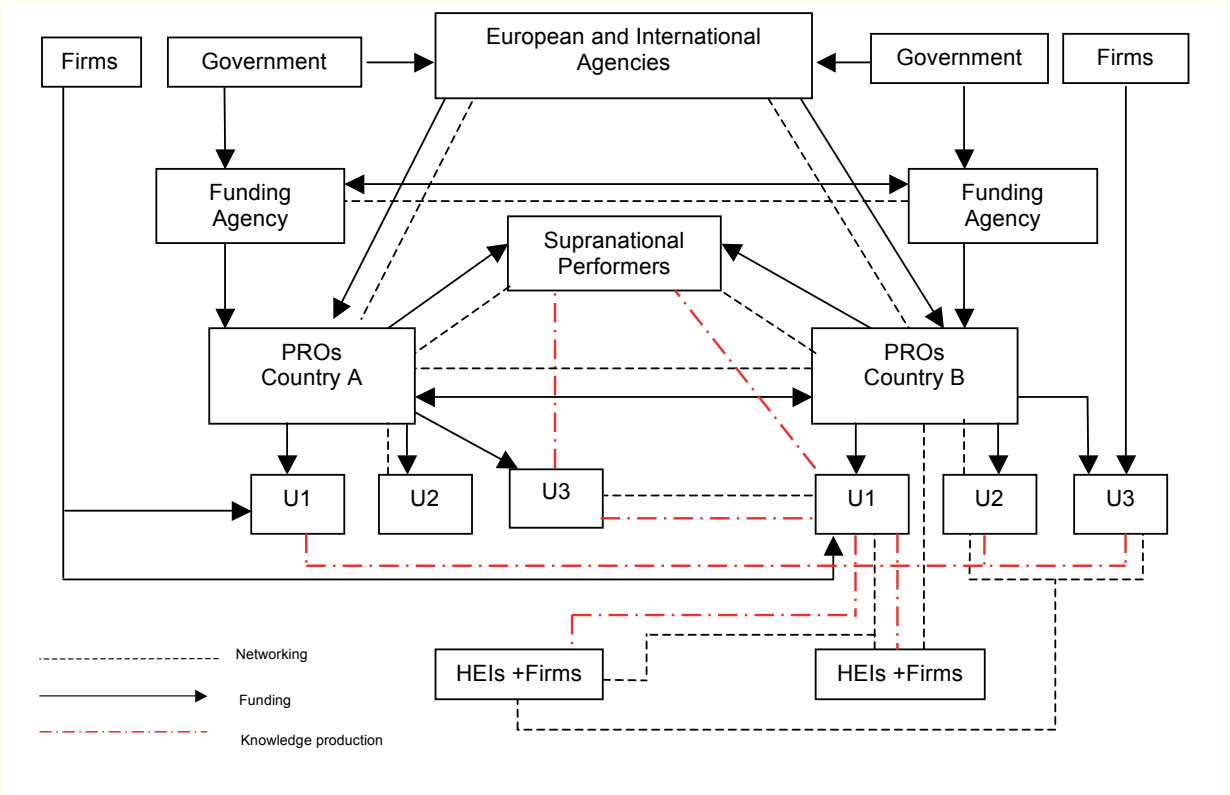

Figure 1. A conceptual framework for the European research system, its actors and their interactions

and networking patterns between non-national institutions, groups and individuals; iii) international co-production of knowledge (publications and technological outputs). These three processes can be represented as the apexes of a triangle that provides a sort of base map to position each organisation regarding its internationalisation policy.

The discussion on these two inputs highlighted the fact that these three processes can alternatively be interpreted as drivers of internationalisation or as consequences of internationalisation, and that there is a need to identify the rationales for internationalisation, which depend heavily on the organisation's missions and on its role in the research system but also depend on its history, resources and scientific fields (for specialised organisations).

Another issue was identified related to the functions performed. Observing production or collaboration processes at the level of research groups or individual researchers (in the case of RPOs) or at the level of specific funded programmes (in the case of FAs) was easily accepted. On the contrary, the internationalisation of the organisation itself, its policy making and governance processes, was less natural for many participating MOs. For FAs, for instance, this facet of internationalisation includes coordination with other agencies for designing, co-funding programmes or sharing funding decisions.

The interactive discussion between MOs and experts led to further refinement of the triangle framework in order to show simultaneously the different rationales for internationalisation and the different functions that are internationalised. As the first framework representing the research system necessarily associates funders and performers, it was considered that, for clarity, the representations have to be specialised for funders *versus* performers.

Therefore two matrices were designed to allow each organisation to define why and how international embedment and activities are supported. The activities are shown in columns. For FAs (Table 1), the first column concerns the resource flows related to international funding or co-funding by the FA, three columns describe the international orientation of the different supported schemes: funding knowledge production, funding knowledge circulation and funding collaboration and networking. The fifth column is related to the internationalisation of the agency governance and processes. Similarly, five columns were chosen for RPOs (Table 2). In the different cells, examples of actions taken to enhance internationalisation or observable results related with international activity are displayed. The two matrices refer to the same processes and the same actions but the rationales are different in relation to each institution mission. The roles of the institutions in research processes are also different: for instance, research performing institutions are involved in the production of output while funding

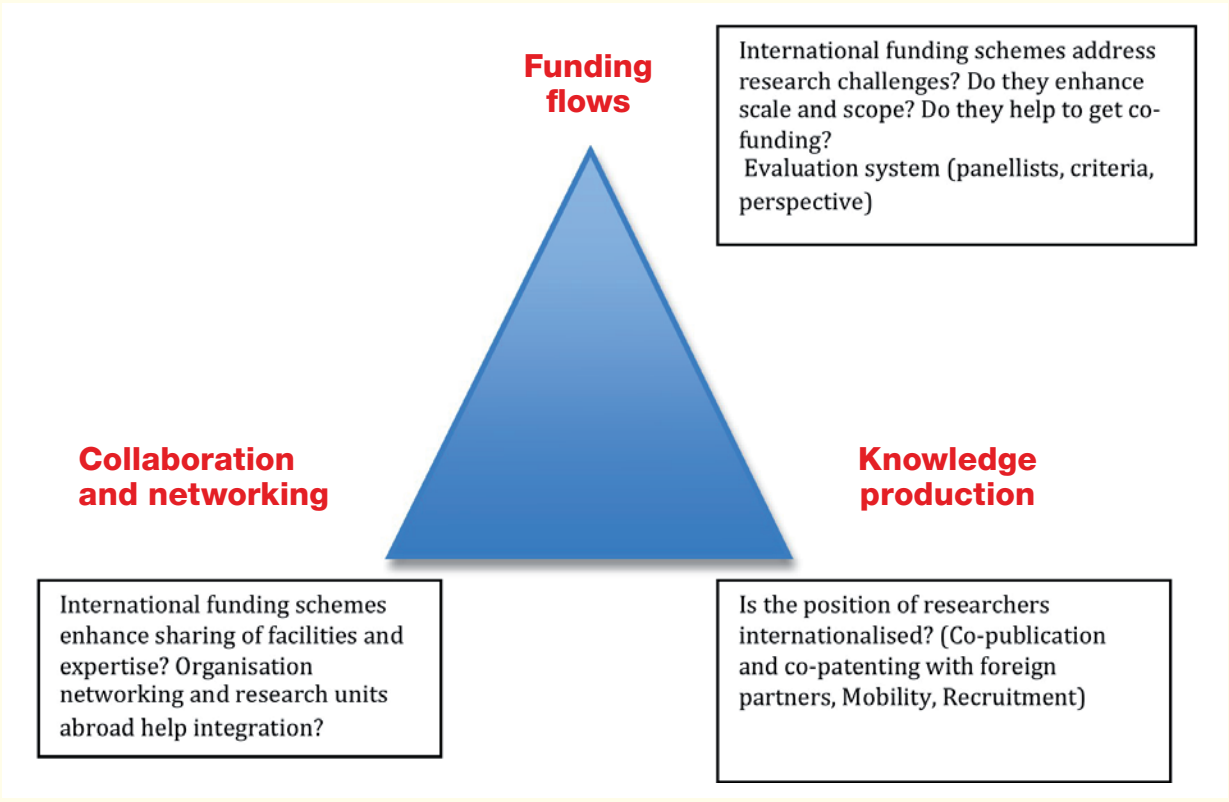

Figure 2. The three dimensions of activity impacted by the internationalisation process of a research institution

Table 1. Internationalisation of funding agencies, the rationales and the dimensions of activity

Activity dimensions	Resources flow	Funding knowledge production	Funding knowledge circulation	Funding collaboration and networking	Governance and processes
Rationales					
Reaching critical mass	Joint programmes within ERA	Co-authored publications with European partners	Mobility of researchers	Shared infrastructures (LSF)	International programming (design, selection, management)
Benefit from complementarities	Joint programmes within ERA	European co-patenting	Workshops and conferences	Shared infrastructures (LSF)	Offices located abroad
Aiming at global coverage	International joint programmes	Co-authored publications with international partners	Recruitment from abroad	Bilateral agreements	Foreign reviewers and panellists
Enlarging innovation networks	Open programmes	International co-patenting	Mobility of PhD	Foreign reviewers and panellists	Recruitment from abroad

Table 2. Internationalisation of research performing organisations, the rationales and the dimensions of activity

Activity dimensions	Resources flow from non-national resources	Knowledge production	Knowledge circulation	Collaboration and networking	Governance and processes
Rationales					
Joining high quality research activities	International programmes	Co-authored publications with European/ international partners	Mobility of researchers	Shared infrastructures (LSF)	International/ European programming (design, selection, management)
Getting access to additional resources	European programmes	European co-patenting	Workshops and conferences	Shared own infra-structures (LSF)	Units located abroad
Signalling and visibility	Inward mobility	Co-authored publications with international partners	Recruitment from abroad	Mobility of researchers	Foreign reviewers and panellists
Broadening the scope of the research agenda and networking	Joint and open programmes	International co-patenting	Mobility of PhD	Foreign reviewers and panellists	Recruitment from abroad

institutions mainly act upon the input of the process. Though the two matrices are not very different, it was essential to design the indicators with a clear understanding of the rationales and the roles of the two types of institution.

The second step again involved both the experts and the MOs.

- The participating MOs provided lists of used or desired descriptors to follow up activities and impacts (10 MOs provided extended lists of descriptors).
- The experts improved the description of these descriptors so that they could be translated into indicators. In addition, they provided meaningful indicators that were not proposed by the MOs but which have proved their usefulness. This led to a large list of possible indicators with three to five indicators for each dimension of activities (i.e., each column of the matrices).

The discussion during a working session[3] between experts and MOs allowed the matrices to be improved and confirmed their usefulness to posi-

3. Experts and MOs working session, Paris, 4 February 2011

Table 3. Steps of the collaborative process

Steps	Actors		
	MOs	Experts	ESF
Topic choice	√		√
Design of the study: objectives and action plan	√	√	
Overview of MOs' international policy and instruments	√		
Analysis of the relevant literature		√	
Conceptual framework for the research system		√	
Comprehensive large set of descriptors	√	√	
Framework for organisation rationales and activities	√	√	
Selecting from the large set useful indicators for MOs managing processes	√		
Providing information on data availability	√		
Selecting feasible indicators		√	
Providing data	√		
Selecting the final set	√	√	
Testing the feasibility of four bibliometric indicators		√	
Describing the indicators		√	
Drawing conclusions of the forum and recommendations	√	√	√
Communicating the results to the academic community		√	
Communicating among users and stakeholders	√	√	√

tion organisation international activity and also to select a relevant set of indicators, which would economically but comprehensively cover the five dimensions.

During the next workshop,[4] a consensus was found to select from the large list of indicators those indicators that the MOs considered useful for the organisation management processes and for which data are available or could reasonably be collected.

The third step consisted of a test of data availability and of the description of the indicators.

A first description of the selected indicators was achieved through templates prepared and pre-filled by the experts. They were completed by MOs in order to provide information about the availability and the quality of the data. Having analysed the MOs' answers, the experts chose six indicators (three indicators for FAs and three for RPOs) for which a test of data collection was achieved.

The findings of the experts about these samples were shared and discussed at the fourth workshop.[5] The description of the indicators was improved through the questions of users and the constraints in data availability. Complementary data were collected after the workshop for those indicators relying on internal data that were only available from the participating organisation. Due to the collection of these data and their analysis by the experts, it was possible to control three of the important properties of indicators: validity, reliability and feasibility. The issue of comparability has been raised but not yet fully considered.

Furthermore, a study was done by the experts to test the feasibility of indicators based on new fields in the Web of Science, which provides acknowledgments to funders (Van den Besselaar *et al.*, 2012).

The fourth step consisted of sharing the findings of the study and preparing the conclusion of this report.

The presentation of the final set of indicators at the last workshop,[6] their full description and their analysis both from the experts' and MOs' point of view was the last step of the participatory indicator designing process. A round of feedback on the quality of the participatory process and the collection of suggestions for future development closed the forum.

4. Paris Workshop, 9-10 May 2011
5. Bern Workshop, 7-8 November 2011
6. Oslo Workshop, 7-8 May 2012

3. Output of the MO Forum

During this process, different lists of indicators were considered. The first list consisted of a large set of possible indicators and the coverage of this list was carefully checked according to the different dimensions represented in the framework matrices. In the further selection steps, the considerations of usefulness for the MOs and the issue of data availability and reliability led the group to select a final set of eight indicators for FAs and nine indicators for RPOs. These indicators were classified into three groups:

- *Mature indicators* regarding the objectives of the pilot study: the last step before production is only to establish strict rules about data collection and analysis, that should result in guidelines for the production of the indicators;
- *Indicators in development stage:* the conceptual basis of these indicators is clear but they are not ready for production and another test of data collection and analysis is necessary to determine exactly what has to be measured;
- *Blue sky indicators* (as defined by OECD): those indicators still have to be developed conceptually in order to find a relevant measure connected to the unobserved reality.

The last column of tables 3 and 4 shows that we have three mature indicators and three indicators under development for FAs, whereas we have four mature indicators and four indicators under development for RPOs. This is related to the fact that producing indicators of internationalisation is a new issue for the participating FAs, whereas it is more usual practice for RPOs.

The indicators are ranked with respect to the dimension of activity as shown in column 1 of tables 4 and 5. The diversity in the status of indicators was the price to pay to propose a comprehensive set of indicators with at least one indicator for each dimension of activity, for both FAs and RPOs.

A complete description of the indicators with selected examples is included in the annex.

3.1 Eight selected indicators for funding agencies

The process to choose relevant, useful and feasible indicators led to a selection of eight indicators for funding agencies which are summarised in table 4 and discussed hereafter.

Summing up and discussing our findings, we use some of the key results (most of this sub-section is extracted from Reale *et al.,* 2012).

First of all, the survey and the dedicated workshops resulted in a consensus between experts and FAs on the assumptions for selecting indicators for the evaluation of internationalisation:

- FAs can be investigated with indicators aimed at analysing the internationalisation of the different funding functions performed, and the international perspective they pursue;
- Explaining the different rationales for FAs' internationalisation – notably scale and scope rationales – is useful for the organisations and the matrix provides good support for the selection of relevant key indicators for evaluation purposes;
- Internationalisation can also be assessed by looking at the internationalisation of the research performers funded by the FAs: indicators showing changes in the beneficiaries' international collaborations and standing – such as their abil-

Table 4. Overview of the selected indicators for funding agencies

Activity dimension	Unit	Code	Indicator name	Feasibility and sources	Status
Resource flow	Budget and share of total direct research funding budget	F1	Budget for Joint Research Programmes	Internal database on budget allocation	Mature
Funding knowledge production	Share of funded papers with international co-authors / share of national papers with international co-authors	F2	International co-authored papers	International database of publications using the field acknowledging funders (WoS)	Development
	Share of funded patents with an inventor from abroad	F3	International co-patenting	International database (patents and articles)	Blue sky
Funding knowledge circulation	Budget and share of total direct research funding budget	F4	Budget for attracting researchers from abroad	Internal database on budget allocation Annual report	Mature
Funding knowledge circulation & resource flow	Number of researchers (head count) whose mobility has been funded (incoming and outgoing)	F5	International mobility	Internal database Annual report Available but uncertain, depends on quality of reports from beneficiaries used	Development
Funding collaboration and networking & resource flow	Share of funded papers which are internationally co-funded	F6	Co-funded research output	International databases of publications using the field acknowledging funders (WoS)	Development
Governance and processes	Share of total number of evaluators coming from abroad	F7	Evaluation procedure	Internal database Annual report	Mature
	1. Budget going to researchers working abroad 2. Number of applicants from abroad to the FA's programmes 3. Share of funded papers with no national authors	F8	Openness of programmes	1. Internal data on budget allocation 2. Internal data on the selection processes of submitted projects 3. International databases of publications using the field acknowledging funders (WoS)	Blue sky

ity to co-sign papers with non-national authors – are indirect proxies of the effectiveness of the funding schemes and of the soundness of the selection process.

As far as the relevance, robustness and feasibility of indicators are concerned, we can distinguish between the different categories of indicators.

Those relating to **resource flow,** namely budgeting for joint research programmes, budget spending abroad and budget for attracting foreign researchers are all measuring key features of internationalisation according to the available literature. The possibility to disaggregate the data by type of programme, and the availability of information on some features of the different programmes (main objective, type of delegation, rules for selection and targeted beneficiaries) would supply robust evidence for patterns of internationalisation of the FAs. Data on budget allocation are generally available from the FAs' internal database, and the breakdown by discipline or field of science does not seem to be too problematic.

Indicators for internationalisation of **funding of knowledge production** are robust and feasible when based on international databases of publications and patents. It is now possible to use the acknowledgments of funders, public and private, national and international, as listed in the publications. This enables FAs' funding of internationally co-authored papers as well as international co-funding of international co-authored papers to be measured. An extensive exploration of these possibilities would be important, although large scale use of these data depends on methods for overcoming problems of data cleaning and disambiguation (Van den Besselaar *et al.,* 2012).

Such indicators, based on the research outputs of funded performers, were first considered by FAs as the most natural indicators to use. But they only measure a part of the whole effort of internationalisation of an agency, that is, related to the research

programmes funded by the agency. FAs pursue internationalisation through various other means, such as funding knowledge circulation or funding collaboration and networking. Therefore the assessment of FAs' strategies for internationalisation cannot be only the assessment of the different funding schemes, although funding schemes are the building bricks of the strategies themselves. In this sense, the indicators based on budget provide a more comprehensive view.

Indicators on **knowledge circulation** are the most problematic in terms of data availability and feasibility.

Measuring mobility from abroad – although considered as one of the most important indicators of internationalisation – showed important methodological constraints. Funds allocated to attract researchers from abroad in dedicated programmes are more easily measurable. But it is much more difficult to measure the budget used for attracting researchers from abroad in the frame of general funding programmes. The allocation of such funds may be only available from budget reports from the funded RPOs. Therefore the selected indicator does not include such funding schemes that do not contain an identifiable sub-budget for international mobility. The same difficulty is encountered for counting the number of incoming or outgoing researchers, and the same restriction is made here: only mobility funded by specific mobility programmes is included. Another difficulty is related to the length of stay: how long should a researcher stay abroad in order to be counted as international mobility?

To approach how FAs support **collaboration and networking**, an indicator related to funding of large scale facilities and, more generally speaking, the budget dedicated to all the large internationally shared infrastructures was suggested during the project. However, data are not easily available. Moreover, what counts as a research infrastructure is not well defined. The discussions showed very different opinions with respect to the relevance of this indicator, which was therefore not selected in the final step. Alternatively, measuring internationally co-funded research provides an indicator for the success of the FA to co-fund research programmes – whether through a top-down process (decision by funders) or through a bottom-up one (collaborating researchers take initiatives to apply to FAs in different countries).

As to the indicators linked to the FAs' **governance and organisation,** the international character of evaluation is important although not always simple in terms of data availability. Comments given by the FAs were interesting, because they reveal the potential and limits of indicators investigating internationalisation. In the case of this indicator the size of the country matters: in small countries non-national reviewers and panellists are needed because of lack of expertise or small size of the research system. As the Danish DNRF underlined, "all reviewers are foreign (considered as an international necessity when doing proposal evaluations)". Similarly, the Flemish FWO only uses referees from abroad; and although this is not the case for all panel members, most of them are affiliated with a non-Flemish university or research institution. A conceptualisation of **openness of programmes** is still to be designed. There is a need to measure how the formal attribution of openness corresponds to the concrete implementation. For instance, the presence of specific features which are supposed to be linked to the openness of a programme (e.g., language of the call and of the application, criteria of eligibility, portability of the grant, etc.) would be interesting to observe. It is also interesting to know how many researchers from abroad apply to the FA's programmes and if such researchers indeed get some funding. Another possible way of measuring the *de facto* use of resources elsewhere is to count the number of papers acknowledging funding but without any national author. Summarising, three approaches have been suggested which are related to the different phases in the funding process and its possible impact on the internationalisation of the funded researchers/groups: i) the budget which is allocated to researchers abroad; ii) the number of researchers from abroad applying to the different programmes; iii) the number of funded papers with no national authors.

- As for the total budget spent abroad, the amount of funds allocated to researchers abroad is not easily available. As an example, AKA noted that "*the comprehensive data are available only in exceptional cases: funding is generally managed in home institution and the budget spent abroad does not appear as separate category even if the work is done abroad. It is a different matter 1) what the funding decision was aimed at, and 2) the actual use of funding in home institution. Budget for 1) is available, but for 2) not*".
- The availability of information about applicants has not been tested yet.
- Finally, there are methodological issues as well as operational ones with respect to the bibliometric indicators. For instance, a funded paper with no national author may be the result of different things, among others a researcher moving abroad after having obtained the grant.

Nevertheless, these suggestions show that promising indicators could be developed on this important issue of openness of programmes but they need further conceptual work and development.

3.2 Nine selected indicators for research performing organisations

The process to choose relevant, useful and feasible indicators led to a selection of nine indicators for research performing organisations, which are summarised in table 5 and discussed hereafter.

RPOs are today more and more concerned about enhancing their internationalisation. Their objectives are related to scope and scale issues, like opening their research agenda to worldwide issues, or getting access to more differentiated resources. They also aim at increasing the quality and visibility of their research.

RPOs have a regular practice of producing indicators, which they use at least in two situations. One is the reporting process to the government. This may take place annually, as well as in the context of a regular evaluation of research organisations and universities. This is the case in France since the creation in 2003 of AERES, the national evaluation

Table 5. Overview of the selected indicators for research performing organisations

Activity dimension	Unit	Code	Indicator name	Feasibility and sources	Status
Resources flow from non-national resources	Budget and share of total budget	P1	Budget coming from abroad	Internal database	Mature
	Number of papers acknowledging foreign funders, with only national authors and percentage of total output of the organisation	P2	Budget coming from abroad: output generated	International database of publications using the field acknowledging funders (WoS)	Development
Knowledge production	Share of total publication output with international co-authors	P3	International co-authored papers	International databases	Mature
Knowledge circulation	Share of researchers recruited from abroad	P4	Recruitments of researchers from abroad	Data in internal HR databases Annual report Usually nationality is recorded in HR databases but the origin is or will be available in most cases	Mature
	Number of researchers coming from abroad Number of researchers of the organisation who went to a foreign organisation	P5	International mobility	Data in internal HR databases Annual report	Development
Collaboration and networking	Budget and share of total budget	P6	Budget for Joint Research Programmes or Projects	Issue of total costs versus marginal costs is difficult	Development
	Percentage of users	P7	International use of own infrastructures	For each type of infrastructure, a relevant measure of the use by researchers from other countries has to be defined	Blue sky
Governance and processes	Share of members from abroad in recruitment committees	P8	Recruitment committees	Local foreigners are not counted Rules may limit the number of external members Data may be confidential	Development
	Share of total number of panellists coming from abroad	P9	Evaluation procedure	Numbers largely depend on the evaluated entity (whole organisation, research departments or teams, individuals ...)	Mature

agency for research and higher education. In Italy the same happened for the three-year evaluation exercise 2001-2003 (VTR) and now for the running 2004-2010 evaluation of the quality of research (VQR), under the control of the national agency ANVUR. The second use of indicators by research organisations is the internal monitoring process and possibly for comparison with other institutions with similar missions and activity profiles.

The forum participants agreed that beyond a routine production of a few indicators about internationalisation there is a real need to improve the follow up of the involvement in international cooperation through a comprehensive set of indicators covering the different dimensions of activities. Indicators based on sound expertise in science policy studies and indicator design, shared between European research organisations and recommended by European bodies, were advocated by the participating MOs and recommended by the experts.

Despite the relatively modest number of RPOs involved in the study, the following facts depict fairly the feasibility of the selected indicators.

The first indicator related to **flow of resources from abroad,** which measures the portion of the budget coming from abroad, is usual for research organisations. Breakdown by country is relevant, including an explicit case for European funding which is often the most important source of non-national budget. This part of the budget has to be compared to the total budget of the organisation, but also to the fraction of the budget which has been obtained through contracts with other organisations or companies and through successful application to calls and programmes (so-called organisation 'own resources').

The second indicator is another way to describe the resources allocated by foreign institutions to researchers in the organisation using the number of **papers acknowledging foreign funders**. Only those papers with no foreign co-authors are considered because this may have implicitly brought international funding into the paper. This new indicator relies on important work to identify the funders (as a large number of name variants appear in the databases). Funding by EU funds should be taken separately, as this is different from other international funding. This indicator could be based either on researchers' names or addresses, which is probably feasible for the research organisation (if not already done). Recommendations to researchers to acknowledge their funding sources and recent recording of this field on the Web of Knowledge database suggest that this indicator could be produced in the near future.

Regarding **knowledge production,** the number of internationally co-authored papers is a typical proxy for the international collaboration of researchers. The standard results extracted from databases can be considerably improved through a disambiguation of authors' names and/or addresses. This indicator is already used to track trends, to identify collaborating countries, to analyse international networks, and occasionally for benchmarking.

Knowledge circulation is a main issue in the internationalisation of the research. It takes different paths: recruitment, bi-directional mobility – inward and outward – and visits. It is not easy to measure outward mobility, but more relevant data are available for inward mobility. Breakdown by country of origin has been considered as more relevant than by nationality. Like other European groups working on researchers' mobility, the (low) threshold of a minimum of three months' duration has been used to distinguish extended mobility from short stay (two weeks to less than three months). Outward mobility of staff is not always recorded by the RPO central administration, in particular when it is directly supported by the institutions. In most cases, researchers leaving the organisation are not recorded as mobility. Available figures would therefore only show a part of researchers' mobility, mainly the fraction supported by dedicated funds. Finally there are new types of mobility, which are not yet characterised and recorded, such as part-time mobility or virtual mobility. Virtual mobility is an effective and efficient complement to physical mobility. It means remote collaboration that uses ICT communication means, such as e-conferences, e-seminars, video-conferences and virtual labs.[7]

Indicators about **collaboration and networking** are the most difficult to develop. The involvement of RPOs in designing and managing joint research programmes with foreign institutions is very important for the coordination of the European research system. In some countries like Italy where no national single research funding agency exists, or in cases where the international cooperation for some disciplines or arenas is delegated to a specialised research organisation, RPOs play an important role in the internationalisation of the national research system. The budget allocated

7. As defined by the European Alliance on Research Career Development Forum, 'virtual mobility' refers to cross-border research cooperation based on verifiable signs of collaboration and participation. The forum also recommends that "the source of information should always be independent of the researcher to be considered. Assessment should be based on elements such as co-publications, co-patenting, cross-border grants, conference papers, organising boards, international peer review panels, appointments based on merit by official 3rd party, e.g., on expert groups".

by an organisation to joint research programmes and projects is therefore very informative. But only those programmes which are jointly planned with a foreign institution should be included (and not the projects related to programmes planned and managed by other agencies or by the EC). Though full costs would be relevant, in general only marginal costs are available and this issue has to be reconsidered when more data are available.

Another desired indicator concerns **research infrastructures**. These infrastructures play an increasingly important role because they offer research services to users from different countries, attract young people to science, and help to shape scientific communities. The indicator suggested by the forum is a measure of the use of owned infrastructures by researchers coming from abroad. At INFN foreign users of infrastructures (accelerators, beams, accelerators, etc.) in the main four laboratories are recorded. The percentage of users coming from abroad is a relevant indicator of the role played by these infrastructures in developing international collaboration and networking. Before further developing this measure, a classification of research infrastructures is needed, related to the type of usage (distant or on the spot, one shot or regular use, etc.) and of their resources and management (e.g., infrastructures owned or supported by more than one organisation). This indicator therefore deserves more conceptual work and is a blue sky indicator for this study.

As for internationalisation in the **governance** processes, the percentage of members coming from abroad in recruitment committees and in evaluation panels for ex-post evaluation is relatively easy to produce. In certain cases the composition of these committees and panels is not under the control of the organisation because there are legal rules enforcing a proportion of staff members in these committees. Nevertheless, it is important to assess how organisations use their flexibility when composing these committees or to compare the compositions when they are or not regulated by law. The breakdown by country and field of science is important because it shows collaboration and sometimes historical relationships at institutional level. Breakdown is usually available by scientific department. However, a translation of the disciplines or departments into OECD Fields of Science has not yet been developed at many organisations.

4. Conclusions

4.1 Relevance of the participatory process

The first conclusion of this forum is that the participative approach involving MOs and experts for designing indicators works well and is relevant. A collective learning process effectively took place with interesting lessons for both MOs and experts.

Detailed discussions between MOs and experts produced a common understanding of the different points of view and enlarged each other's view of the objectives and the practices of the institutions involved. For experts, it was essential to start from the question "why do we need indicators?". The conceptual framework that was collectively designed allowed for a common understanding of the issues at stake. At the same time, it clarified the diversity of points of views among MOs. One main result of this bottom-up process was the choice to develop two sets of indicators in a process that involved FAs and RPOs for the duration of the forum. Before starting the forum, the hypothesis was that indicators of internationalisation would mainly concern RPOs. This was related to the wish of the RPOs involved to be able to compare themselves to similar organisations. Therefore, indicators have to be shared among RPOs in Europe in order to overcome the diversity of national indicators currently used for interaction with their national governments. But it was soon recognised that the internationalisation issue is equally relevant for FAs. Beyond their usual concern about measuring the effectiveness of the funding schemes, questions were raised about their rationales for investing in international collaboration and about the outcomes of this investment: evidence was needed about the international orientation of the funding schemes, about the international activities developed by the agencies themselves and about the internationalisation of the funded performers. These issues were important to share between funders and research performers. As one participant said "*as a funding agency, we do not interact so often with our customers and this study was an interesting opportunity to understand their interests and objectives about international collaboration*".

MOs learned about the process of indicator design, which necessarily includes in the first steps a clarification of the concepts to be represented, based on a view of the research system and its evolution. The experts provided useful knowledge through a global vision and an understanding of the current issues about internationalisation and its relationship with the different missions and contexts of the research institutions. This participative process also allowed the experts to understand the different perceptions and ideas of the participants about indicators and the interactive process was a way to make users aware of the 'machinery' of indicator design and development.

In the further steps**, MOs understood the requirements of indicator definition:** the precision needed about each measure used for an indicator implied eventually going back to the intention of the indicator. Starting with information about the currently available data was essential and explaining issues about perimeter, definitions of words, breakdown, weighting and rules for data collection contributed to a better understanding by MOs of indicator requirements. This understanding is essential for the future production and use of the indicators, in particular because many of them rely on data only available from internal databases.

This **interactive process** between users and experts is therefore not only **a robust basis for indicator development** but was also considered as the only way to do it. Skills in indicator design are essential but the participants are convinced that, if proposals had been prepared by experts without interaction with users, the design phase would have been faster; however, in such a case the consensus on the usefulness and on the requirements for data collection would take much more time to reach. At the end, the process is considered as very productive and the participants of the forum strongly recommend using this method in other indicator development studies.

4.2 Relevance of indicators to assess the internationalisation of research institutions

For both types of institution, **the internationalisation process is implemented at different scales and through different activities.** FAs' internationalisation goes beyond the sum of the funding schemes they manage and the assessment of FAs' strategies does not coincide with the assessment of its funding schemes. Specific features of the scientific strategy and of internal governance processes are also related to the international orientation of the institution. This is also true for RPOs, as their internationalisation is not restricted to the sum of individual researchers' international standing.

It is possible to assess the internationalisation of a funding agency or of a research performer through its different activities. The selected indicators rely on measures related to the usual vectors of interaction: money (as budget allocation), people (mobile researchers, external experts) and scientific output (as co-publications and co-patenting). A fourth type of evidence is very informative though it was found more difficult to use: research infrastructures are important vectors of collaboration. For the moment, we only have a measure for a particular type of infrastructure and there is a need for relevant and feasible measures adapted to the other types. Further work is needed on this issue because infrastructures are an important vector of internationalisation to follow up in the future.

The pilot exercise has also produced some promising findings to **investigate separately Europeanisation and internationalisation.** The former can contribute to the better understanding of how European research policies have modified the national as well as European research system. The key criterion for further investigation is to collect relevant data and time series.

The accountability issue was outside the scope of this study, as the aim was to contribute to strategy formulation of the research institutions with **indicators designed as a positioning tool.** The conclusion of the forum is that this aim is feasible and that the indicators developed should be useful to map institutions' positions in terms of internationalisation of the research system. But, as we detail below, the comparability issue has not been studied and now requires more work by experts and users.

Outputs. The forum allowed the production of a framework and a small set of mature indicators for which validity, reliability and feasibility issues have been addressed. However, the important issue about transparency and independence of the data production, which is a key point in the production process of the indicators, has not been addressed yet. Other indicators – in development stage – are ready to be developed but they require some data collection and more work to check their feasibility. Three blue sky indicators would complete the set of indicators. They need more conceptual work and feasibility studies before they are developed. **The whole set consists of a comprehensive but still economical set of indicators. There is therefore no need for more indicators but for more quality.**

Finally, it has to be noted that these results are based on research which has been presented in scholarly conferences[8] and published in peer reviewed journals (Reale *et al.,* 2012) and proceedings (Reale *et al* 2011, Van den Besselaar *et al.,* 2012).

8. STI-ENID conferences in Rome (September 2011) and in Montreal (September 2012)

5. Open Issues for Further Work

It is now possible to go further and define what could be the next steps in the production of common indicators of internationalisation in Europe. Four types of development would be necessary and they need the involvement of the different actors: the member organisations, the experts and ESF.

Towards the production of mature indicators
Rules and guidelines for data collection should be defined in order to ensure transparency and independence of the data collection process. The issue of comparability is now fundamental to address. This deserves careful work based on enough data. If organisations were now to start using the seven mature indicators, they could refine them, possibly enlarge the types of breakdown and start to build time series. Sharing this between organisations and with experts would allow a further step in improved comparability. Other organisations which did not participate in the forum should also be invited to join. Expertise and coordination is needed in order to capitalise on this experience and to eventually produce a revised version of these indicators.

Further developing the other suggested indicators
The seven indicators classified as *in development* have a safe conceptual basis but there were not enough data collected to confirm feasibility and comparability of the measures.

- Mobility data were missing for both FAs and RPOs and this is mainly due to a lack of recording. The relevance of these indicators is recognised and organisations have to centralise information collection on mobility in order to produce these indicators.
- More exploratory work is needed to develop the three indicators based on funding acknowledgment in published papers. This would require the development of operational data cleaning methods.
- Availability and comparability issues of indicators relying on RPOs' budget data has to be further explored, as not enough data could be provided during the pilot study. Several expected difficulties should be solved, such as the choice between accounting in terms of total or marginal costs, and the choice between taking budget allocation decisions or actual funding, etc.

The objective is that these seven indicators will be developed into indicators usable for assessment and positioning. As for the mature indicators, improving the quality of these indicators strongly relies on MOs' data collection activity.

Future research is also necessary to develop the blue sky indicators, such as openness of FAs' programmes, measures of international co-patenting and international use of RPOs infrastructures.

International harmonisation of classifications
Another issue for the development of common indicators is the harmonisation of definitions, of classifications and of data production. Harmonisation is a regular practice of international organisations (OECD, UNESCO, Eurostat, etc.). For this project there is a need for a revision of categories of *fields of science*. The revised OECD classification leaves some problems unresolved. It is only used by a few organisations because it is not closely enough related to their internal organisational structures. The ESF MO Forum on Evaluation of Publicly

Funded Research has investigated this issue further (ESF MO Forum on Evaluation of Publicly Funded Research 2011).

As pointed out by the Academic Careers Observatory, there are presently four existing classifications used in the European context. There is a need for a unified taxonomy of these stages in order to relate researchers' mobility with career stages and compare these data between countries. The ESF MO Forum on European Alliance on Research Career Development endorses the new classification developed jointly with the European Commission (ESF-FNR 2012).

Finally, the ongoing work within ESFRI to better describe and classify the different research infrastructures[9] will be very useful to further develop the related indicator. The ESF MO Forum on Research Infrastructures in the joint project with the European Commission MERIL (Mapping of the European infrastructure landscape) has achieved a consensus definition.

Debate about internationalisation of research institutions and its assessment

Besides these necessary developments required for the production of indicators, it is useful to continue to debate about the meaning of internationalisation. This is particularly relevant for FAs which have different missions and different roles in the various national research systems. The question of how internationalisation of FAs can facilitate the internationalisation of researchers and research organisations is worth considering at the science policy level. The possibility of launching studies to support this should be considered.

It is also necessary to further explore the way internationalisation of research and internationalisation of research institutions is presently assessed in practice. Institutions could be asked to produce evidence on their international orientation in their annual reports. This practice would produce information which could feed the debate about internationalisation with some useful evidence.

9. The ESF Forum and MERIL defines research infrastructure as follows: *"a European Research Infrastructure is a facility or (virtual) platform that provides the scientific community with resources and services to conduct top-level research in their respective fields. These research infrastructures can be single-sited or distributed or an e-infrastructure, and can be part of a national or international network of facilities, or of interconnected scientific instrument networks." More at: http://www.esf.org/meril*

6. Recommendations

6.1 Recommendations to research funders and performers

- Start a pilot on data collection to produce the mature indicators, follow them over time and use them in strategy development.
- Introduce the mature indicators suggested by this ESF report to complement the set of indicators already used in the assessment exercise and in reporting to national governments.
- Discuss the indicators in development and invest adequate resources for collecting and cleaning of relevant data.
- Discuss the use of the indicators with other research institutions and stakeholders in order to improve collective learning processes about internationalisation.

6.2 Recommendations to international organisations

- Support processes that improve a shared understanding of indicators. Promote participatory processes for indicator designing projects.
- Support a project to study the conditions and mechanisms to improve the robustness of indicators and to address the issues of transparency and independence of data collection for the mature indicators and those in development.
- Support phase 2 of the present project to discuss these indicators with more institutions and to explore the issue of comparability of the indicators.
- Support more research on the suggested blue sky indicators which are strategic for better understanding internationalisation, such as the new bibliometric indicators suggested in this report and other indicators for *openness of programmes*, *funded international co-patenting*, *international use of own infrastructures.*
- Improve the harmonisation of the deployed classifications of *fields of science, mobile researchers, research infrastructures,* as this may help the development of shared indicators.

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Glossary

Breakdown by length of mobility: F5
Short-term: from two weeks to three months; Long-term: above three months.

Co-patents: F3
Co-applicants of the patents are from at least two different countries.

Direct research funding budget: F1, F4
This budget includes neither the part that supports internal research activities (in the case of hybrid organisations) nor the salaries of the personnel (even administrative personnel).

Fields of Science (FoS): all
OECD definition of Fields of Science as in Frascati Manual (OECD 2002, p. 67): Natural Sciences, Engineering and Technology, Medical Science, Agricultural Sciences, Social Sciences, Humanities.

Funding agency (FA):
A governmental agency or private organisation which funds research.

International co-authored papers: F2, P3
They have at least two authors with an address from different countries, without taking into account their nationalities, their affiliations.

Joint research programme (JRP): F1, P6
Two or more organisations develop, launch and manage a programme together. Common source is not a criterion for joint programming because matching funds can also facilitate joint programmes. Programmes where the institution pays all the costs may also be counted here (e.g., programmes with developing countries).

Joint research project (JRPj): P6
Two or more RPOs in different countries are jointly conducting a certain research project for the mutual benefit of the parties. At least one of the project functions (management, calls, project selection, funding) is shared between more than a single country (or by regions belonging to more than one country).

Non-national researcher:
Researcher with a foreign nationality (this group is a mix of researchers from abroad and home-grown non-naturalised researchers).

Panellist: F7, P9
Panellists work together and the panel generally provides a decision or a ranking of candidates.

Papers/Publications: F2, P3
Publications which are included in the ISI Web of Knowledge, or SCOPUS.

Patent: F3
A patent is an intellectual property right relating to inventions in the technical field. A patent may be granted to a firm, an individual or a public body by a patent office. An application for a patent has to meet certain requirements: the invention must be novel, involve a (non-obvious) inventive step and be capable of industrial application. A patent is valid in a given country for a limited period (20 years). (Frascati Manual, OECD 2002, p. 200) See also OECD Patent Manual OECD Patent Statistics Manual, 2009.

Research institution: Part 1
An institution which has activities related to the management and coordination of research or which performs research. A research institution can be a funding agency, a research performing organisation, an academy. Some institutions can be considered as hybrid as they are both funding and research performing institutions.

Research:
The activity performed by researchers in all sciences.

Research infrastructures: P7
Research infrastructures (RIs) play an increasingly important role in the advancement of knowledge and technology. They are key instruments in bringing together a wide diversity of stakeholders to look for solutions to many of the problems society is facing today. The term 'research infrastructures' refers to facilities, resources and related services used by the scientific community to conduct top-level research in their respective fields, ranging from social sciences to astronomy, genomics to nanotechnologies. http://ec.europa.eu/research/infrastructures

Researchers: F2
"are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned". (Frascati Manual, OECD 2002, p. 93)

Researcher from abroad: P4, P5
Researcher coming to work in the country whose previous professional address was outside the country, whether national on non-national. This includes national researchers coming back (returnees).

Research funding organisation (RFO):
A governmental agency or private organisation which funds research.

Research performing organisation (RPO):
An institute or other organisation, which is itself realising research and employs active researchers.

Reviewer: F7, P9
A reviewer receives the documents and sends back his /her evaluation report.

Science:
Refers to all disciplines, including Humanities and Social Sciences.

Total budget of the organisation: P1, P8
The total amount of financial resources, wherever the money comes from (including money from funding agencies, contracts, etc.)

List of abbreviations

AERES
Agence d'évaluation de la recherche et de l'enseignement supérieur (France)

ANVUR
Agenzia nazionale di valutazione del sistema universitario e della ricerca (Italy)

CERN
European Organization for Nuclear Research

CNR
Consiglio Nazionale delle Ricerche (Italy)

ERA
European Research Area

ESF
European Science Foundation

ESFRI
European Strategic Forum on Research Infrastructures

EUROHORCs
European association of the heads of research councils

FA
Funding agency

FoS
Fields of science

INRA
Institut National de la Recherche Agronomique (France)

Inserm
Institut National de la Santé et de la Recherche Médicale (France)

JRP
Joint research programme

JRPj
Joint research project

MERIL
Mapping of the European Research Infrastructure Landscape

MO
ESF member organisation

OECD
Organisation for Economic Cooperation and Development

RFO
Research funding organisation

RI
Research infrastructure

RPO
Research performing organisation

List of Forum meetings

- 1st Workshop: 10-11 May 2010, Stockholm, Sweden, hosted by VR and FAS
- Experts' working session: December 2010, Paris, France, hosted by INRA
- Experts' and MOs' working session: February 2011, Paris, France, hosted by INRA
- 2nd Workshop: 9-10 May 2011 in Paris, France, hosted by Inserm and INRA
- Experts' working session, 12 September 2011, Rome, hosted by CNR
- 3rd Workshop, 7-8 November 2011, Bern, hosted by the Swiss National Science Foundation (SNF)
- Experts' working session, 3 February 2012, Paris
- 4th Workshop, 7-8 May 2012, Oslo, hosted by The Research Council of Norway
- Experts' working session, 9 May 2012, Oslo, hosted by The Research Council of Norway
- Experts' working session, 26 June 2012, Paris
- Expected final workshop, December 2012, hosted by DFG

The three experts of the Forum met on several occasions with the Co-Chairs.
Several Steering Committee teleconferences took place in 2010, 2011 and 2012, including with the experts.

List of Forum members

Table 6: MOs participating in the Forum and their representatives

Country	Organisation	Member
Austria	Austrian Science Fund (FWF)	Reinhard Belocky
Belgium	Research Foundation - Flanders (FWO)	Hans Willems Stijn Verleyen
Czech Republic	Academy of Sciences of the Czech Republic (ASCR)	Petr Ráb
Denmark	Danish National Research Foundation (DNRF)	Niels Lagergaard Pedersen Marie-Louise Munch
Finland	Academy of Finland (AKA)	Sirpa Nuotio
France	National Institute for Agronomic Research (INRA)	Gilles Aumont Elisabeth de Turckheim (Co-Chair) Odile Vilotte
	French National Institute of Health and Medical Research (Inserm)	Nicole Haeffner-Cavaillon
Germany	Max Planck Society (MPG)	Berthold Neizert
Italy	National Research Council (CNR)	Alessandra M. Stilo
	National Institute for Nuclear Physics (INFN)	Valerio Vercesi (Co-Chair)
The Netherlands	Netherlands Organisation for Scientific Research (NWO)	Patricia Vogel
Norway	Research Council of Norway (RCN)	Kari-Anne Kristensen Stig Slipersaeter
Spain	Council for Scientific Research (CSIC)	Marian Gomez Rodriguez Sofia Torallas Tovar
	Inter-ministerial Committee on Science and Technology (CICYT)	Carolina Cañibano
Switzerland	Swiss National Science Foundation (SNF)	Katrin Milzow Gillian Olivieri
Turkey	The Scientific and Technological Research Council of Turkey (TÜBITAK)	Yasemin Aslan Aysegül Günel
United Kingdom	Research Councils UK	Sophie Laurie
Observer		
	Foundation for Polish Science, Poland	Marta Łazarowicz-Kowalik
Experts		
	IKU Innovation Research Centre, Hungary	Annamária Inzelt
	CERIS-CNR, Italy	Emanuela Reale
	University of Amsterdam, The Netherlands	Peter van den Besselaar
Forum management		
	European Science Foundation (ESF)	Laura Marin Madelise Blumenroeder

Annex:
Description of the indicators with examples of available data

The 17 selected indicators – eight indicators for FAs and nine for RPOs – are described in this section. They were chosen to cover the different dimensions of activity where the international orientation of the organisation could be implemented. For FAs, this includes funding schemes which are aimed at developing international collaboration or international mobility, but also the organisation governance and processes. For RPOs, impacted processes are resource flows from abroad, knowledge production and circulation, collaboration and networking, and governance processes such as recruitment and evaluation. For each indicator, comments explain limitations in indicator production and constraints encountered by MOs to produce data.

Seven indicators – three for FAs and four for RPOs – are *mature* indicators that organisations are encouraged to produce and to use in their strategic thinking process or in reporting procedures. Seven other indicators – again three for FAs and four for RPOs – are in the *development stage* and should be tested and discussed among research institutions. Lastly, three indicators are *blue sky* indicators, one for international co-patenting, one about openness of programmes and another for infrastructures. They are related to important aspects of research internationalisation but they need more conceptual work by experts.

After each indicator description, examples illustrate some data which were readily available during the forum. These data were helpful to understand the constraints and difficulties of getting data related to the indicators. Therefore the data in these examples are not the values of the indicators. They should neither be considered as definitive information about each institution nor used for comparison between organisations as the comparability issue has not been discussed yet and a validation process, which would ensure transparency and independence of data production, has yet to be achieved.

1. Indicators for Funding Agencies

F1 Budget for Joint Research Programmes

Code	**F1** Mature Indicator
Indicator	**Budget for Joint Research Programmes (JRP)**
Objectives	FAs are important actors of the research system. Their coordination to design and manage Joint Research Programmes is an important feature towards ERA building. These programmes are European initiatives or common initiatives with other national agencies.
Use	Intensity of funding for collaboration European integration at the level of joint funding International collaboration, mutual learning
Measure	• Amount of financial resources for JRP • Total budget for direct research funding of the organisation All the programmes are co-developed with foreign organisations. Examples of programmes to be included: • ERA-NET • Article 185 projects • Eurostars • JPI • ESF EUROCORES • Joint calls for projects based on bilateral or trilateral agreements • Nordic Center of Excellence programmes (Nordforsk) • Nordic Top-Level Initiative (Nordforsk) Not included: membership fees of international organisations and infrastructures (CERN, ESF, EMBL, EMBC, several infrastructures)
Type of breakdown	• By field of science (using OECD 6 main fields) • By country • By year of funding decision • By type of programme: i) programme co-developed with a foreign organisation, ii) own or national programmes requiring international collaboration of applicants
Limitations in indicator production and constraints	Registering the amount of funding for JRP the year when the decision is made was considered as easier than tracking this budget during the years when the funds are paid to the organisations of research teams. Therefore, the total budget (to be used as denominator) has to be also the total budget commitment decision taken each year. However, this choice may be more difficult for some organisations (as FWF and DNRF mentioned). As the funds are broken down by scientific field, there might be big differences between years and scientific fields. For this reason, calculating a moving average would be relevant. Besides JPIs and other specific joint programming Initiatives, data in some cases also include the sums allocated to international activities as estimated by the project officers.

Indicator F1: **Budget for Joint Research Programmes (JRP).** Example of available data

In the data collected, the breakdown by each category was not always provided or with a breakdown different from OECD FoS. Table A1 shows some figures by field of science.

Table A1: **RCN, ESRC and FWO budget for JRPs**

	Budget for joint research programmes and projects (€)			
	RCN 1 2009+2010	**ESRC 2 2010-2011***	**FWO 3 2009+2010+2011**	**SNF 4 2010**
Humanities	7,296,640		630,800	1,665,000
Agricultural sciences	30,931,822			0
Natural sciences	101,735,894			12,305,645
Science and Technology			2,791,731	
Medical sciences	44,007,388		602,317	3,944,288
Biological sciences			2,786,602	
Social sciences	51,713,032	7,095,742	2,238,994	3,345,450
Technology	116,065,682			3,912,690
Interdisciplinary			200,000	
Total	**351,533,996**	**7,095,742**	**9,250,444**	**25,173,074**
% of direct research funding budget	**21.96%**	**na****	**na**	**na**

*budget established by academic year – **na: non available

Table A1 (cont.)

1. RCN: According to RCN policies most instruments include an international component and consequently in most projects a sum is allocated to joint initiatives and international cooperation. Besides JPIs and other specific Joint Programming Initiatives, data thus also include the sums allocated to international activities as estimated by the project officers.

2. ESRC: The following programmes are included: ESRC contribution to Open Research Area in Europe for Social Sciences, International Pathfinder Research Projects China-SA, Bilateral collaborative research project ESRC-RGC (Hong Kong). ESRC contribution to ESRC-DFID Joint Scheme for Research on International Development has not been included (common ESRC-DFID funding to Phase 2 of Poverty Alleviation Scheme is 7,233,432€).

3. FWO: Bilateral programmes are with Vietnam, Quebec, China, South Africa, Ecuador. Multilateral programmes within ERA and ESF programmes.

4. SNF acknowledges that there is no priori attribution by FoS and the figures reflect therefore the demand in a given field and the quality of proposals.

F2 International co-authored papers

Code	F2 Indicator in development
Indicator	**International co-authored papers**
Use	Monitoring the international orientation of the research funded by the funding organisation and through this the effectiveness of the internationalisation of the organisation. This indicator can be used to answer questions such as: 1. Are the resources distributed by the FA used by researchers that are actively cooperating on the international level, or by researchers that operate mainly nationally? 2. Does the FA have a stronger international orientation than another FA in the same country, or in other countries? These are important indicators for FAs as it is well known that internationally co-authored papers generally have higher impact scores than nationally (co-)authored papers. The share of international co-authored papers can be used for measuring the internationalisation orientation of a funding organisation compared to the national average, and to other national or international funders. This can be done for the organisation as a whole, and at the level of research fields and disciplines. The latter is important, as the level of international cooperation differs between disciplines, and the FA's portfolio may differ from the portfolios of others.
Measure	International orientation (IO): IO = (share of FA funded papers with international co-authors) / (share of papers with international co-authors in the total national output)
Type of breakdown	• By disciplines, or by subject areas • By year • By funding organisation
Limitations in indicator production and constraints	1. We only use publications from Web of Knowledge, which results in a coverage of only part of the output. Furthermore, we probably miss more national than international authored papers. The internationalisation may therefore be overestimated. For fields such as social sciences and humanities, the low coverage by the WoK is a problem. 2. Before 2011, not much information is available. In 2011, (roughly tested for some countries) about two-thirds of all publications have funder information. This is expected to increase even more, and may at a certain moment be rather complete. However, this needs to be tested. Data may be very biased between fields, countries and funding agencies. 3. Large disambiguation task. Funding organisations are mentioned with many different names. It appears that for the SNF more than 150 names are used. Furthermore, sometimes the acknowledgment is not of the FA but a specific funding instrument. However, for an FA's staff member, this may not be a huge task. 4. Time lag between funding and publications. So this year's publications reflect the funding from several years before. 5. Access to Web of Knowledge is needed. 6. We may go from papers to researchers, and measure the same indicators at that level. However, this requires a lot of author disambiguation work.

Indicator F2: **International co-authored paper.** Example of available data

Data for the indicator are not yet easily available within the funding organisations. However, the inclusion of the field 'funding agency' enables output and co-author relations to be coupled to the funding source. Data were directly collected from WoS by the experts and have not been discussed with SNF. Below are some early examples of the indicators, which are under development.

SNF: Table A2 below shows the international orientation indicator (IO) for the Swiss National Science Foundation (SNF). Of all papers in 2011 with a Swiss address, two-thirds are internationally co-authored. If we focus on the papers that received SNF funding, this is about 60%. The papers that acknowledge other funders than SNF show a considerably higher level (above 80%) of international co-authors. By the way, these 'other funders' can be from Switzerland, from abroad, or from international organisations (EC, CERN), and they can be public, private foundations and charities, or companies. Finally, the papers that do not acknowledge funding organisations at all have the lowest share of international co-authors: about 56%.

Table A2: **Overall international orientation of funding organisation (Switzerland 2011)**

	Total	SNF**	Other funder*	No funding
All papers	23,296	5,608	8,996	8,692
International co-authors	67.7%	59.7%	83.4%	55.8%
Swiss (co-)authors only	32.3%	40.3%	16.6%	44.2%
International orientation		59.7 / 67.7 = 0.88	83.4 / 67.7 = 1.23	55.8 / 67.7 = 0.82

*No SNF funding, but at least one other funder – **Possibly also other funders.

As this may be influenced by the composition of the project portfolio (an FA may have many projects in nationally oriented fields), it is useful to disaggregate to individual fields. Apart from a set of small fields (in terms of FA funding), the internationalisation indicator at the disaggregated level is generally also below 1, similar to the general IO indicator of SNF.

Table A3: **Field specific international orientation of funding organisation (Switzerland 2011)**

	Biochemistry & molecular biology		Chemistry		Physics		Psychology	
	all	SNF	all	SNF	all	SNF	All	SNF
Total	1,281	547	2,184	772	2,883	1,080	519	63
International co-authors	66.1%	54.8%	60.2%	45.9%	76.6%	70.3%	64.5%	66.7%
National co-authors	33.9%	45.2%	39.8%	54.1%	23.4%	29.7%	35.5%	33.3%
International orientation		0.83		0.76		0.92		1.03

F3 International co-patenting

Code	**F3** Blue sky indicator
Indicator	**International co-patenting**
Use	Monitoring the contribution of research funded by a funding organisation to international innovation. Monitoring the effectiveness of the internationalisation of the organisation.
Measure	• Number of patents resulting from research funded by a funding organisation (that is, referring to papers with an acknowledgment to funder) • Part of those patents with an inventor from abroad
Type of breakdown	• By third country • By year • By field of technology (patent class) • By field of research
Limitations in indicator production and constraints	• Given the increasing pressure on funding organisations to explain their societal contributions, contributing to research which results in patents may become important. This is the case independently from internationalisation. International co-inventing (co-patenting) is a derived indicator. • Direct acknowledgments in patents do not exist – for legal reasons. • Therefore this indicator depends on the development of indicator F4, and on techniques to extract non-patent references from the patent text. The latter requirement gets considerable attention, and may be solved in the near future. However, even if the techniques become available, it may take a while before they can be applied in a quick and easy way.

F4 Budget for attracting researchers from abroad

Code	**F4** Mature indicator
Indicator	**Budget for attracting researchers from abroad**
Objective	Draw top talent into the country/region either from other ERA countries or from outside ERA. Various types of programme may serve this objective.
Use	Analysis of funding for mobility (such as brain circulation and brain gain)
Measure	• Amount of financial resources dedicated to attract researchers from abroad • Total budget for *direct research funding* of the organisation
Type of breakdown	• By field of science (OECD 6 main fields) • By year of funding decision • By type of programme: i) programmes dedicated to attract researchers (returnee programmes, exchange programmes and so on), ii) general programmes (including the possibility to use part of the funds for attracting researchers from abroad)
Limitations in indicator production and constraints	The choice is to consider researchers coming (possibly back) from abroad instead of non-national researchers*. Registering the amount of funding for attracting researchers from abroad the year when the decision is taken was considered as easier than tracking this budget during the years when the funds are paid to the organisations of research teams. Therefore, the total budget (to be used as denominator) has to be also the total budget commitment decision taken each year. However, the comparison is difficult across countries since the decision may allocate budget for a different number of years. Variability between year/fields would merit a rolling average indicator. The funds allocated to attract researchers from abroad in dedicated programmes are clearly measurable. Comparing the attractiveness by fields of science, it is better to use a three-to-five year average as the allocation by fields is rotating. Much more difficult to measure the budget for attracting researchers from abroad in the frame of general programmes (type ii). More and more general programmes include the possibility to use part of the funds for attracting researchers from abroad but the funding organisation may not allocate a special sub-budget as dedicated funding. In the frame of this programme, budget allocated for attracting/hosting researchers from abroad in a bottom-up way (by RPOs) and not by FAs. Because of this allocation method relevant data are available only from budget reports. Therefore programmes (type ii) are not included in this indicator if it does not contain a direct sub-budget.

* This issue is discussed in the report for European Commission -Directorate-General for Research GR *Monitor human resources policies and practices in research. List of indicators*. Deloitte, July 2011.

Indicator F4: **Budget for attracting researchers from abroad.** Example of available data

Table A4: **Summary of available data for 8 FAs**

	Budget for attracting researchers from abroad (k€)							
	AKA 1	**DFG 2**	**DNRF 3**	**FWF 4**	**FWO 5**	**RCN 6**	**ESRC 7**	**SNF 8**
2006		0			7,287			
2007	0	0			36,346			
2008	8,500	0	4,322		11,630			
2009	0	0	4,482	3,400	3,311	10,731		
2010	10,500	0	4,444	3,900	76	12,070		3,782
2011			2,950		31,281			
2010-2011							37,647	

1. Finland's Distinguished Professors Programme is launched every 2nd year. Two other programmes exist, not included in this data.

2. No specific funds. All funds can be used for hiring candidates from abroad.

3. Sum of two professor programmes *Niels Bohr Visiting Professorships and DNRF professors* and of bilateral agreements with NSF and CNRS. Numbers are actual costs.

5. Sum of two schemes: Visiting postdoctoral fellowships and Odysseus programme; *Networking Programme* budget not included (for 2005-2010, the budget for incoming researchers was 426 169€).

7. This amount is related to the two programmes 1) *British Academy/ESRC China Exchange Scheme*, 2) *ESRC/ICSSR India Scholars exchange* (part of the budget for Indian scholars coming to the UK).

8. The incoming SNF instrument (Ambizione) is also open to young researchers based in Switzerland or to Swiss researchers abroad wanting to come back. The figure given here therefore only reflects how much of the total available budget (21.8 M€ in 2010) was attributed to researchers from abroad.

Table A5: **RCN and SNF budget for attracting researchers from abroad, by field of science**

	Budget for attracting researchers from abroad (k€)	
	RCN 2009+2010	SNF 2010
Humanities	1,805	1,004
Agricultural sciences	2,203	0
Natural sciences	9,845	1,995
Medical sciences	1,468	428
Social sciences	3,776	353
Technology	3,702	0
Total	**22,801**	**3,782**

Comments on data. Different categories for field of science than OECD are presently used by MOs.

AKA: There are three funding instruments dedicated to attracting researchers from abroad (also coming back). By the type of instrument, data availability is different; however, it may summarise them on the organisation level. As the programmes are not open every year budget appropriations may fluctuate between years. Finland's Distinguished Professor Programme allocated 10.5 M€ in 2010 and 8.5 M€ in 2008 but nothing in 2009 and 2007.
Budget is available by OECD field of science.

DFG: Similar to other German organisations, all programmes are open to researchers from abroad. If the planned research projects are carried out at a German institution researchers from abroad may be funded from the grants. Therefore there is not a specific budget for attracting researchers from abroad; however, full budget could be used for this purpose.

DNRF: Annual data on how much money spent on these specific programmes is available.
The main programmes with the specific target of attracting international top researchers and talents to Denmark are the two professor programmes and bilateral programmes with NSF and CNRS. However, the foundation's main funding instrument, the *Centre of Excellence* scheme, has proven to be a major internationalisation instrument as 30 % of all PhDs and 60 % of all postdocs are from abroad. Data from the *Centre of Excellence* programme are not included in this table. Neither are data from the joint research centres the DNRF funds together with the NSFC. The objective of this programme is to strengthen collaboration between leading researchers from China and Denmark, but not necessarily by attracting Chinese researchers to Denmark. The DNRF also ran a special *International Talent Recruitment Programme* in 2008-2011. The total cost for this programme was 31 MDKK (breakdown in separate years not possible).

FWF: Budget is available for year of paying by field of science (FWF categories). In 2010, 3.2% of total budget was devoted to attract foreign researchers for natural and technical sciences, 1% for life sciences and 3% for humanities and social sciences. This budget allocation has been available since 2004.

FWO: Budget appropriation data are available for two programmes devoted to attracting foreign researchers: Visiting postdoctoral fellowships and Odysseus. Budget data are available by fields of science that are included in these programmes (classification is different from OECD). So-called networking programmes support not only attracting foreigners but also allowing Flemish researchers to go abroad. (Based on FWO agreements with various countries to exchange researchers.) In the case of these programmes budget data are available only after funding decision on applications and paying. Just to illustrate the size of this budget it was 534.8 k€ from which 80% served the inflow of researchers into Flemish regions. The networking programmes are available by countries and institutes. In 2011, with support of the Marie-Curie Cofund programme, the Pegasus programme was launched. Pegasus is aiming to attract postdoctoral researchers active abroad. This programme had a total budget of 8.1 M€ for five years.

RCN: In 2009 the total budget for attracting researchers from abroad was 10.7 M€ (82.5 M Norwegian Crowns); in 2010: 12.1 M€ (92.8 M Norwegian Crowns). Data are available by OECD fields of science. Largest sum was allocated for natural sciences in both years. (Lowest for medical sciences.)

ESRC: Until 2010 a budget was allocated for Indian scholars coming to the UK. New programme (International Partnership and Networking Scheme) has broader geographic coverage and supports various types of mobility. The programme has general mobility (bi-direction) character and budget allocated by bottom-up approach. Budget appropriations do not provide information on 'attracting'. Only after the granting decision may get relevant budget data. Estimated budget for this programme is k£ 25 (covering 15-20 awards for 2-4 years).

SNF: SNF has one main instrument to attract young researchers (Ambizione). This programme is, however, also open to Swiss researchers (either working in Switzerland or currently abroad). There is no ear-marked sum either concerning the nationality of the applicants or the field of research. The total budget available in 2010 was 26.2 M Swiss Francs of which 4.5 M went to foreign researchers.

F5 International Mobility

Code	**F5** Indicator in development
Indicator	**International Mobility**
Objective	Inward mobility supports an influx of talent from all over the world. Its indicator measures the attractiveness of a country for talent from other European countries and from outside Europe. Outward mobility supports career development of researchers, international experience, mutual learning. Its indicator measures the capability of nationally educated researchers to have an international research career as well as the opportunities of national researchers to accumulate knowledge abroad.
Use	Assess bi-directional international mobility Indicators provide information on integration into international science
Measure	• Number of researchers (head count) whose mobility from abroad to a national institution has been funded by the organisation • Number of researchers (head count) whose mobility from a national institution to an institution located abroad has been funded by the organisation • Number of incoming researchers from abroad to a national institution funded by the organisation as a percentage of the total research personnel • Number of outgoing researchers whose mobility from a national institution to an institution located abroad has been funded by the organisation as a percentage of the total research personnel
Type of breakdown	• By direction of mobility (incoming, outgoing) – By country of destination (for outgoing mobility) – By year (moves that happened at a point of time in the year) – By country of the institution they were previously working at before arriving (for incoming mobility) • By type of mobility: i) temporary mobility (two weeks to three months), ii) mobility (three months and more) • By type of programmes: i) programme dedicated to mobility, ii) more general programmes including the possibility to use a part to fund mobility • All above by gender
Limitations in indicator production and constraints	As for indicator F4, it may be impossible to identify the mobility funded through general programmes. If this is confirmed, only the mobiles funded by specific mobility programmes (for example, fellowship programmes) will be counted. Beyond that there are statistically uncovered mobility programmes. Time-series are short because mobility is a new issue. Data sources are different by agencies that have impact on timing, quality of data. The available data by agencies are different in the content of information: intention of mobility or factual mobility; nationality or coming from abroad; employed classifications by field of science, by status of mobiles and so on. As relatively newly observed/used data there are quality problems. Now the FAs (such as RCN) are working on improving the quality. Different length of stay raises several measuring problems. Not only because the archives are counting mobile by different classification of time length, but various groups of mobiles are not counted. Planned or proposed mobility are not relevant figures here. The counting has to be based on performed mobility. Incoming mobility is counted by country of origin, i.e., the country the researchers arrived from and not their nationality.

Indicator F5: **International mobility.** Example of available data

Table A6: **Summary of available data for funded mobility (head counts)**

	Outgoing mobility			Incoming mobility	
	DFG 1	**FWO 2**	**FNP 3**	**FWO 4**	**FNP 5**
2005		1,374		32	
2006		1,424		38	
2007		1,293		62	
2008		1,351	15	91	18
2009		1,321	11	141	18
2010	2,140	1,817	15	190	21
2011					33

1. only doctoral and postdoctoral

3, 5. senior and young researchers included

4. PhD and postdoc fellowships (not including the visiting postdocs)

Table A7: **Destination of outgoing mobilities funded by DFG (2010)**

Destination for stays abroad of doctoral students (2010)	%	number
Western Europe	50.9	906
Eastern Europe	8.9	159
Middle East	1.6	28
South Asia	1.0	18
South-East Asia	0.7	13
East Asia	10.8	192
Africa	2.1	37
North America	18.4	328
Central America	1.6	29
South America	1.5	26
Australia	2.5	44
Total		**1,780**

Destination for stays abroad of postdoctoral fellows (2010)	%	number
USA	8	
Canada	5	
Great Britain	3	
The Netherlands	4	
Switzerland	4	
Australia	3	
Other countries	13	
Number of fellowships		**360**

Comments on available data

DFG: For some programmes, notably the temporary mobility of doctoral students in Collaborative Research Centres and Research Training Groups, incoming researchers by country and duration and the outward mobility of the Fellowship programme (normally for two years) data are available. Data also exists for outgoing mobility by level (PhD, postdocs, researchers), by country and by duration. However, these programmes and related data are just a tiny fraction of the full mobility picture. There is a lot of mobility in all DFG programmes going on (incoming and outgoing) but there are no structured data on them. The existing data can illustrate only the main destination regions (table A7 above).

DNRF: For all programmes data counted in heads is available for incoming researchers. Data also exists for the different staff groups including senior/VIP, postdocs, PhD students and guest scientists. Data on funding is also available – with breakdown by DNRF, the host institution and other means.

FWO: Regarding the FWO data in table A6 above for regular postdoctoral fellows, it is important to notice that in 2011 18% of them were researchers from abroad. This percentage is still increasing, due to the new Pegasus fellowship programme, launched in 2011. By field of science the most attractive Flemish science field was so-called exact sciences (79), followed by biological sciences (27), all other fields have less than 20 visiting postdoctoral fellowships between 2005 and 2010. The visiting postdoctoral fellowship programme funded between 19 and 33 since 2005 (yearly average 25.5).

FNP: The data above concern the specific mobility programmes: *HOMING* and *HOMING PLUS* programmes are devoted to funding incoming mobility of postdocs and young researchers (79 researchers between 2008 and 2011). *WELCOME* programme is for incoming mobility of senior programmes (11 researchers 2008 and 2011). *KOOLUMB* programme is devoted to fund mobility from a national institution to an institution located abroad. Comment: It is impossible to identify the mobilities funded through general programmes (i.e., TEAM, International Doctoral Projects).

F6 Co-funded research output

Code	**F6** Indicator in development
Indicator	**Co-funded research output**
Use	Measuring the level of the *de facto* integration at European or international level of research funders, through activities of researchers who jointly decided to collaborate. This *de facto* brings the different funders together in a 'bottom up' way.
Measure	Internationally co-funded research (ICR) ICR = (number of internationally co-funded and internationally co-authored papers/number of all funded papers)
Type of breakdown	• By field of science • By year • By countries • By type of funders
Limitations in indicator production and constraints	1. We only use publications from Web of Knowledge, which results in coverage of only part of the output. Furthermore, we probably miss more national than international authored papers. The internationalisation may therefore be overestimated. For fields such as social sciences and humanities, the low coverage by the WoS is a problem. 2. Before 2011, not much information is available. In 2011, (roughly tested for some countries) about two-thirds of all publications have funder information. This is expected to increase even more, and may at a certain moment be rather complete. However, this needs to be tested. Data may be very biased between fields, countries and funding agencies. 3. Large disambiguation task. Funding organisations are mentioned with many different names. For example for the SNF more than 150 names are used. Furthermore, sometimes the acknowledgment is not of the FA but a specific funding instrument. However, for an FA's staff member, this may not be a huge task. 4. Time lag between funding and publications. So this year's publications reflect the funding from several years before. 5. Access to Web of Knowledge is needed. 6. We may go from papers to researchers, and measure the same indicators at that level. However, this requires a lot of author disambiguation work.

Indicator F6: **Co-funded research output**. Examples of data

SNF 2011: Of the 15,772 internationally co-authored papers with at least one Swiss address, some 3,348 got SNF funding and 4,452 got public funding from a non-Swiss funding agency. These two sets have overlap: some 1,249 were co-funded by SNF and one or more of the foreign public funders.

The appropriate indicator *internationally co-funded research* (ICR) is
ICR= (internationally co-funded papers and internationally co-authored / all funded papers)
This indicator lies between 0% and 100%. Applying this to the SNF data for 2011, we find the following ICR:
ICR = 1,249 / 5,608 = 22.3% (table A8).
However, if we again exclude EC and ESF funding from the analysis, the number of papers with international funding declines to 2,906, and the overlap with the SNF funded papers declines to 1,028. The resulting value for the IRC indicator is 18.3%.
Data were directly collected from WoS by the experts and were not discussed with SNF.

Table A8: **International co-funded output (Switzerland 2011)**

	SNF funded	International public funding	Co-funded (overlap)	International without EC	Co-funded without EC (overlap)
Internationally co-authored papers	3,348	4,452	1,249	2,906	1,028
All papers	5,608				
International co-funded research (ICR)			1,249 / 5,608 = 22.3%		1,028 / 5,608 = 18.3 %

F7 Evaluation procedure

Code	**F7** Mature indicator
Indicator	**Evaluation procedure**
Use	Internationalisation of peer review to enhance objectivity in selection process Benefits from experiences and perception of foreign panellists and reviewers
Measure	• Number of reviewers and panellists from abroad involved in ex-ante selection of research proposals* • Number of all reviewers and panellists involved in ex-ante selection of research proposals • % of reviewers and panellists from abroad
Type of breakdown	• By the country of the employing institution • By field of science (OECD 6 main fields) • By year
Limitations in indicator production and constraints	Some organisations have difficulties to have two separate counts (reviewers/panellists) partly because the same researchers are acting as reviewers and as panellists. Others may want to show that the ratios are very different for reviewers and for panellists.

Indicator F7: **Evaluation procedure**. Example of available data

Table A9: **Summary of available data for foreign reviewers and panellists**

	% of foreign reviewers and panellists							
	AKA 1	**DFG 2**	**DNRF 3**	**ESRC 4**	**FNP 5**	**FWF 6**	**RCN 7**	**SNF 8**
2006	85						78	
2007	91						80	
2008	94	14					86	
2009	95	15					83	
2010	96	16					86	77
2010+2011					35			
Average			100	10-15*		100		

*estimation

3. According to DNRF all panellists and reviewers are from abroad.

4. On a standard ESRC review panel it is usual to have between 10% and 15% of members drawn from outside of the UK. However, for certain calls where there is a significant international element to the research, such as the ESRC-DFID Joint Scheme on Poverty Alleviation, or the Rising Powers call (for research on the BRIC countries), there is generally a higher percentage of non-UK based reviewers (e.g., up to 40% depending on available expertise and fit to the research agenda of the call).

6. FWF rule is that all panellists and reviewers are from abroad.

7. Includes reviewers and panellists together (split not possible).

8. Only reviewers. Counts those invited (and not those who accepted). SNF only seldom works with panels. Most of the decisions are taken by the Research Council. Most of its members are based in Switzerland.

Table A10: **Data by field of science for DFG and FNP** (two different classifications for fields of science are used by these institutions)

% of foreign reviewers and panellists by FoS			
FoS for DFG	**DFG 2010**	**FoS for FNP**	**FNP 2010-2011**
Humanities and Social sciences	15.5	Humanities	28.1
		Social sciences	22.5
Natural sciences	20.5	Natural sciences	43.5
Life sciences	18.0	Medical sciences	55.6
		Agricultural sciences	20.4
Engineering sciences	6.5	Technology	20.1

Table A11: **Reviewers from abroad by country of origin for FWF and RCN**. For FWF, all reviewers have to be from abroad (but for some reviewers the nationality was not recorded: sum is less than 100%). For RCN the average of foreign reviewers and panellists during 2006-2010 is 82%.

Reviewers and panellists from abroad: % by country				
Country	**FWF 2008**	**FWF 2009**	**FWF 2010**	**RCN 2006-2010**
Austria	0	0	0	
Germany/Switzerland	24	21	19	
Remaining EU	29	33	33	
EU	**53**	**54**	**52**	**80**
Rest of the world	**9**	**9**	**10**	**6**

ESRC: In general, non-UK based reviewers are drawn from countries that historically have a close connection with the UK and where it could reasonably be expected that there would be an understanding of English (e.g., US, Canada, South Asia, Southern Africa, Australasia – including Australia, Hong Kong, Singapore – and Western Europe).

F8 Openness of programmes

Code	**F8** Blue sky indicator
Indicator	**Openness of programmes**
Use	Understanding the extent to which national programmes are open to funding people working abroad
Objective	Increasingly, funding organisations do also fund applicants not living and working in the home country of the funding organisation. A good example is the US National Institutes of Health (NIH), which has been opening up many programmes to non US applicants. Measuring the amount of resources that are spent abroad provides information about the international integration of the research funding system, which may be particularly relevant within the ERA, but also for policies fostering international scientific collaboration. This indicator should provide information on the progress of the country toward the European Research Area and integration of research activities at European level. It would also allow understanding of the extent to which national programmes are designed in order to favour processes of integration at international level.This is a new indicator that needs some work in order to be developed. Here a conceptualisation of openness of research programmes must be designed and applied at the national level in order to check how far the formal attribution of openness to national funding schemes foreseen by laws and regulations corresponds to the concrete reality of the scheme implementation.
Measure	Three different measures could be explored related to different steps in the funding process (from input to output): 1. Direct budgets that are going to researchers abroad would be the best indicator 2. Numbers of applicants from abroad would show how confident researchers are in the openness of the programmes 3. A third option is focusing on the publications that acknowledge the funding organisation of country A but which do not have an author with an address in country A. The indicator is defined as: • Number of papers funded by FA with no author from the country • Number of papers funded by FA • Share of papers with no author from the country among FA funded papers
Limitations in indicator production and constraints	Limitations for measure 3: • The meaning of this indicator needs further research, as the reason for funding researchers abroad needs to be clarified. • The share of papers is not necessarily equal to the share of money. • Not all papers yet have acknowledgments to funders, although it may be expected that this will increasingly be the case. • Disambiguation is a huge task, as very many names of FAs are being used, and sometimes the acknowledgment is not of the FA but the specific instrument. However, FA staff may easily recognise which names and programmes refer to the FA. • No author from country A may also be the effect of missing address data. This should be carefully checked. • This indicator does not cover contributions to, e.g., international research institutes abroad. Those data may be relatively easily available, although these contributions do not often go through FAs but more often direct through ministries of research.

Indicator F8: **Openness of programmes**. Example of available data

SNF 2011: For this indicator, data for the first two measures are not available. Experts collected data for the third measure directly from WoS. To test this method, a pilot investigation was achieved for one agency: SNF.

We retrieved all papers with acknowledgement to SNF in the database, published in 2011. In total, we found 6,252 articles, reviews, notes, letters and proceedings papers, and of these some 644 have no Swiss address. We checked whether these 644 papers did have an address at all. That is the case for 642 of the papers. In other words, the analysis is not influenced by 'missing values'.

The findings suggest that about 10.3% of the output produced with SNF funds is produced by foreigners and/or by Swiss researchers abroad. One should bear in mind that this may also be due to mobility of researchers, although if the grant was used in a Swiss university or research institution before moving, one would expect this organisation in the address. If we can disambiguate the funding agencies field in the Web of Knowledge adequately, this indicator of internationalisation can be produced.

This indicator provides relevant information. Therefore this attempt proved that it is worth developing the indicator further. As for F2 and F6, data were collected by the experts and not discussed with SNF.

Table A12: **Funding research abroad – SNF 2011**

	Number	%
All papers with SNF funding in 2011	6,252	100.0
All papers with SNF funding in 2011, at least one Swiss author	5,808	89.7
All papers with SNF funding in 2011, no Swiss author	644	10.3

P1 Budget coming from abroad

Code	**P1** Mature indicator
Indicator	**Budget coming from abroad**
Use	Measuring the capability to attract funding from non-national sources in terms of volume of funding and of type of sources attracted
Measure	• Financial resources coming from abroad • Total resources beyond the budget allocated by government • Total budget of the organisation
Type of breakdown	• By fields of science (OECD 6 main fields) • By country (including an item EU for EU funds) • By year

Indicator P1: **Budget coming from abroad**. Examples of available data

Table A13: **Share of external resources and resources coming from abroad**

	Inserm 2010	Inserm 2010	MPG 2010	MPG 2010	CNR 2010	CNR 2010	CNR 2011	CNR 2011
		%		%		%		%
Resources coming from abroad		**12%**	**54 M€**	**3.2%**	**44.5 M€**	**4.6%**	**43.8 M€**	**4.3%**
Europe		10%	54 M€	3.2%	39.3 M€	4%	37.6 M€	3.7%
International		2%	na	0%	5.2 M€	0.6%	6.2 M€	0.6%
Resources beyond government allocation	206 M€	27.74%	280 M€	16.5%	339 M€	35.1%	382 M€	37.5%
Total budget	742.6 M€	100%	1,692 M€	100%	996 M€	100%	1,019 M€	100%

P2 Budget coming from abroad: output generated

Code	**P2** Indicator in development
Indicator	**Budget coming from abroad: output generated**
Use	Measuring the capability to attract funding from non-national sources in terms of volume of funding and of type of sources attracted
Measure	• Number of papers acknowledging foreign funders, with only national authors • Percentage of these papers in total output of the organisation. The following funders can be distinguished: 1. Foreign companies 2. Other EU member states (government, agencies, foundations, universities) 3. EC (FW programmes, ERC) 4. International organisations (e.g., CERN) 5. Other countries – non-EU (government, agencies, foundations, universities) Papers selected should have no foreign co-author because foreign funding could be obtained by the foreign co-authors. Papers with national co-authors getting foreign funding are attributed to the organisation funds attracting ability, possibly through national collaboration.
Type of breakdown	• By funder type • By country (including an item EU for EU funds) • By year
Limitations in indicator production and constraints	1. We only use publications from Web of Knowledge, which results in a coverage of only part of the output. Furthermore, we probably miss more national than international authored papers. The internationalisation may therefore be overestimated. For fields such as social sciences and humanities, the low coverage by the WoS is a problem. 2. Before 2011, not much information is available. In 2011, (roughly tested for some countries) about two-thirds of all publications have funder information. This is expected to increase even more, and may at a certain moment be rather complete. However, this needs to be tested. Data may be very biased between fields, countries and funding agencies. 3. Large disambiguation task. Funding organisations are mentioned with many different names. As an example, for the SNF more than 150 names are used. Furthermore, sometimes the acknowledgment is not of the funding organisation but a specific funding instrument. 4. Time lag between funding and publications. So this year's publications reflect the funding from several years before. 5. Access to Web of Knowledge is needed. 6. We may go from papers to researchers, and measure the same indicators at that level. However, this requires a lot of author disambiguation work.

Indicator P2: **Budget coming from abroad: output generated**. Examples of data

Data were directly collected from WoS by the experts.

As an example, we take the University of Bern, including the Bern University Hospital. In 2011, this RPO published 2,185 papers, of which 734 have only Swiss authors. Acknowledgements to public and non-for-profit (charities, foundations) international funding agencies are in total in 436 papers. Quite a few of these papers have international co-authors, which may have brought the international funding into the paper. Therefore we consider as research (output) based on incoming funds only those papers that (i) mention international funders, and (ii) have only Swiss authors: 70 papers.

The majority of this is EC funding, through Framework Programmes and through the European Commission: 50 papers. If we exclude the papers with only EC funding, 26 papers remain. As a conclusion, only 3.5% of the 734 Bern University papers with only Swiss authors acknowledge international (non EC) funding.

Table A14: **Incoming funding (University Bern 2011)**

	Only international funding	Only EC funding	Other international funding
All papers (2,185)	436	233	259
National authored papers (734)	70	50	26
			26/734 = 3.5%

P3 International co-authored papers

Code	**P3** Mature indicator
Indicator	**International co-authored papers**
Use	Measures the level and growth of international collaboration of the RPO
Measure	Share of papers with international co-authors
Type of breakdown	• By 112 Web of Knowledge disciplines • By 240 Web of Science subject areas • By the collaborating countries • By year
Limitations in indicator production and constraints	• Not all cooperation leads to co-authoring, and that holds also for international cooperation. Co-authoring is only one specific form of international cooperation. • Disambiguation of authors' and institutes' names included in databases is a time consuming activity, but RPOs may have fewer problems recognising their own staff and output. • The indicator is generally derived from bibliographic databases such as Web of Knowledge, Scopus, and covers therefore only part of all output. The part covered differs between fields, and is rather small in some fields – making the indicator for those fields probably very biased. • Integer counts are preferred to fractional counts when calculating the indicator per collaborating country, as we aim to count the number of international collaborations and a link becomes not of less value if more countries are authoring a paper.

Indicator P3: **International co-authored papers**. Example of available data

INRA and Inserm: Data available from WoS and regularly displayed by the INRA and Inserm bibliometric services. ISI database used. Tables were provided by MOs.

Table A15: **International co-authored papers (INRA, Inserm, MPG)**

	INRA			Inserm		MPG	
	2001	**2005**	**2010**	**2005**	**2010**	**2005**	**2008**
Number of internationally co-signed papers (integer counts)	872	1243	1,683	2,237	3,733		
Total number of papers	2,564	3,151	3,767	5,835	8,439		
% internationally co-signed	**34%**	**39%**	**45%**	**38.3%**	**44.2%**	**65.3%**	**65.8%**
Number of foreign addresses	1,646	2,676	4,905				
Total number of addresses	6,150	8,639	14,087				
% foreign addresses	**26.7%**	**31.0%**	**34.8%**				

Table A16: **Papers with co-authors by country: % among internationally co-authored papers and country rank**
(20 first countries for Inserm and INRA, 12 first countries for CSIC)

	Inserm %	**INRA %**	**CSIC %**	**Inserm Country rank**	**INRA Country rank**	**CSIC Country Rank**
	2005-2011	2007-2010	2010-2011	2005-2011	2007-2010	2010-2011
USA	30.0	17.8	14.5	1	1	1
UK	21.7	14.6	9.2	2	2	4
Germany	17	12.4	10.6	3	3	3
Italy	13.2	9.5	8.8	4	5	5
Canada	10.1	6.8	3.5	5	9	9
Switzerland	9.1	7.2	4.4	6	7	6
The Netherlands	9.1	6.9	4.2	7	8	7
Spain	9.0	10	--	8	4	--
Belgium	8.8	7.3	na	9	6	>12
Sweden	6.1	4.5	3.1	10	11	11
Australia	4.6	4.9	na	11	10	>12
Japan	4.4	2.6	3.0	12	16	12
Denmark	3.8	3.6	na	13	13	>12
Austria	2.9	2.4	na	14	19	>12
China	2.7	3.5	na	15	14	>12
Greece	2.6	1.3	na	16	>20	>12
Finland	2.5	2.3	na	17	20	>12
Norway	2.4	2.0	na	18	>20	>12
Brazil	2.3	4.0	na	20	12	>12
Poland	1.8	2.4	na	>20	18	>12

Table A16 (cont.)

	Inserm %	INRA %	CSIC %	Inserm Country rank	INRA Country rank	CSIC Country Rank
	2005-2011	2007-2010	2010-2011	2005-2011	2007-2010	2010-2011
Portugal	1.7	1.9	3.9	>20	>20	8
Czech Republic	1.7	2.4	na	>20	17	>12
Tunisia	1.5	3.5	na	>20	15	>12
France	--	--	11.7	--	--	2
Russia	1.0	1.0	3.2	>20	>20	10

P4 Recruitment of researchers from abroad

Code	**P4** Mature indicator
Indicator	**Recruitment of researchers from abroad**
Objective	Attract talent to the organisations to add external knowledge to the organisations' human resources and attractiveness of the organisation.
Use	The inward mobility indicator measures the additional resources and changing attractiveness of an organisation over time. This is a flow indicator measuring fresh inflow in the investigated period
Measure	• Number of researchers recruited from abroad • Total number of researchers recruited by the organisation (denominator)
Type of breakdown	• By type: permanent, non-permanent positions • By field of science (OECD 6 main fields) • By country where they previously worked • By year
Limitations in indicator production and constraints	The choice is to consider researchers coming (possibly back) from abroad instead of non-national researchers*. Presently data are more often recorded by nationality. For junior recruitment, the place where PhD was prepared is also informative**. Recruitment of PhD candidates employed by the organisation is also considered in this indicator (the general case is recruitment by a University). For permanent researchers, breaking down by position may be relevant, but the definition of the different levels is not common to all organisations.

*This issue is discussed in the report for EC-DGR by Deloitte, *Monitor human resources policies and practices in research. List of indicators*. Deloitte, July 2011.

**As pointed out by the ESF MO Forum on European Alliance for Career Development, career tracking is an important issue and deserves methodological development and a joint European initiative and platform promoting career tracking studies. *Joint ESF-FNR Workshop How to track Researchers' Careers, 9-10 February 2012 – Luxembourg.*

Indicator P4: **Recruitment of researchers from abroad**. Examples of available data

Table A17: **Summary of available data on recruitment of researchers from abroad**

% of recruited staff coming from abroad (if not otherwise indicated)								
MO	INFN		Inserm		MPG		INRA	
Staff status	Temporary 1	Permanent 2	Temporary 3	Permanent 4	Temporary 5	Permanent 6	Temporary 7	Permanent 8
2007	14.4				59.1	63.6	na	6.4
2008	12.3				76.0	63.2	na	14.6
2009	12.8				76.9	46.1	na	15.7
2010	15.6		36	25	51.6	60.0	na	6.6
2011					77.8	50.0	na	15.5
2006-2011		10.7						
2007-2011					68.3	56.6		

1. Temporary staff without postdocs and PhD students, figures given by nationality and not by country of origin.

2. INFN: Over 2006-2011, 10.7% of recruited permanent researchers were foreigners (8.6 for entry positions and 50 for senior positions).

5, 6. MPG: Data only for Max Planck Institute Directors (permanent positions) and Research Group Leaders (non-permanent). Both of these two groups of scientists represent only a minor part of all researchers at Max Planck Institutes. Concerning the whole staff, as of 1 January 2011, 16.4% of all of the MPG employees and 33.1% of all MPG researchers were foreign nationals and as of 1 January 2012, 17.3% of all of the MPG employees and 34.8% of all MPG researchers were foreign nationals. 2012, 17.3% of all of the MPG employees and 34.8% of all MPG researchers were foreign nationals.

8. INRA: Data for non-permanent are not available. For permanent researchers, data are available by nationality. They are very versatile. Between 2004 and 2011, 8% to 21% for permanent junior recruitment: 2% to 13% for permanent senior recruitment. Data by country of origin will be available from 2011 on. FoS not immediately available because of multidisciplinary character of several departments.

Table A18: **Permanent staff recruited from abroad (or with foreign nationality), by country: Inserm and INRA researchers, MPG Institute directors**

Country	Inserm recruited in 2010	INRA recruited in 2011	MPG present March 2011*	
	by nationality	by nationality	by nationality	by country of origin
Austria	1		6	5
Belgium	1	1	2	
Denmark			4	5
France	--	--	1	2
Germany	4	3	--	--
Greece	3	1	1	
Italy	4	2	4	1
The Netherlands			9	9
Romania	1			
Spain	1	1	1	
Sweden			6	3
Switzerland	1		7	9
UK	1	1	13	20
Other Europe			6	
Total Europe	17	9	60	54
USA	1	2	20	52
Russia		1	1	1
Africa	1	1		
China/Japan	1	1	1	1
Other outside Europe			6	3
Total foreigners	**20**	**15**	**88**	**111**
Total foreigners and national	**79**	**97**	**277**	**277**

*MPG data are for the whole staff of Institute Directors as on 31 March 2011 (and not the newly recruited staff as for Inserm and INRA)

In this table, empty cells stand for 0, -- means that a figure is not relevant

P5 International Mobility

Code	**P5** Indicator in development
Indicator	**International Mobility**
Objective	Brain circulation is important in the age of globalisation. Organisations are encouraging their own researchers to spend time working abroad and to return. Another important aim is to draw talent to the organisations to add external knowledge to the existing human resources.
Use	The inward mobility indicator measures the additional resources and changing attractiveness of an organisation over time. This is a flow indicator measuring fresh inflow in the investigated period.
Measure	• Number of researchers from an organisation abroad who came to the organisation • Number of inflow researchers to total researchers at the organisation • Number of researchers from the organisation who went to a foreign or an international organisation • Number of outflow researchers to total researchers at the organisation • Rate of circulation: inflow mobility compared to outflow mobility
Type of breakdown	• By field of science (OECD 6 main fields) • By country of origin/destination • By type of mobility i) temporary mobility (two weeks to three months), ii) mobility (three months and more) • By status (permanent, PhD candidates, postdoc or junior, senior) • By year
Limitations in indicator production and constraints	Breakdown by duration with a threshold at three months is consistent with other work*. There is a need to improve the classification of mobile researchers for the development of this indicator. Another issue is about virtual mobility. Virtual mobility is a new challenge for measurement. For outgoing mobility, only those who are still paid by the organisation will be known (e.g., researchers leaving will be missed from the counting). International organisations (such as EU joint research centres, European Space Agency) may be located either in the country or abroad. In any case the research environment is different from the national one. How international organisations have integrated in the host country research community takes us far from the mobility issue. No data is available from MOs for the time being.

*Report for EC-DGR, *Monitor human resources policies and practices in research, List of indicators*. Deloitte, July 2011

P6 Budget for Joint research programmes or projects

Code	**P6** Indicator in development
Indicator	**Budget for Joint research programmes or projects (JRP and JRPj)**
Use	Measuring the level of integration at European or international level of research performers, which jointly decided to plan and to manage programmes and/or projects where one or more functions are shared (e.g., determination of research objectives, funding rules, evaluation procedures, reporting rules, dissemination of results)
Objective	This is an important issue about the coordination of the research system. As FAs, RPOs can play a role in shaping the environment through design and management of bilateral or transnational programmes. This is more naturally the case in certain disciplines when the research arena is not a national one.
Measure	• Financial resources allocated for JRP • Total resources beyond the budget allocated by government • Total budget of the organisation
Type of breakdown	• By field of science (OECD 6 main fields) • By year
Limitations in indicator production and constraints	The objective of this indicator is to identify the budget that the organisation allows to joint programmes. In general, foreign partners have a financial contribution to these projects but not always (e.g., programmes for development). In any case, these external contributions are not included in the measure for the indicator but only the resources taken from the organisation (initial) budget. Therefore these resources have to be identified at the decision step, not when resources are distributed to units (which may be of mixed origin). The issue of *marginal* versus *total* costs is tricky. Full costs are preferred. But this relies on information which is (at least presently) much more difficult to collect. There is an issue about joint projects such as FP projects or projects in programmes managed by a funding agency, which are not at the initiative of the performing organisation. They should not be included in the measure for this indicator. On the contrary, projects like JPI, ERA-NET, KIK should be included.

Indicator P6: **Budget for Joint research programmes or projects (JRP and JRPj).** Examples of data

MPG: Data (i.e., marginal expenditures or budgets, not total costs) are only available for the so-called 'strategic measures' in the framework of the internationalisation strategy of MPG (e.g., Partner Groups, International Max Planck Centres, LEAs/GDREs with CNRS, etc.). These measures account only for a minor part of the complete entity of international activities.

INRA: Full costs are only available for European projects (when contracts are closed, a justification of INRA salaries and other charges has to be done). Some specific INRA research programmes (so-called *metaprogrammes*) have a specific part of their budget allocated to international collaboration.

P7 International use of own infrastructures

Code	**P7** Blue sky indicator
Indicator	**International use of own infrastructures**
Use	Monitoring the international use of infrastructures
Objective	Monitoring the openness of national research infrastructures. Monitoring EC policy with respect to the development and use of top research infrastructures in Europe (ESFRI).
Measure	A possible measure could be • Number of foreign visitors to the infrastructure • Number of days spent by visitors
Type of breakdown	The indicator should be broken down by (i) field of research, (ii) countries of origin of the visitors
Open issues	Problem is that an overview of all research infrastructures (RI) does not exist, also not on the national level. The measure has to be adapted for each type of infrastructure, therefore a classification of RI would be useful. Examples of RI are given on the EU site ec.europa.eu/research/infrastructures as well as a classification related to location: single-sited, distributed, virtual. *"Examples include singular large-scale research installations, collections, special habitats, libraries, databases, biological archives, clean rooms, integrated arrays of small research installations, high-capacity/high-speed communication networks, highly distributed capacity and capability computing facilities, data infrastructure, research vessels, satellite and aircraft observation facilities, coastal observatories, telescopes, synchrotrons and accelerators, networks of computing facilities, as well as infrastructural centres of competence which provide a service for the wider research community based on an assembly of techniques and know-how."*

Indicator P7: **International use of own infrastructures**. Example of data

INFN: The main indicator which can easily be shared by other institutions is the fraction of colleagues who come to exploit these facilities and ask for their usage. The following table summarises the last four years. National Laboratories are LNF: Frascati, LNL: Legnaro, LNGS: Gran Sasso, LNS: South, close to Catania.

Table A19: **Number of users, total and % of and foreign users at INFN Laboratories**

	Total number of users				% of foreign users			
	2007	2008	2009	2010	2007	2008	2009	2010
LNF	561	570	439	460	39%	39%	43%	47%
LNL	809	804	904	1,022	30%	34%	30%	33%
LNGS	846	867	883	862	59%	64%	62%	64%
LNS	198	240	365	504	41%	43%	32%	34%

P8 Recruitment committees

Code	**P8** Indicator in development
Indicator	**Recruitment committees**
Use	Measuring international participation in the process of recruiting researchers
Measure	• Number of members in the recruitment committees who are working abroad • Total number of members in the recruitment committees (denominator)
Type of breakdown	• By type (four types: permanent/PhD candidates/postdoc/other non- permanent) • By field of science (OECD 6 main fields) • By country of origin • By year
Limitations in indicator production and constraints	The indicator counts committee members working abroad instead of committee members with a foreign nationality. Therefore, local foreigners are not counted. For permanent position recruitment committees, there are often legal rules about panel composition (Italy, France, Spain). For instance, at INRA, at least 50% of members have to be from the staff of the organisation. For permanent researchers, breaking down by position may be relevant, but the definition of the different levels (recruited by each committee) is not common to all organisations. For the moment, we decided to merge the different levels for permanent staff recruitment.

Indicator P8: **Recruitment committees**. Examples of data

Table A20: **Summary of available data on recruitment committees**

% of members from abroad	INFN 1	INRA 2	Inserm 3
Committees for permanent positions	0	1.8	0
Committees for non-permanent positions (reviewers)	0	(no reviewers)	100
Committees for non-permanent positions (panellists)	0	not available	38

1. INFN: No members from abroad in recruitment committees.

2. INRA: (2011) Information only available for permanent positions. For junior positions, 5% are foreign members but many of them are working in France. Only 1.8% come from abroad. For senior recruitment 1.7% are foreign, 1.7% are not working in France. Countries of origin in 2011: Belgium, UK, Tunisia, Sweden.

3. Inserm: For permanent recruitments, all members are living in France. Among 246 committee members, 13 (0.5%) are local foreigners (data are available by nationality and detailed by field of science). For non-permanent recruitment (ATIP-AVENIR programme) 100% of the reviewers and 38% of the panellists are researchers from abroad.

Comments on data availability

CSIC: The evaluation panels for permanent positions and for JAE programmes are normally composed of permanent staff and often also staff from universities. This means that a percentage of foreigners can be expected equivalent to the percentage of permanent staff at the institutes, which is very low: 3.45%. It cannot be verified, since there is no record of all the panels working at the institutes at all times. These foreigners are therefore normally working in Spain.

MPG: Data on committee members is confidential.

P9 Evaluation procedure

Code	**P9** Mature indicator
Indicator	**Evaluation: Panellists from abroad involved in ex-post research evaluation**
Use	Internationalisation of peer review to enhance objectivity in ex-post evaluation process. Benefits from experiences and perception of foreign panellists in order to enhance the international perspective of the research agenda
Measure	• Number of panellists (and reviewers when relevant) from abroad involved in ex-post evaluation • Total number of panellists and reviewers when relevant - involved in ex-post evaluation (denominator)
Type of breakdown	• By level of evaluation: persons, research units or divisions, whole organisation • By field of science (OECD 6 main fields) • By country of the institution they are employed by • By year
Limitations in indicator production and constraints	The choice was to consider panellists working abroad and therefore leave out foreign panellists working in the country. For staff evaluation, there may be legal rules on panel composition. For instance, in France, at least 50% of members have to be from the organisation staff.

Indicator P9: **Evaluation procedure**. Examples of data

INRA: The evaluation of the 14 research divisions (evaluated every four to five years) is operated by the direction board under the control of the Scientific Council (data below). Documents and working language is English.

Evaluation of individual researchers: for 244 members of the panels, only 7 have foreign addresses (2.9%): 2 for the Agricultural Sciences panel, 3 for the Environmental Sciences panel, 1 in the Genetics panel and 1 in the Social Sciences panel. These are from Laos, Brazil, Madagascar, Kenya, Sweden and Belgium (2).
Comment: These evaluations are routine assessments of the activity of the scientific staff. Documents and working language is French. By law, at least 1/2 of the members are INRA staff. This explains the low percentage of experts from abroad. As the French community in agricultural research (including environmental issues related to agriculture) mainly works at INRA, and as the worldwide issues on agriculture are important in INRA scientific policy, there is a need to associate experts working abroad in the two corresponding panels.

Table A21: **Panellists for the evaluation of INRA research divisions (2002-2009)**

Number of panellists from abroad						
Country	**Fields of science**					
	Natural sciences	Engineering/ Technology	Medical sciences/Health	Agricultural sciences	Social sciences	Total by country
Belgium	6	1		2	1	10
Denmark	3			2		5
Finland	1					1
Germany	5			1		6
Italy	3		1	1		5
The Netherlands	8		2	2	1	13
Poland	1					1
Portugal				1		1
Spain	4					4
Sweden	2					2
Switzerland	3	1		2		6
UK	11	2	2	2		17
Europe	47	4	5	13	2	71
USA	11		2		1	14
Canada	3	2		2		7
Israel	1					1
Australia	9			1		10
South Africa				1		1
Asia	1					1
South America				1	1	2
Total from abroad	72	6	7	18	4	**107**
Total panels	124	11	12	38	10	**195**
%	58	55	58	47	40	**55**

Table A21 (cont.)

MPG: Comprehensive quality assurance is an essential element of the high-trust principle practised by the Max Planck Society. This is why the Society established an effective system of Scientific Advisory Boards. Every two years, a researcher's work is subject to critical assessment from internationally outstanding and independent colleagues within the relevant specialist discipline. The members of these Scientific Advisory Boards are both assessors and advisors to the researcher being evaluated. There are around 756 highly qualified Max Planck Institute Scientific Advisory Board members in total: between 5 and 15 per Max Planck Institute, depending on size and subject.

Table A22: **Panellists for the evaluation of Max Planck Institutes**

MPG Scientific Advisory Board members (total approx. 756)			
Section	Chemistry, Physics and Technology	Biology and Medicine	Humanities
% of Scientific Advisory Board members from abroad	79	85	73

Table A23: **CSIC Panels for evaluation of the progress of the strategic plan**

Scientific area	Number of evaluators	% Spanish	% foreign
Human and social sciences	26	15	85
Biology and biomedicine	25	16	84
Natural Resources	21	14	86
Agricultural sciences	16	13	88
Physical science and technology	23	9	91
Materials science and technology	13	23	77
Food science and technology	6	17	83
Chemical science and technology	11	9	91
Total	**141**	**14**	**86**

INFN: Panel for the evaluation of the organisation: 5/7 are from abroad

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