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EUROPEAN RESEARCH AREA FACTS AND FIGURES 2014

Accompanying the document

COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT

European Research Area Progress Report 2014

{COM(2014) 575 final}

Facts and Figures accompanying the ERA Progress Report 2014

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1. INTRODUCTION AND PRELIMINARY REMARKS

The Commission has developed the ERA Monitoring Mechanism (EMM) with the objective of assessing progress in the compliance of ERA at three different but interrelated levels: national and regional policies, funders and research performing organisations (RPOs).

This report presents progress observed in Member States in terms of adoption of measures in support of ERA[1]. In collaboration with Member States and some Associated Countries[2], the Commission identified new measures and updated the contents of last year's state of play.

It also presents - for the first time and based on results from the ERA survey 2014[3] - the state of play in terms of support provided by funders (RFOs) for the adoption of ERA measures as well as the implementation of ERA in the different research performing organisations (RPO).

For the funders' level, there are no official sources of information on ERA implementation, which motivated the Commission to launch the first ERA survey in 2012. The responses to the first exercise were not sufficiently representative. Member States suggested fine-tuning the indicators for the purpose of this exercise. Therefore, the indicators to use and the questionnaire of the ERA survey 2014 have been discussed and agreed with Member States which participate in the European Research Area Committee (ERAC) ad hoc group on the EU semester and ERA monitoring[4]. Strong support by national authorities motivated many funders to answer the survey.

For the RPO level most information on ERA implementation did not exist in official statistical sources. The first ERA survey in 2012 raised a great deal of interest. However, the questionnaire was too long and gathered too much information which turned out not to be necessary to estimate ERA implementation. Therefore, the indicators to use and the questionnaire to employ have also been discussed and agreed with Member States which participate in the ERAC ad hoc group on the EU semester and ERA monitoring[4]. The ERA survey 2014 received a similar number of responses as in the 2012 exercise.

[1] The identification of new measures undertaken by Member States was based on the analysis of the 2014 National Reform Programmes and also on information provided by the Joint Research Centre, notably the specific analysis of the implementation at national level of the ERA Communication priorities carried out with the support of independent national experts.

[2] It concerns those Associated Countries which indicated their willingness to participate in the exercise at the Commission's invitation.

[3] There is no register of public funders or of research performing organisations in ERA. With the help of national authorities Commission services developed a list of around 600 public funders and around 8,500 research performing organisations which were invited to participate in the ERA survey 2014. The organisations were requested to provide the information on a voluntary basis. This implies that the results are biased, as they correspond **only** to the situation in those institutions which answered the survey and not the overall situation in each Member State.

[4] See annex 5.1

The results presented in the report provide an indication of the situation **only** among those institutions which responded to the survey[5], which include funders which manage 34% of total GBAORD in the EU, and performers which employ 32% of total staff and 20% of researchers in RPOs. The constituency in the survey gathers 20% of the most important RPOs as identified by Member States[6].

All indicators have been estimated weighting the answers provided by the organisations. In the case of funders, the answers were weighted by the total funding managed by the responding funders institutions, in comparison with the total funding handled at national or EU level. In the case of RPOs, the results were weighted by the number of researchers (headcount) in the institutions and compared with the total number of researchers in the responding organisations (at national or EU level).

Throughout the analysis it will be shown that the level of ERA implementation varies across countries, reflecting the national situations and contexts. To classify the countries two criteria were used. The first is the existence of specific measures in support of ERA as identified by Commission services. The second is the level of implementation by funders and/or RPOs in comparison with the EU average. In the absence of targets or identified desirable levels of implementation, it is difficult to identify and assess an adequate level of ERA implementation for each of the actions. Whenever meaningful, the degree of support and the implementation are compared with the average observed at EU level. The use of the EU average does not imply that it should be considered to target a desirable level of implementation. On this basis, four (or in some cases five) possible groups could be identified (see Table 1).

Table 1: Classification of countries according to ERA policies and implementation of the ERA actions

<table>
<tr><th></th><th>Specific measures in support of ERA</th><th>No specific measures in support of ERA</th></tr>
<tr><td>Implementation above EU average</td><td>Top-down ERA proactive</td><td>Bottom-up ERA proactive</td></tr>
<tr><td rowspan="2">Implementation below EU average</td><td rowspan="2">Limited implementation by stakeholders</td><td>Limited measures and limited implementation</td></tr>
<tr><td>Limited measures and no implementation</td></tr>
</table>

It should be noted that the EU averages are influenced by the high response rate by German institutions and the low responses by UK RPOs. They influence the average in both directions: upwards in situations where the country's institutions are very advanced

[5] The use of "micro" data for the identification of ERA implementation and possibly policy assessment appears to be extremely interesting. However, the limited response rate restrains the scope of the results. In future similar exercises Member States and the Commission need to continue interacting to identify possible ways to further motivate the national organisations to participate in the exercise.

[6] Member States were requested to identify among the full list of organisations the most important research performers in their countries. This information was matched with the respondents to the survey.

in the implementation of ERA, and downwards on a few other issues for which the level of implementation by German institutions is low.

Finally, it should be noted that the results have to be analysed and used with care by Member States and the Commission. Responding organisations did not provide any answer for a number of questions, which requires further analysis to explain this lack of responsiveness. Therefore, Member States are invited to check the scope of the results with their constituency when identifying their national policy priorities.

Nevertheless, it is expected that the results included in this report which accompanies the recently adopted Commission's Communication 'Research and innovation as sources of renewed growth' will help Member States and Stakeholders in identifying areas where more effort is needed on ERA implementation.

2. WHY ERA?

- *Compliance to ERA differentiates RPOs and also research performance.*
- *ERA compliant organisations produce more patent applications and publications by researcher.*
- *ERA related reforms are still needed, even among ERA compliant organisations, and in some countries, the importance of organisations in the limited compliance to ERA clusters calls for serious attention by the authorities.*

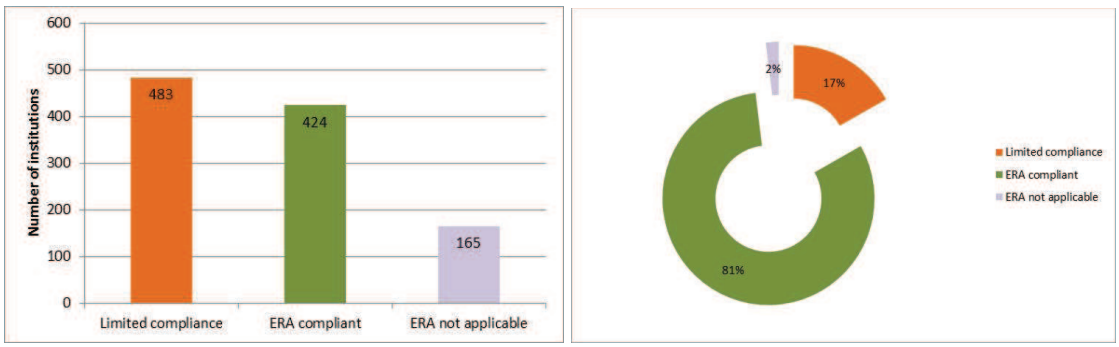
Statistical analysis[7] of the responses to the ERA survey 2014 indicates that three types of organisations can be singled out according to their compliance to ERA:

- **ERA compliant**: organisations which are implementing some or all of the ERA actions with high intensity.
- **Limited compliance to ERA**: organisations which are implementing some of the ERA actions with low intensity.
- **ERA not applicable**: organisations in which research is a minor activity or in which the implementation of the ERA actions is not compatible with their mandate.

In terms of number of organisations, the second cluster, Limited compliance to ERA, is the largest. However, the importance of the clusters varies significantly when the number of institutions is weighted by the number of researchers. Then the cluster ERA compliant becomes the largest, gathering 81% of the researchers (see Graph 1)

Graph 1: Number of institutions (left) and share of institutions weighted by number of researchers (right) in each ERA cluster, 2013

[7] The methodology to identify the clusters is presented in annex



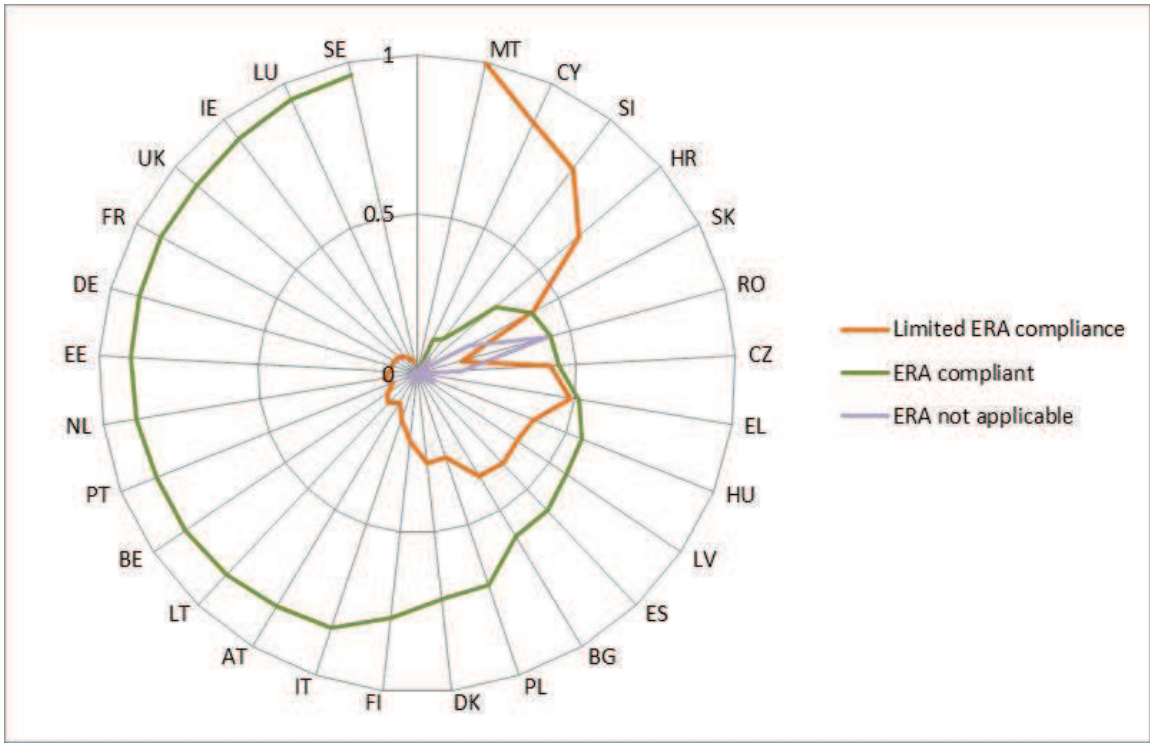
Source: ERA survey 2014

NB: International organisations are not considered in the graph.

It should be mentioned that these figures concern research performing organisations which answered the ERA survey in 2014, which employ 515,000 researchers (around 20% of total EU researchers employed in the private and public sector).

As shown below, the importance of the clusters (weighted) varies between countries. According to the ERA survey results, in MT, CY, SI and HR, most of the organisations are in the 'Limited compliance' cluster. In CZ, EL and SK the share of organisations is similar in the clusters 'Limited compliance' and 'ERA compliant' (see Graph 2).

Graph 2: Share of RPOs (weighted) by cluster of ERA compliance, 2013

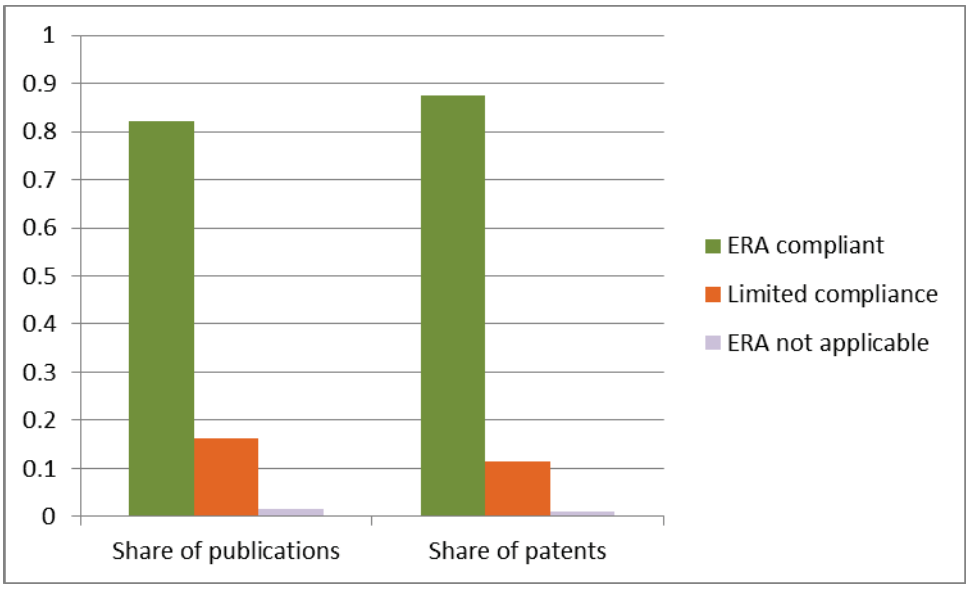


Source: ERA survey 2014

According to the ERA survey 2014 results, a higher the share of publications and a higher the number of patent applications are observed in the ERA compliance cluster in the sample. This result is due not only to the higher number of researchers in the cluster,

but also because researchers in this cluster are respectively 15% and 50% more productive on publications[8] and patent applications than in the cluster Limited compliance to ERA (see Graph 3).

Graph 3: Outputs by RPOs according to their cluster of ERA compliance, 2013



Source: ERA survey 2014

A positive correlation is also observed between national performance indicators and the share of organisations in the ERA compliance group identified through the ERA survey, while it is negative for the other two clusters. This correlation compares the share of RPOs (weighted) with three indicators of performance at national level: the first is scientific and technological research excellence[9], which can be defined as the top-end quality outcome of systematically performed creative work undertaken to increase the stock of knowledge and new applications; the second is the Innovation index, as presented in the Innovation Union scoreboard 2014[10], and the third is the Innovation output indicator[11] (see Table 2).

[8] This figure reflects the number of publications by researcher, excluding the outliers (institutions with more than 5 publications by researcher) in the sample.

[9] The top-quality output of scientific and technological research activities at the national level is measured considering four variables: (i) a field-normalised number of highly cited publications of a country as measured by the top 10% most cited publications (in all disciplines) per total number of publications (HICIT); (ii) the number of high quality patent applications of a country as measured by the number of patent applications filed under the Patent Cooperation Treaty (PCT) per million inhabitants (PCTPAT); (iii) the number of world class universities and research institutes in a country as measured by the number of organisations of a country in the top 250 universities and 50 research institutes divided by gross expenditures in R&D of a country per (TOPINST); and (iv) the number of high prestige research grants received by a country as measured by the total value of European Research Council grants received divided by public R&D expenditures of a country (ERC). For details see Hardeman et al., 2013.

[10] http://ec.europa.eu/enterprise/policies/innovation/policy/innovation-scoreboard/index_en.htm

[11] http://ec.europa.eu/research/press/2013/pdf/staff_working_document_indicator_of_innovation_output.pdf

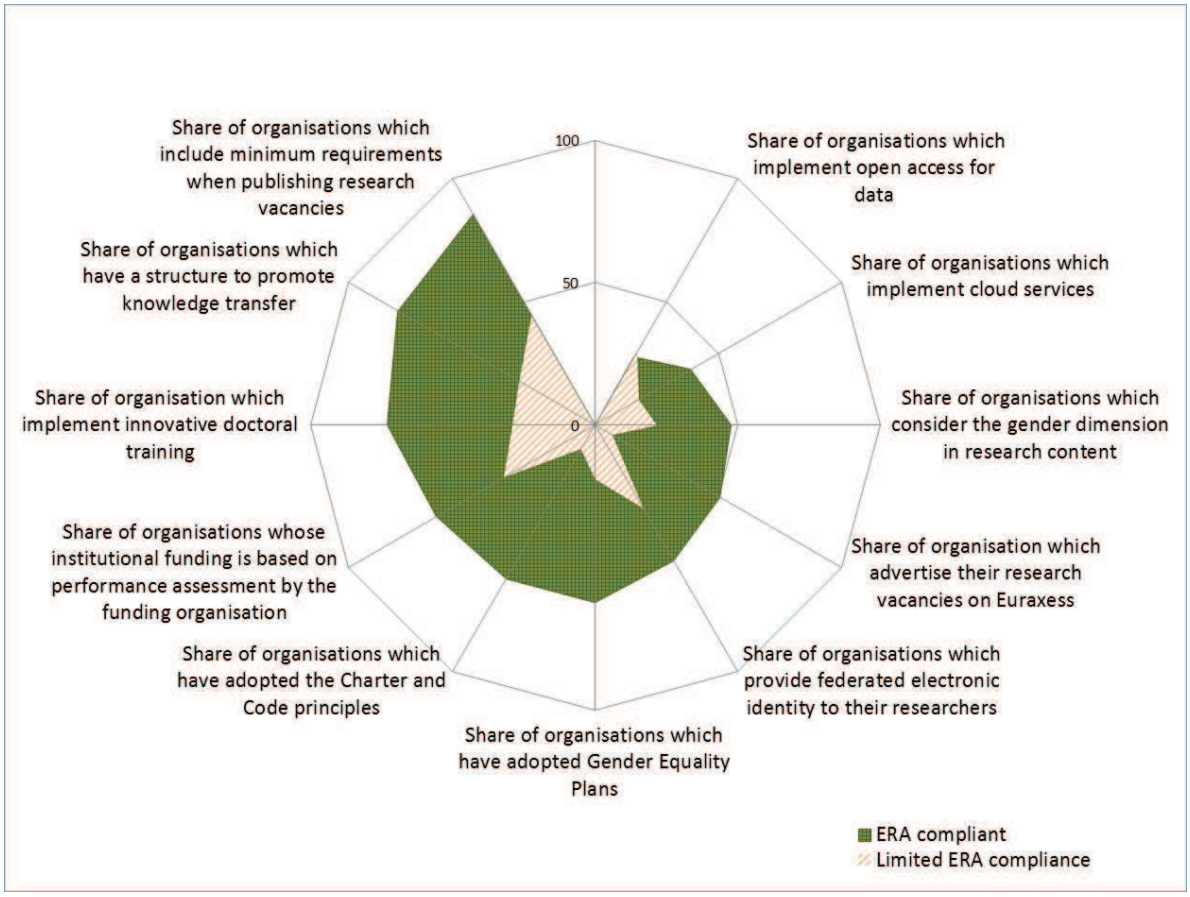
Table 2: Correlations between the share of RPOs (weighted) (2013) with three indicators of performance

	Research Excellence		Innovation Performance		Innovation output indicator	
	Number	Weighted	Number	Weighted	Number	Weighted
ERA compliant	19%	52%	21%	52%	21%	42%
Limited ERA compliant	-24%	-43%	-21%	-42%	-30%	-38%
ERA not applicable	-2%	-35%	-7%	-40%	1%	-21%

Source: Innovation scoreboard, ECFIN, ERA survey 2014

The implementation, as well as the intensity of implementation (i.e. frequently vs. occasionally) of ERA actions, is not homogeneous within the groups. As observed in Graph 4 according to the ERA survey 2014, even in the ERA compliant cluster the share of institutions implementing the different ERA actions is not close to 100%. For example, only 50% of the organisations in this cluster frequently advertise their vacancies in EURAXESS.

Graph 4: Share of organisations within each cluster implementing some of the ERA actions (according to their ERA compliance), 2013



Source: ERA survey 2014

More detail on the situation in each country is presented in the Country fiches annexed to this document, including the share of organisations in each cluster. They also include the comparison of the results at country and EU level for the ERA compliant cluster.

3. ERA PRIORITIES

3.1. Effectiveness of national research systems.

- *Guidance through national R&I strategies is present in almost all countries.*
- *Differences in R&I funding remain.*
- *The importance of competitive funding through calls for proposals is difficult to identify. Institutional funding based on institutional assessment is not broadly used by Member States. However, survey results show that the latter is associated with better performance by researchers in RPOs.*

Improving the effectiveness of national research systems is an important priority in ERA. Competition to access public funding is an important factor linked with effectiveness. Before presenting the state of play on the allocation mechanisms at national level, the

next sections present a brief update on national R&I strategies and the related public funding.

3.1.1. National strategies for R&I

R&I strategies are important as they present the priorities of national and/or regional authorities in these fields. The Commission could identify that all Member States with the exception of Portugal have adopted a national strategy for R&I. In IT, MT, RO and SK the strategies have been adopted/adapted since 2013. There are specific mentions to all or some of the ERA priorities in the strategies of AT, DE, ES, FI, HU, IT, LU, MT, RO, SE, SI, SK and the UK.

For its part, the Commission launched the Smart Specialisation Platform (S3 Platform) in 2012 to support EU countries and regions in the preparation and development of their smart specialisation strategies, facilitating mutual learning and sharing of tools, techniques and practice through a genuine bottom-up approach. By the end of June 2014, more than 150 EU regions and 15 EU countries had registered on the Platform and the vast majority have participated in at least one mutual learning or sharing workshop. In particular, the S3 Platform has developed its own peer-review methodology, which allowed around 60 EU regions and countries to submit their smart specialisation strategy to their peers and experts, receive feedback and decide on the appropriate follow-up action to take. This has been the most comprehensive mutual learning support tool ever launched by the Commission on regional R&I strategies, and proved to be well received by the stakeholders. A more thematic approach was launched in 2013, first via the establishment of the Eye@RIS3, an on-line publicly accessible mapping tool, which gathers the R&I priorities declared by regions and countries in their smart specialisation strategies, and second via the organisation of specific workshops/events around 'common issues' raised by regional or national policy-makers (e.g. the involvement of universities and science parks, the discussion of common priorities, the role of key enabling technologies etc.).

Also, the Commission organised and funded 15 expert groups which visited EE, LT, LV, SK, SI, HU, RO, BG, PL, CZ, EL, ES and PT in order to help local authorities responsible for R&I in preparing their Smart Specialisation Strategies. The reports were formally sent to all relevant Commission services plus the relevant Permanent Representations of these Member States. The reports were extremely pertinent to the governments of these countries as they helped to identify both weaknesses and proposed solutions.

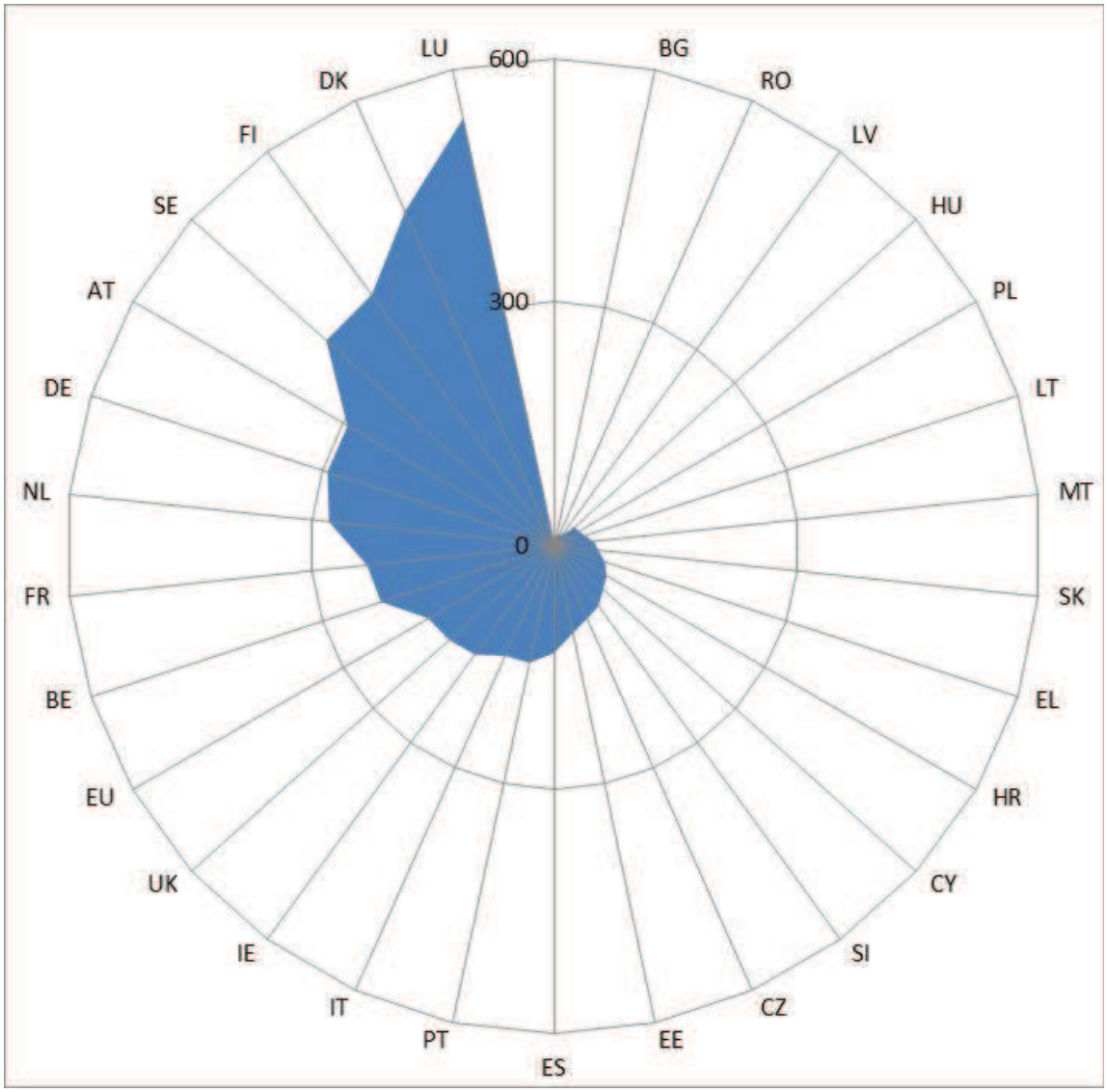
Since February 2014, 11 institutions were awarded an ERA Chair for a period of five years. A new call under Horizon 2020 - Widespread - was published on 11 December 2013 with a call deadline on 15 October 2014. The budget for this call is EUR 34 million. The ERA Chairs brings outstanding researchers to universities and other research institutions that have high potential for research excellence. From their side, institutions mobilise support from different funding sources, including the ESIF, to invest in facilities and infrastructures in the context of their national/regional Smart Specialisation Strategies and commit to institutional change in addition to broader support for innovation.

3.1.1. Public funding for R&D and its evolution

In terms of public funding for research measured through the Global Budget Appropriations or Outlays on Research and Development (GBAORD), big differences

remain. Expenses in R&D per citizen are 39 times higher in LU than in BG (See Graph 5). The differences are partly explained by differences in national income and purchasing power. However, it should be noted that GBAORD does not consider other efforts undertaken by national authorities in support of R&D such as tax incentives, credits, etc. whose importance has risen in the past few years, but for which limited information is available.

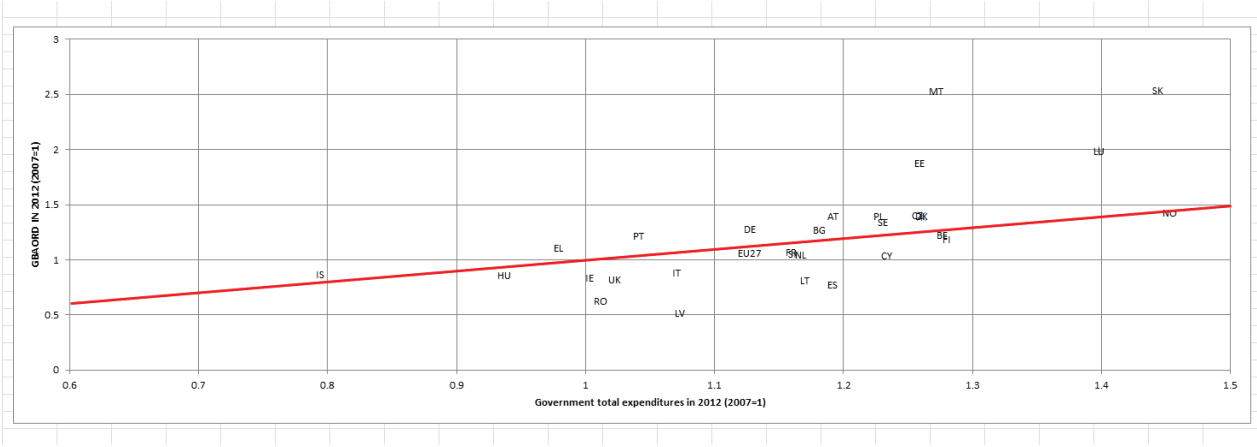
Graph 5: GBAORD per capita, 2012 (in EUR)



Source: DG RTD based on Eurostat

In terms of the evolution of public funding for research, when compared with total government expenditures the situation also varies greatly among countries. Since the crisis (2007), in the graph below it can be observed that countries above the line have increased their GBAORD in 2012 more than total government expenditures demonstrating the high importance given to R&D (see Graph 6). In the others, fiscal consolidation has been carried out at the expense of R&D (BE, IE, ES, FR, IT, CY, LV, LT, HU, NL, RO, SI, FI, UK). It should be recalled that these figures do not include tax incentives for innovation, which in some cases have been increased in the last few years (at least in FR, NL, UK).

Graph 6: Evolution of GBAORD compared with total government expenditures (2007=1)



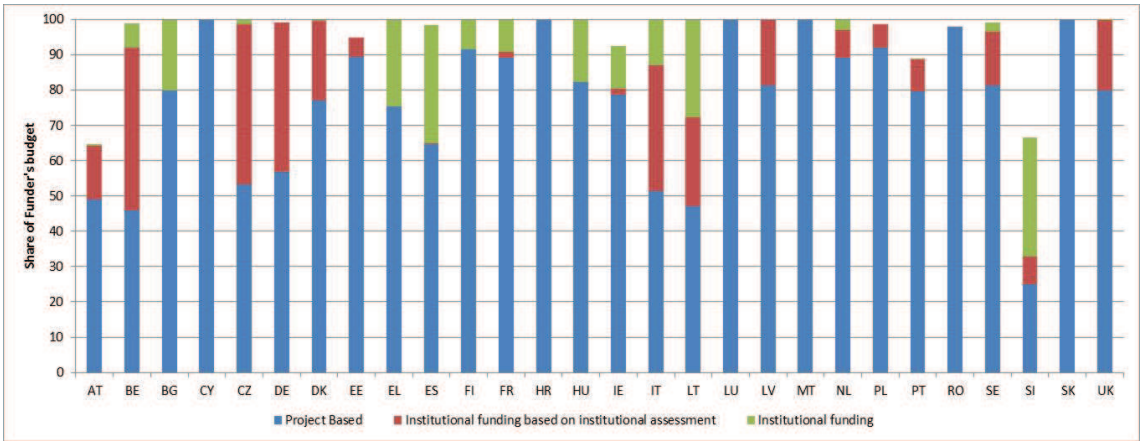
Source: DG RTD based on Eurostat[12]

3.1.2. Competition for public funding

Project based funding is the most important way to induce competition in research. The Commission could identify support to the implementation of project based funding in the national R&I strategies in 21 Member States: AT, BE, BG, CY, CZ, DE, DK, EL, ES, FI, FR, HR, IT, LT, LU, MT, NL, PL, RO, SE, UK.

According to the results of the ERA survey 2014 (see Graph 7), project based is allocated by funders in all Member States, with an average of 64% of their R&D funding allocated using this modality[13]. Funders in four Member States allocate all their funding using this modality.

Graph 7: Allocation of funding according to different modalities, by funders in Member States, 2013



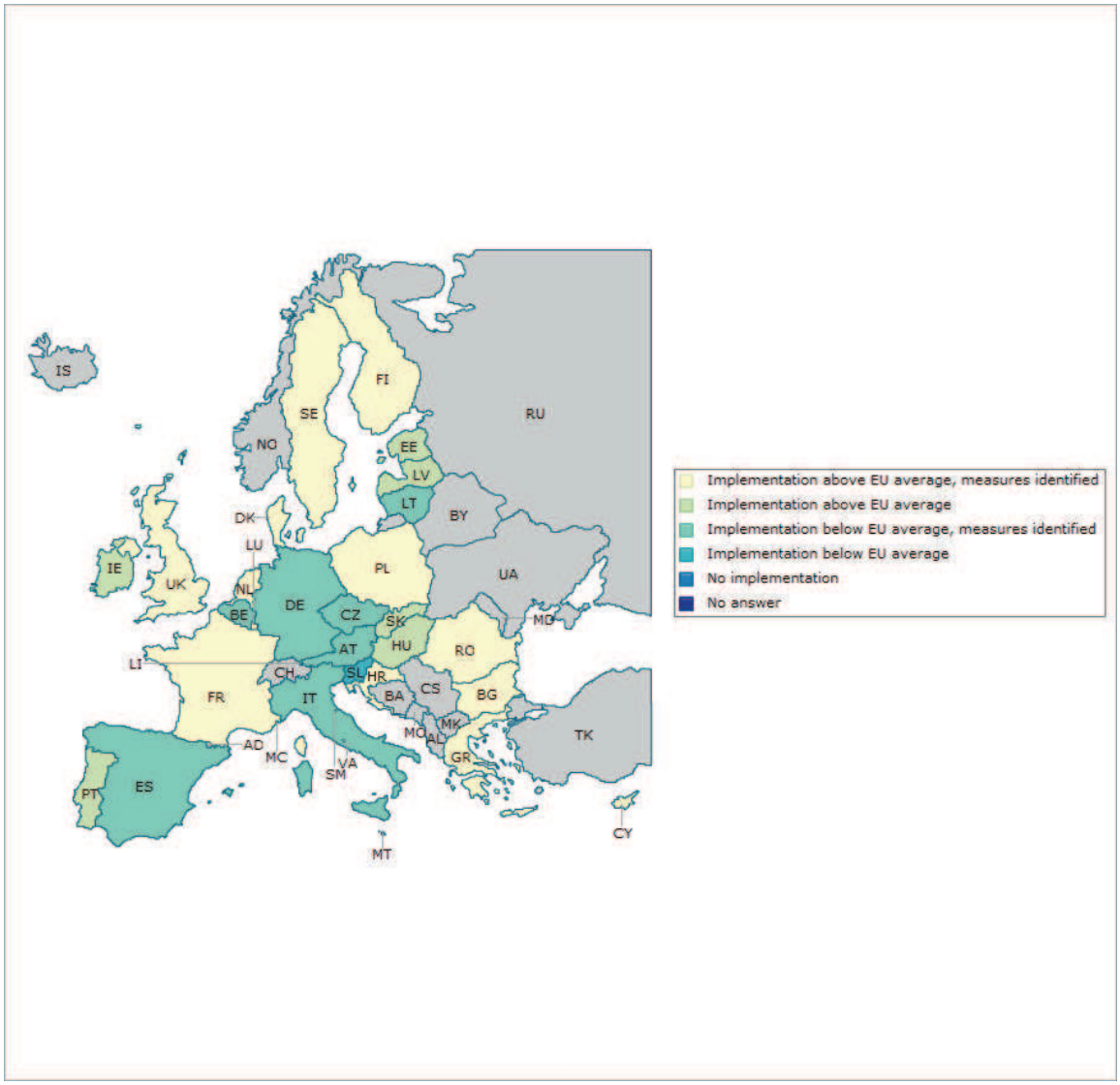
Source: ERA survey 2014

[12] Croatia is not included in the graph as data for this country is only available for 2012.

[13] It should be noted that these figures concern funders who answered the ERA survey in 2014 which represent 34% of total EU GBAORD.

In comparative terms (see Map 1), according to survey results funders which answered the ERA survey allocate a higher share of their funding as project based than the EU average in 20 Member States.

Map 1: Classification of EU Member States according to support to project based funding in the R&I strategy and the share of funding allocated as project based by funders, 2013



Among the other Member States where the share is lower than the EU average, the Commission could identify specific measures supporting the implementation of project based funding in AT, BE, CZ, DE, ES, IT and LT, whilst in one country (SI) the Commission could not identify any specific measures.

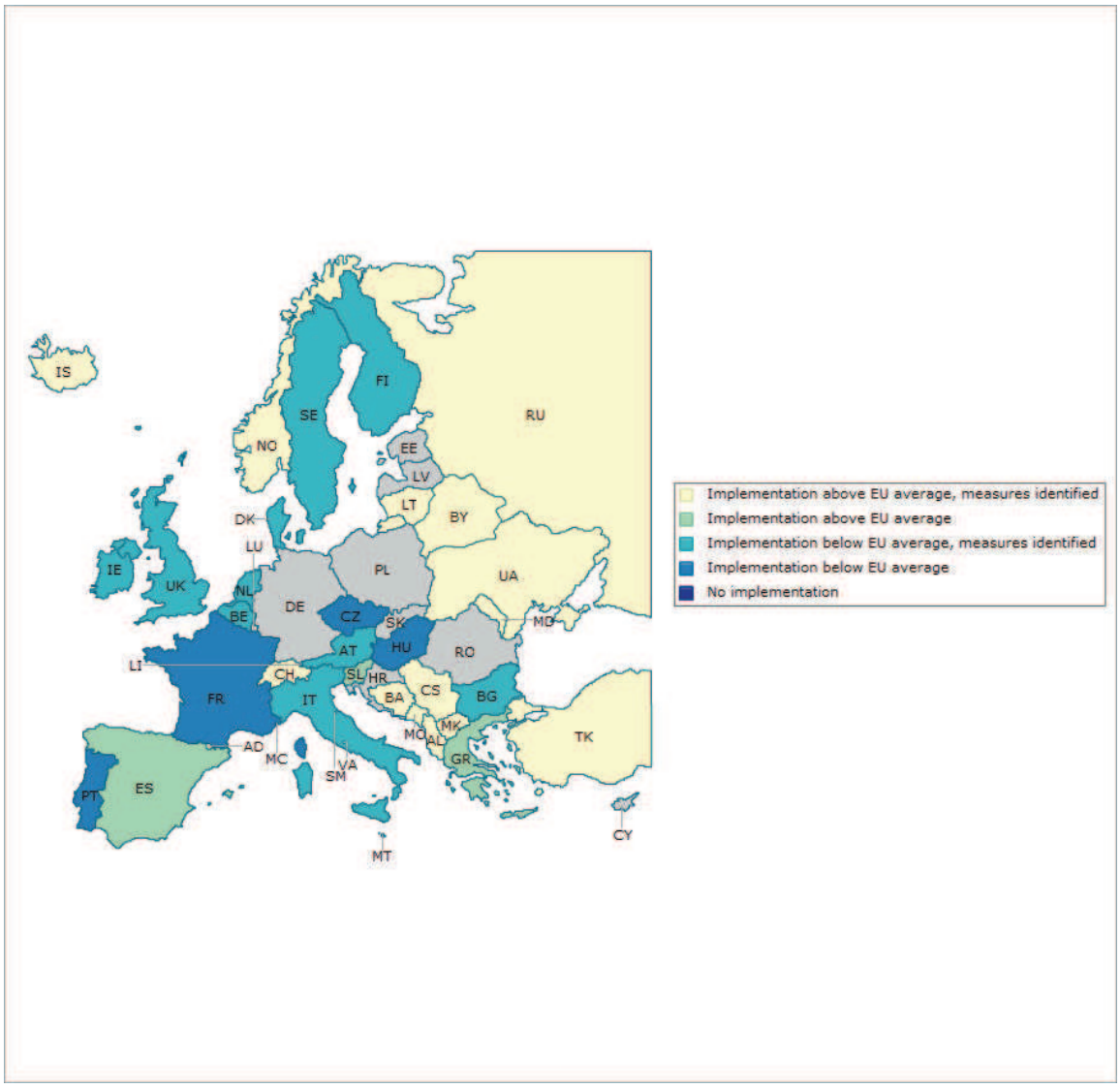
Evaluation mechanisms used for the allocation of project based funding should comply with high standards. The Commission could identify provisions supporting peer review in all Member States. However, these principles vary and are not uniformly used: the Commission identified that in 21 MS the principles are expected to be used in all calls (AT, BE, CZ, DK, EE, EL, FI, FR, HR, IE, IT, LT, LU, MT, NL, PL, RO, SE, SI, SK, UK) while in the rest of the Member States they are expected to be used in some calls (BG, CY, DE, ES, HU, LV, PT).

3.1.3. Institutional funding

Institutional assessment linked with institutional funding is another powerful mechanism to promote competition in research and increase the effectiveness of national expenditures. The Commission could identify measures to support the allocation of institutional funding based on institutional performance in 17 Member States (AT, BE, BG, CY, DE, DK, EE, FI, HR, IE, IT, LT, LU, NL, SE, SK, UK).

In terms of implementation of institutional assessment for institutional funding, according to the ERA survey 2014 results, funding agencies in 18 of the 22 countries which allocate institutional funding base part or all of it on some form of institutional assessment, while in the other four countries they do not (BG, FI, EL, HU) (see Map 2).

Map 2: Classification of EU Member States according to the identification of measures in support of institutional funding allocated on the results of institutional assessment and the share of funding allocated by funders using this modality, 2013



Among the six Member States whose agencies declared that they do not allocate institutional funding, four Member States (CY, HR, LU, SK) have policies in place to address this issue. In the other two, the Commission could not identify any measure (MT,

RO). It should be noted that some funders in some countries did not report their funding modalities.

Almost 70% of researchers in the ERA survey 2014 belong to institutions whose institutional funding is linked to institutional assessment. Of them, 88% are in the ERA compliant cluster.

3.2. In terms of pan-European cooperation and competition

3.2.1. Transnational cooperation

- *The relevance given to transnational cooperation is increasing at strategic level in most countries*
- *Differences in share of budget allocated to transnational cooperation are important (1:21)*
- *Several large initiatives (ERA-Nets, Article 185 initiatives, joint programming initiatives (JPIs)) are continued and/or enhanced in Horizon 2020, increasing the coordination and effectiveness of European research*

Europe is facing a number of societal challenges for which a combined effort on R&I is needed. The Framework Programme Horizon 2020 is a major facilitator of cross-border research based on excellence. However, in some cases this effort may be insufficient and combined actions by several Member States may be required. The Commission could identify willingness to foster transnational cooperation in national R&I strategies in more than half of the Member States (AT, BG, CZ, DE, DK, EL, ES, FR, HU, IT, MT, NL, PL, PT, RO, SE, SI).

The Commission, through its ERA-NET scheme continues to provide financial support from the framework programme by co-funding calls and other joint activities related to the coordination of national/regional R&D programmes. For example, ERA-NET Cofund E-Rare action now coordinates, in combination with Horizon 2020 activities, 40% of all research in the field within ERA. National ministries and their funding agencies appreciate it as a powerful tool, creating joint transnational calls between national programmes with an almost constant total volume of EUR 400 - 500 million per year. They have also used the scheme to launch a broad variety of additional activities that strongly support the realisation of ERA.

In May 2014 Parliament and Council adopted the four Article 185 initiatives, which are research programmes undertaken jointly by several Member States, proposed by the Commission as part of the Innovation Investment Package (IIP), based on Article 185 TFEU. In total, the Commission will invest EUR 1.5 billion from Horizon 2020 in the four initiatives. These activities contribute to the coordination of national research programmes. For example, the Article 185 initiative on Metrology now coordinates 50% of the European research and is considered the leading metrology research programme in the world. Further initiatives might follow after the mid-term review of Horizon 2020.

Joint programming initiatives aim to pool national research efforts to tackle common European challenges more effectively in a few key areas (10 since 2010). For example, the JPI on Neurodegenerative diseases contributed to an increase in overall investment to

tackle the major societal challenges (from less than EUR 100 million to EUR 350 million), it increased coordination of research in ERA (from less than 5% to 10% of all ERA research in the field), attracted 'Foreign Direct Investment' from Canada and will eventually contribute to more effective research in Europe. They are led by Member States and have only received EU support for their set-up phase. Most JPIs have now adopted joint strategic research agendas setting their priorities and some have multi-annual implementation plans. In total their joint activities up to the end of 2013 amounted to more than 20 joint calls and joint actions for a total of more than EUR 200 million. However, this amount is still of a limited size considering that at European level[14], with the exclusion of the Framework programme and the European Funding Agency funding, less than 1% of national public R&D funding is spent on transnational research.

Finally, a specific focus has been developed within the Smart Specialisation Platform (S3 Platform) on trans-national co-operation, through the establishment of permanent liaisons with two EU macro-regional strategies (those for the Baltic Sea Region and the Danube Region). The contribution has been methodologically targeted to the identification of concrete issues through the decisive involvement of stakeholders. The Danube region stakeholders focused on financial support of trans-national R&I projects, while the Baltic Sea Regions stakeholders focused on the priority-setting process and the subsequent identification of concrete joint projects.

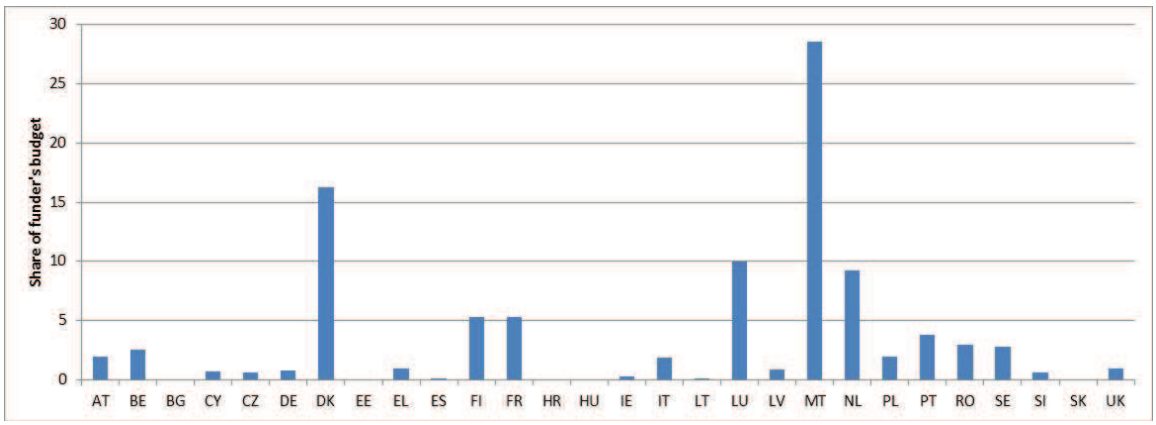
According to the results of the ERA survey 2014, the average share of funding dedicated to joint research agendas[15] among the funders which answered the survey is 1.42% of their R&D budgets[16] (see Graph 8). The 'intensity' of support for the implementation of joint research agendas varies from very low shares to a maximum of almost 30% in the case of Malta. In the latter case, the high figure may reflect a specific project and not a regular thrust.

Graph 8: Share of funder's R&D budget dedicated to joint defined research agendas with non-national funders, 2013

[14] This represents 0.2% of total GBAORD for 2012.

[15] Research funding organisations were asked to indicate their approximate percentage of the organisation's overall R&D budget dedicated to joint research agendas with EU countries in 2013. Joint research agendas were defined as "annual or multiannual research agendas for a joint programme between EU Member States outside the framework of the EU Framework Programme. Joint research agendas include activities such as JPIs and ERA-Net+ where the bulk of funding does not come from EU sources."

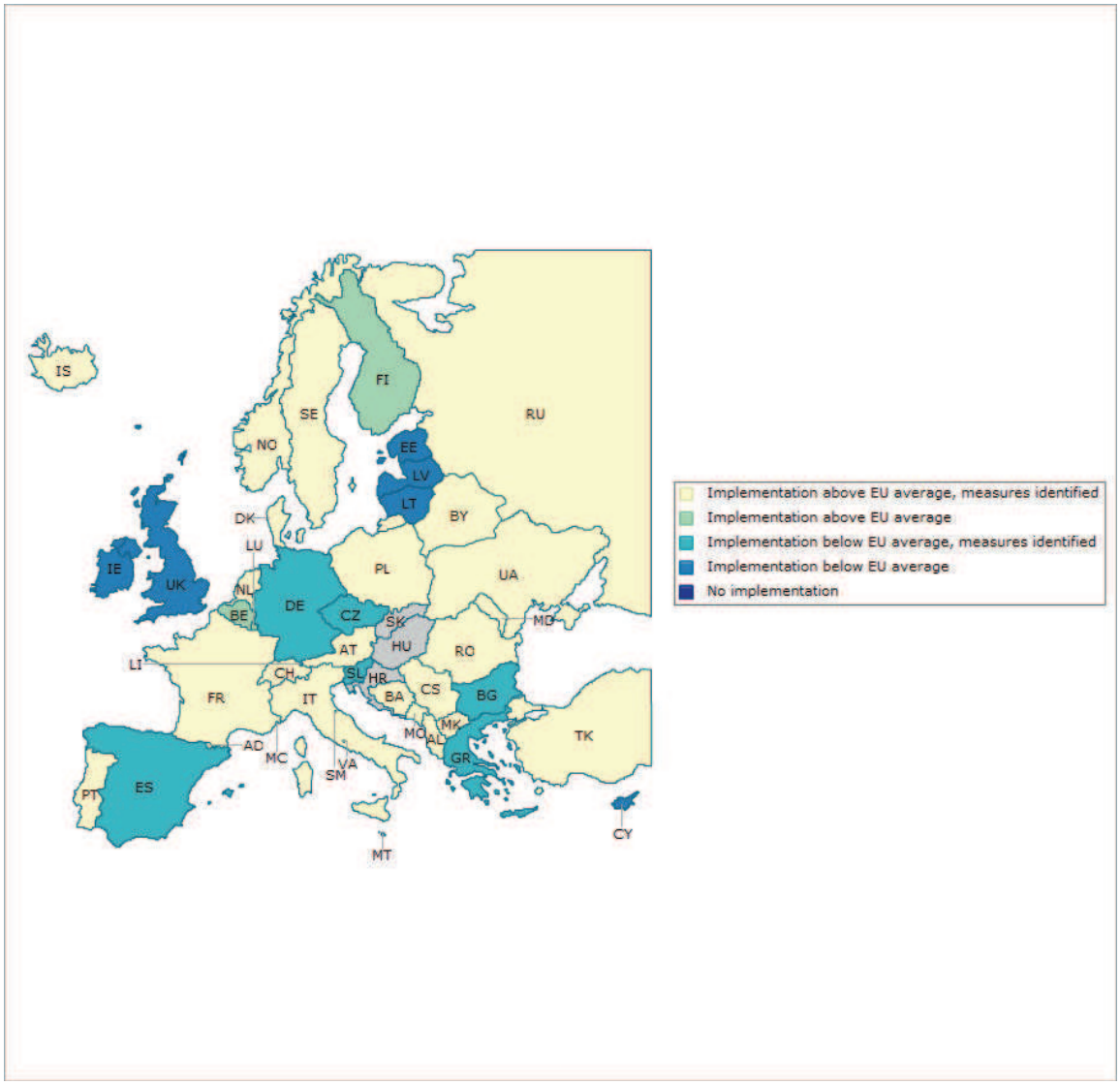
[16] It should also be noted that these figures concern funders which answered the ERA survey in 2014, which represent 34% of total EU GBAORD.



Source: ERA survey 2014

In comparative terms (see Map 3), according to the ERA survey funders in almost half (13) of Member States funders dedicate a higher share of funding to joint R&D agendas with other EU countries than the EU average.

Map 3: Classification of EU Member States according to the measures in support of the implementation of joint research agendas and financial support provided by funders, 2013



In the other 15 Member States the share of funder's budget dedicated to these issues is below the EU average or non-existent. Among them, in six cases (BG, CZ, DE, EL, ES, SI), the Commission could identify support for the implementation of joint research whilst in other countries (CY, EE, IE, LT, LV, UK), the Commission could not identify any explicit measure or strategy. In three cases, the funders did not report any support (HR, HU, SK).

Given the importance of the societal challenges that Europe is facing in addition to R&D budgetary evolutions presented above, Member States may consider the possibility of further coordinating their research efforts whilst allocating more resources to their implementation.

3.2.2. International cooperation

- *Member States are increasingly open to international cooperation*
- *Horizon 2020 is open to the participation of legal entities from across the world. The Commission will seek to enhance international cooperation through:*
  - *horizontal activities*
  - *targeted activities across the societal challenges*
  - *enabling and industrial technologies*
  - *other relevant parts of Horizon 2020*

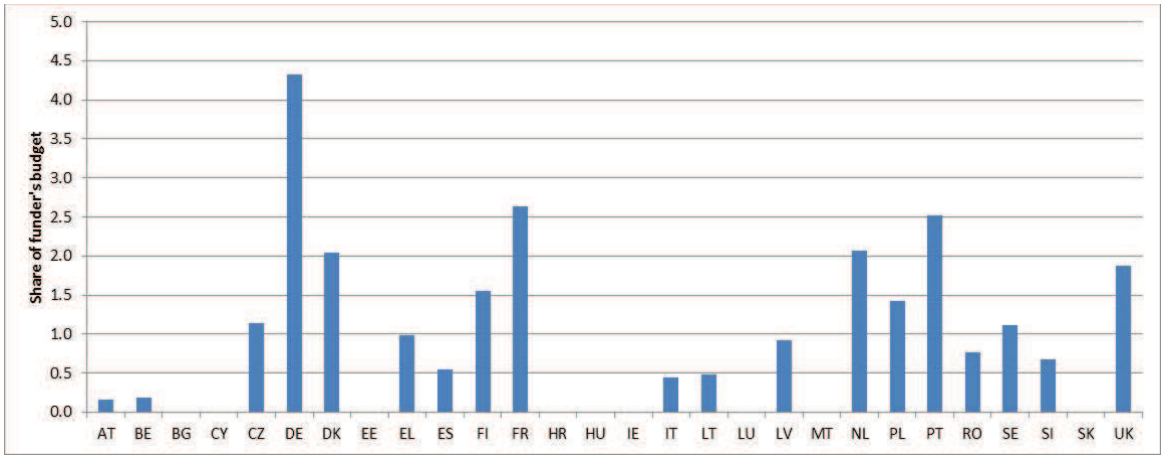
Openness of ERA to the rest of the world is an important factor for knowledge generation both in Europe and abroad. The Commission has been able to identify specific support in 12 Member States: AT, CZ, DE, DK, FR, IT, NL, RO, SE, SI, SK and the, UK. In three of these countries, new measures were proposed/adopted in 2014.

Regarding international cooperation, 85% of the National Rectors' Conferences (NRCs) surveyed by EUA in 2013 indicated the existence of international research collaborations at national level. Results also showed that EU Countries partner with other EU Countries, Associated Countries and third countries on an equal basis (point validated by 90% of the respondent NRCs). In particular, regarding bilateral agreements with third countries, NRCs indicated the existence of agreements with the United States of America, Canada, Japan, China, Brazil, and Russia. Other countries, such as India or South Africa, were also mentioned, although less frequently.

According to the ERA survey 2014 results, funders in more than half (17) of Member States allocate an average of 0.7% of their budget to collaboration programmes with third countries, ranging up to almost 4.3% in Germany[17] (see Graph 9).

[17] It should be mentioned that these figures concern funders which answered the ERA survey in 2014, which represent 34% of total EU GBAORD.

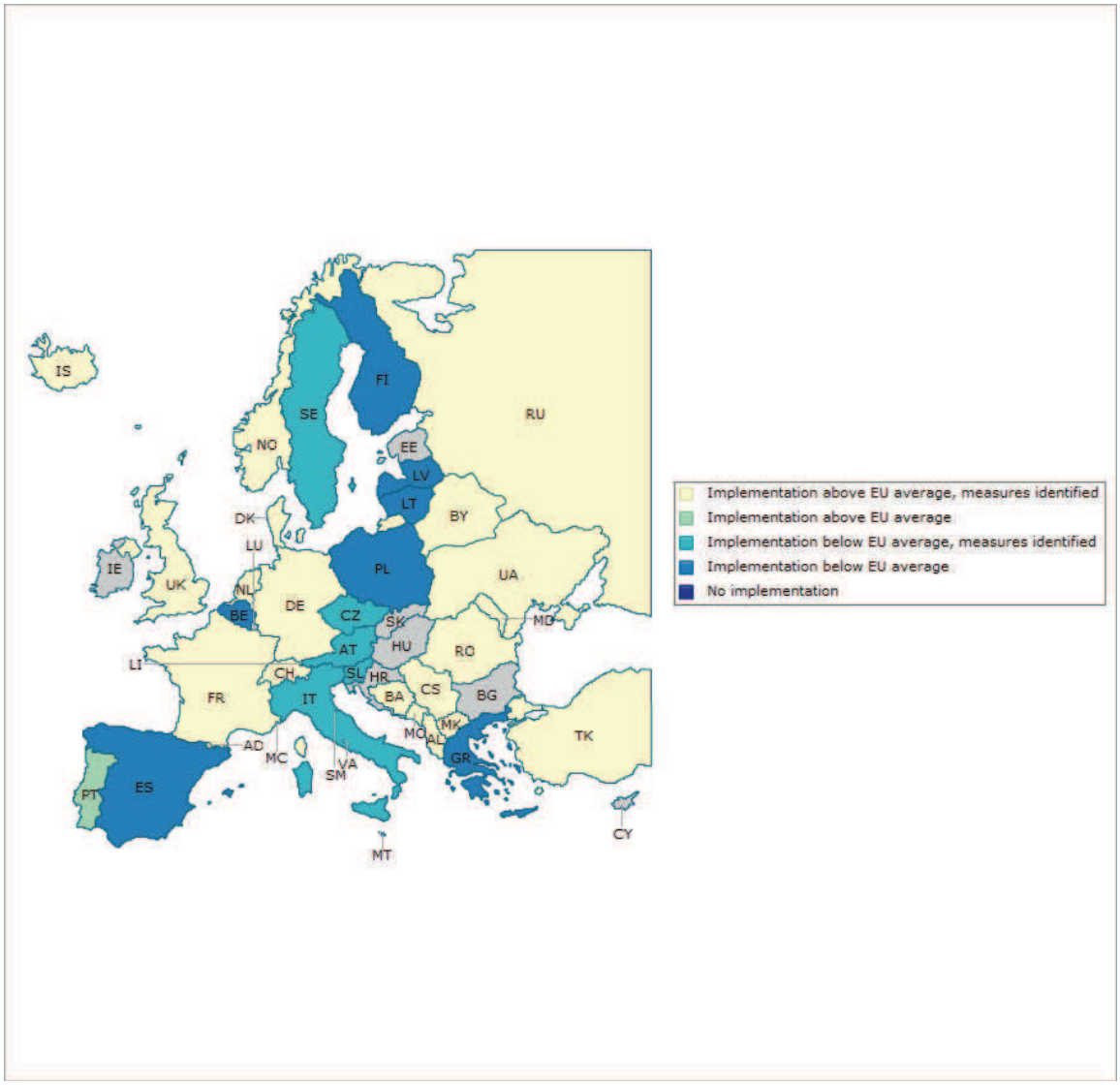
Graph 9: Share of R&D budget allocated to collaboration programmes carried out with third countries, 2013



Source: ERA survey 2014

In comparative terms (see Map 4), according to survey results among the funders in the 19 countries which indicated that they dedicate funding to international cooperation, in six of them funders dedicate a higher share of funding than the EU average (more than 2.4% of their funding). Among them, in five countries (DE, DK, FR, NL, UK) the Commission could identify policy support. Funders declared that there is no budget allocated to these activities in BG, CY, EE, HR, HU, IE, LU, MT and SK.

Map 4: Classification of EU Member States according to the measures in support of collaboration with third countries and the share of funding allocated by funders to this type of activity, 2013



In the other 13 Member States there are two situations. In six countries (AT, CZ, IT, RO, SE, SI), the Commission could identify measures in support of international cooperation whilst in three others (BE, EL, ES, FI, LT, LV, PL), the Commission could not identify any explicit measure or strategy.

In order to step up the intensity of international cooperation in R&D, in September 2012 the Commission adopted a Communication entitled "Enhancing and focusing EU international cooperation in R&D: a strategic approach[18]". With this Communication, the Commission called for making better informed, and therefore more strategic, choices as regards the areas selected for cooperation and the international partners with whom to engage, in particular with a view to preparing for the implementation of Horizon 2020.

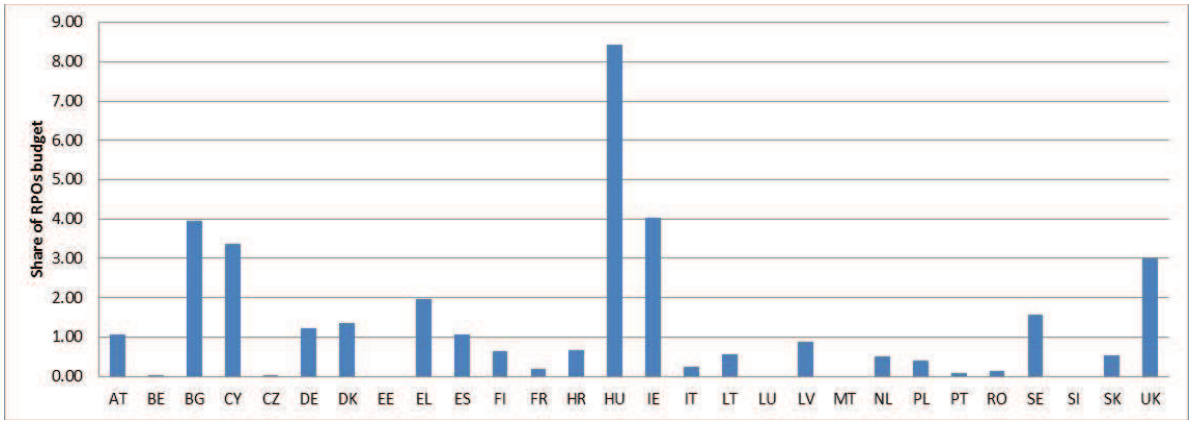
In line with the aim of the new strategy, the Commission's ambition is to increase the participation of legal entities from international partner countries in Horizon 2020 projects and, more generally, to enhance international cooperation activities supported or catalysed through Horizon 2020. Integrating international cooperation into the first Horizon 2020 work programmes, strengthening communication on the openness of Horizon 2020 to the participation of international partners and enhancing cooperation

[18] COM(2012) 497

with the external funding instruments and overall EU external policies have been major points of attention during the two years of implementation of the Commission's new international cooperation strategy.

Another important factor linked with international cooperation is that RPOs may attract funding from third countries, both from the public and the private sector. The degree of funding received may reflect the attractiveness of the RPO in the country. According to the results of the ERA survey 2014[19], research performers in 24 Member States receive part of their funding from third countries, ranging from very low shares up to almost 9% in the case of Hungary (see Graph 10).

Graph 10: Share of organisations' R&D budget originating from third countries, 2013



Source: ERA survey 2014

3.2.3. Interoperability

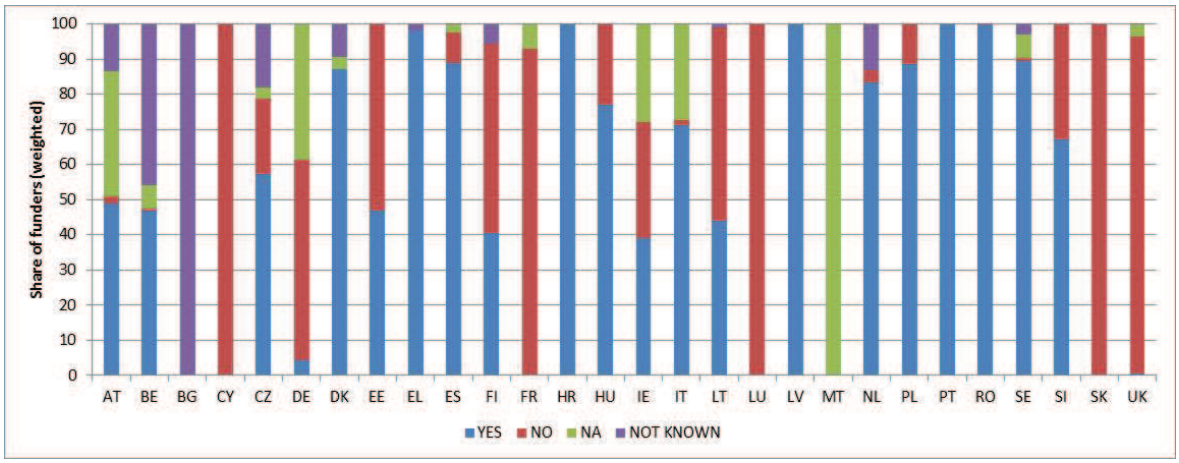
– *Mutual recognition of evaluation results is linked with funding allocation, opening the way for more interoperability*

Cross border cooperation and implementation of joint research agendas will be facilitated by the adoption of common procedures and standards, but also by delegating some of the task to other actors beyond the national borders. This is the case, for example, when funding agencies in one country fund their constituency on the basis of results of an evaluation carried out by a stakeholder in another country.

According to the ERA survey 2014, funders in 24 Member States can base their project based funding on evaluation results from non-national funders (see Graph 11), even if the proportion of funders which can do so varies significantly between countries. It should be recalled that these figures concern funders who answered the ERA survey in 2014, which represent 34% of total EU GBAORD.

Graph 11: Share of funders which can base their project based R&D decisions on peer reviews carried out by non-national funders, 2013

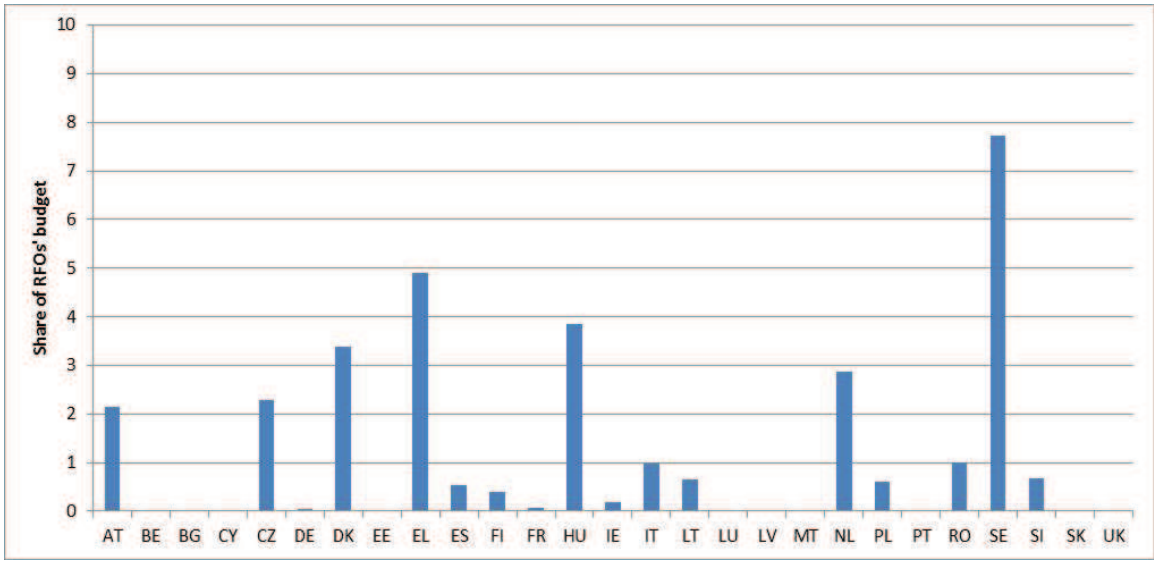
[19] It should be recalled that these figures concern research performing organisations which answered the ERA survey in 2014, which employ 515,000 researchers (around 20% of total EU researchers).



Source: ERA survey 2014

Also, according to the ERA survey 2014 results the proportion of funding allocated using this modality by funders which answered the survey varies greatly (see Graph 12).

Graph 12: Share of project based R&D budget allocated through peer review carried out by funders outside the country, 2013



Source: ERA survey 2014

NB: funders in Croatia which answered the ERA survey indicated that 100% of their project based funding is allocated using this modality. It was not included in the graph to facilitate the presentation of the results for the other countries.

To facilitate interoperability, the Commission prepared and held a workshop on "Why and how to facilitate cross-border research operations in ERA?" in February 2013, addressing the issue of the potential ERA-Mark, proposed in the ERA Communication of July 2012, as a voluntary label for attesting that national research programmes possess criteria that would facilitate trans-national collaboration with other programmes. Key conclusions were that it is an interesting concept and that the ERA Mark could provide more action and evidence at EU-level. However, it was also concluded that it will need to be periodically renewed, opened to international partners and that a wide range of

stakeholders need to be involved in the development of the concept to make the ERA Mark happen (RPOs, the European Network of Innovation Agencies (TAFTIE), structural funds experts, etc.)

In addition, to test the feasibility of synchronised calls in Horizon 2020, in 2014 the Commission launched an open call (CSA) in order to fund the process. However, the Commission did not receive any proposals.

3.2.4. Financial commitments for the construction and operation of European Strategy Forum on Research Infrastructures (ESFRI), national, regional research infrastructures (RIs) of pan-European interest

- *The commitment to have completed or launched the construction of at least 60% of the ESFRI roadmap projects by 2015 is in reach*
- *Member States should regularly report their financial contribution to the development of the RIs included in the ESFRI roadmap*
- *The development of the Charter of Access for Research Infrastructures is well advanced*

ESFRI is a strategic instrument to develop the scientific integration of Europe and to strengthen its international outreach. As confirmed by the Council on 26 May 2014, Member States commit to focus their available national resources on the respective prioritised projects in which they are financially participating.

The commitment under the Innovation Union of the Member States and the Commission to have completed or launched the construction of at least 60% of the ESFRI roadmap projects by 2015 is in reach. The prioritisation of the ESFRI roadmap projects confirmed by Council in May 2014 will allow Member States and the Commission to give additional support for reaching this objective. Progress can also be seen from the report that is to be presented by the Commission to Council and Parliament, concerning the application of the European Research Infrastructure Consortium Regulation (ERIC) in which it is stated that although the take up of the new legal instrument was relatively slow, with the establishment of seven ERICs and the prospect of reaching about 15 ERICs in 2015, momentum seems to have been reached by Member States using this instrument which will lead to a further fulfilment of the ERA.

Most Member States (22) have national roadmaps for the development of RIs (AT, BE, BG, CZ, DE, DK, EE, ES, FI, FR, HU, IE, IT, LT, NL, PL, RO, SE, SI, SK, UK, soon HR)[20]. Among these countries, the intention to contribute to the development of ESFRI in national roadmaps in 21 cases (AT, BE, BG, CZ, DE, DK, EE, ES, FI, FR, HU, IE, IT, LT, NL, PL, RO, SE, SI, SK, UK). Upon the Commission's request for the purpose of the current report, only two Member States (SE, UK) were able to report its financial contribution to the development of the RIs included in the ERA roadmap, while financial indications are present in several national roadmaps for RIs.

[20] In five cases, new developments have been observed since 2013 (DE, EE, NL, HR and BE).

Member States should enhance their efforts in identifying and reporting the actual financial contributions from the Member States to the development of the RIs included in the ESFRI roadmap.

3.2.5. Access to RIs of pan-European interest

The competitive and open access to high quality RIs supports and benchmarks the quality of the activities of European scientists and attracts the best researchers from around the world.

Under the Commission initiative, progress has been made in the development of a Charter of Access for Research Infrastructures which is to be published at the beginning of 2015 and would allow for a more efficient use of these European infrastructures by users from across Europe.

In addition, the Commission could identify the existence of a strategy to support the competitive and open access to RIs in 12 Member States (BG, EL, FI, FR, HU, IT, LT, NL, PL, RO, SK, UK) and specific supporting measures in AT, DE, EL, ES, HU, IE, LT, NL, PT and the UK.

3.3. An open labour market for researchers

An open and attractive labour market for researchers is an essential component of the ERA. Significant progress has been made in removing or alleviating some of the obstacles to mobility, improving doctoral training and making research careers more attractive, albeit to varying degrees across countries.

Across the EU, Member States and/or institutions have introduced a range of measures, programmes, strategies and legislative acts. This includes, for example, measures to make research a more attractive career option through the implementation of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers. Work has also centred on enhancing the quality of doctoral training, in particular to prepare doctoral candidates for a career outside academia, and on measures to improve researchers' career development opportunities through, for example, life-long learning.

For its part, the Commission has focused efforts on a series of policy initiatives which have contributed to the overall progress. This includes further development of the EURAXESS network, in particular a large increase in the publication of research job vacancies, the revised "Scientific Visa Directive", the Human Resources Strategy for Researchers based on the Charter and Code, the European Principles of Innovative Doctoral Training and support for a new pan-European supplementary pension fund for researchers. Marie Skłodowska-Curie actions have also had a pronounced structuring impact on ERA by setting standards for research training, attractive employment conditions and open recruitment for all EU-researchers, and by aligning national resources as well as influencing regional or national programmes through the Co-fund mechanism.

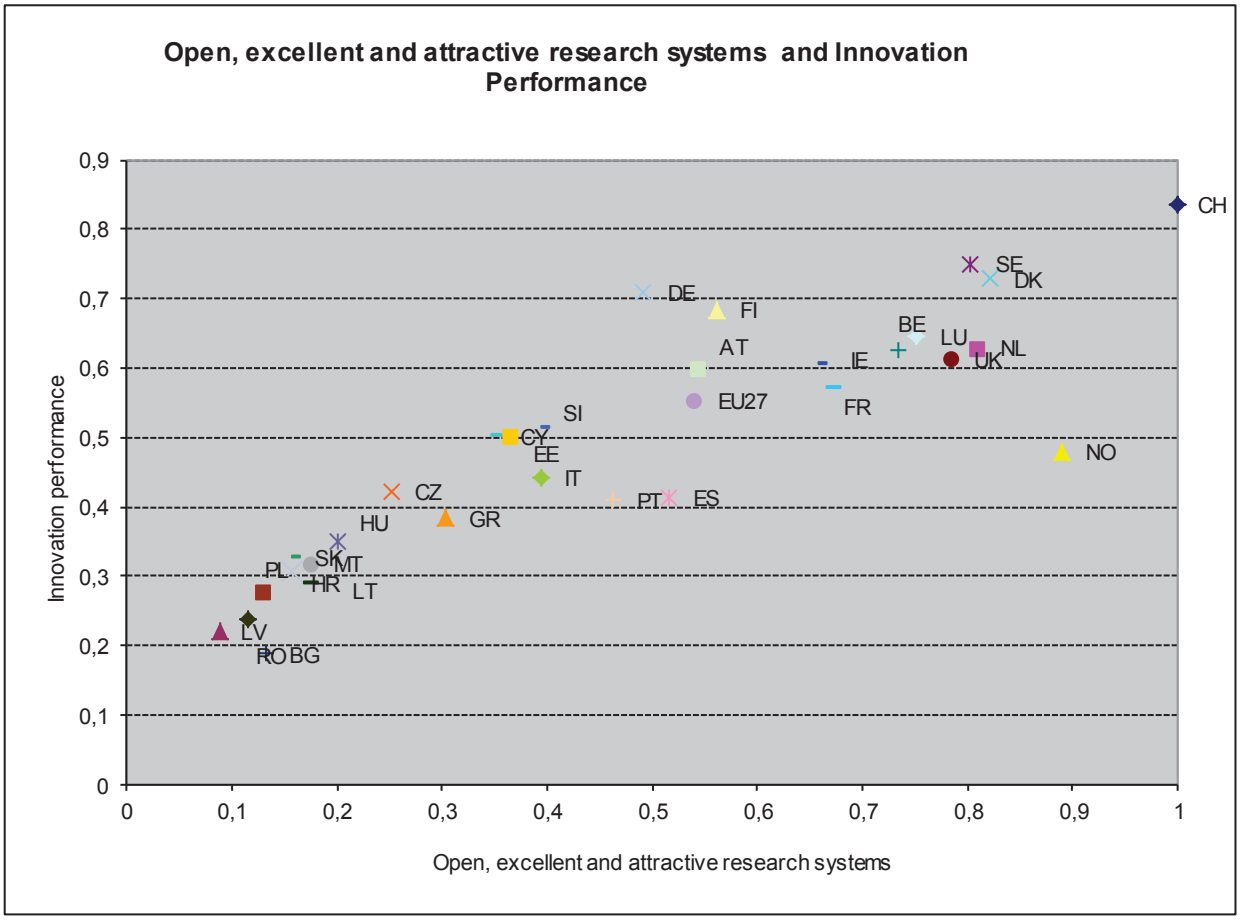
Progress has nevertheless been uneven and a number of challenges remain, in particular in a number of Member States where the lack of open, transparent and merit-based recruitment gives cause for concern, where intersectoral mobility is relatively low or where working conditions and career opportunities are rather limited. A concerted and

coordinated effort is needed from the Member States and institutions together with the Commission.

3.3.1. Open, transparent and merit based recruitment of researchers

Evidence shows that countries with open and attractive research systems are strong performers in terms of research excellence and innovation (see Graph 13). While several factors play a role in determining whether a system is open and attractive, it is clear that open, transparent and merit-based (OTM) recruitment is a prerequisite. Open competition enables hiring of the best researchers, at all career stages and fosters effective geographical mobility. This is important because recent research by the OECD[21] shows that 'on average, the research impact of scientists who change affiliations across national boundaries is nearly 20% higher than that of those who never move abroad.' OTM recruitment also has the potential to match supply and demand across Europe and can have a positive impact on equal opportunities for men and women.

Graph 13: Open, excellent and attractive research systems and innovation performance (2014)



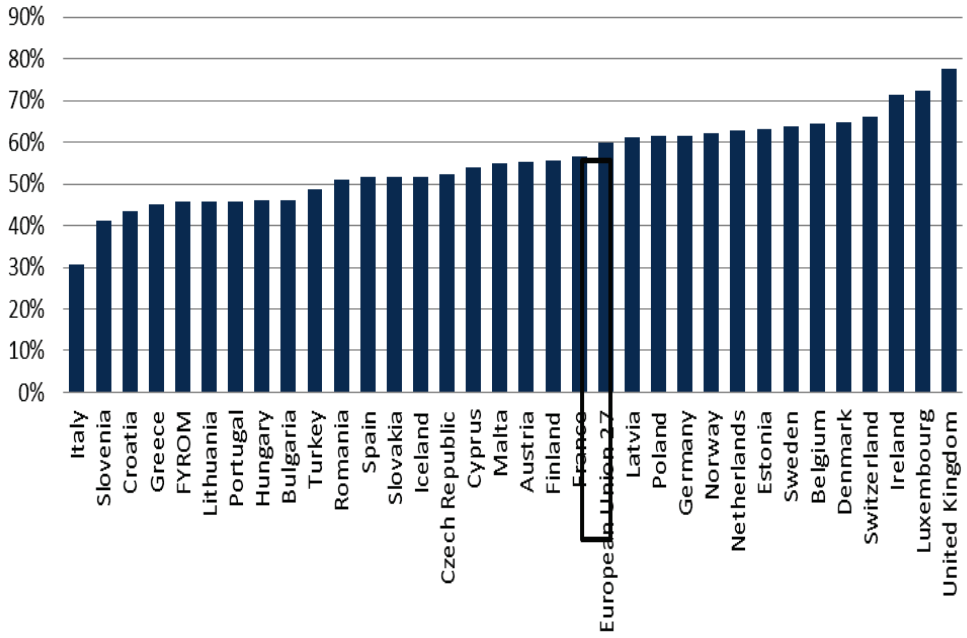
Source: DG Research and Innovation calculations based on Innovation Union Scoreboard 2014

While policymakers generally understand the recruitment systems in place to be OTM, a substantial share of researchers do not perceive OTM as such, which potentially acts as a

[21] OECD Science, Technology and Industry Scoreboard 2013 Innovation for Growth

major disincentive to start or remain in a research career. The results from the MORE2 survey demonstrate strong country specificity in levels of satisfaction with open recruitment. Additionally those in the early career researcher stages are most dissatisfied with the openness and transparency of their recruitment and female researchers show lower levels of satisfaction than males: data shows that around 40% of researchers associated to European universities were 'dissatisfied' with the extent to which research job vacancies are publicly advertised and made known by their institution. This average masks significant differences between countries, e.g., while 22% of researchers in the UK were not satisfied, the figures increased to 54% in Portugal, 55% in Greece and 69% in Italy (see Graph 14).

Graph 14: Share of university-based researchers satisfied with the extent to which research job vacancies are publicly advertised and made known by their institution, Europe (2012) (%)



Source: MORE2 Study

The European Code of Conduct for the recruitment of researchers has had a positive but limited impact, due to its voluntary nature, on OTM recruitment procedures. Moreover, the majority of individual institutions which have received the Human Resources for Researchers Excellence logo have reviewed, or are in the process of reviewing, their recruitment processes. As part of Horizon 2020, there is now an obligation on beneficiaries (Article 32 of the Grant Agreement) to take all necessary measures to implement the Code of Conduct.

One prerequisite for OTM recruitment is to ensure publication of the vacancy. In this regard, following concerted efforts by the Commission, several Member States and institutions, the number of research vacancies posted on EURAXESS Jobs continues to grow from 7,500 in 2010 to over 40,000 in 2013. This excellent progress, which is helping to match demand and supply across borders, has been boosted by national legislation to make it mandatory for publicly funded institutions to advertise their positions on EURAXESS (e.g. Poland, Croatia, Italy) or at least internationally (Austria). An increasing share of universities and other employers are also publishing vacancies.

NordForsk has renewed its grant agreement for Nordic Centres of Excellence (NCoE) which includes a mandatory requirement, stating that any new positions funded by the NCoE grant shall be announced internationally in open competition and according to OTM recruitment procedures. Similarly, a survey carried out by the League of European Research Universities (LERU) in 2013 showed a high degree of compliance with OTM recruitment among its members.

In line with a recommendation by the European Research Area and Innovation Committee (ERAC) mutual learning workshop held in March 2014, the Commission intends to work closely with Member States and stakeholders to produce an OTM recruitment toolkit/practitioner's guide during 2015, including good-practice examples, templates, and other material useful for HR practitioners/employers of researchers.

3.3.2. Researchers' careers

Member States continue to support the implementation of the Charter and Code (C&C)[22] which aims to improve researchers' working conditions. More than 480 organisations from 35 countries in Europe and beyond have explicitly endorsed the principles underlying the C&C, Many of them are membership or umbrella organisations.

The Commission's Human Resources Strategy for Researchers (HRS4R) supports institutions and funders in the implementation of the C&C principles in their policies and practices. Award of the 'HR Excellence in Research' logo recognises institutional progress in this process and helps institutions to promote themselves to prospective research talent as providers of a favourable work environment. Currently, more than 240 organisations are members of a Strategy Group. As of May 2014, more than 180 organisations have received the logo. A significant proportion of the awarded logos are within the UK which reflects the strong enabling framework provided by Vitae. Moreover, thirty stakeholder organisations in the UK have developed the 'Researcher Development Framework', a strategic agenda to train and support researchers and further improve their skills. In contrast, a number of other Member States[23] are underrepresented or absent altogether from the HRS4R.

A feasibility study on a possible certification mechanism for human resource management found little support among stakeholders. Nevertheless, the results showed strong support to continue with the HRS4R and to strengthen the procedure. A series of seminars with stakeholders is therefore being organised in 2014-2015 to see which areas of the C&C can be strengthened in the process. SHO partners in the ERA platform have encouraged their members to engage in the HRS4R process by organising working groups, high level discussions and workshops, launching surveys, and improving guidelines.

3.3.3. Support structured innovative doctoral training programmes

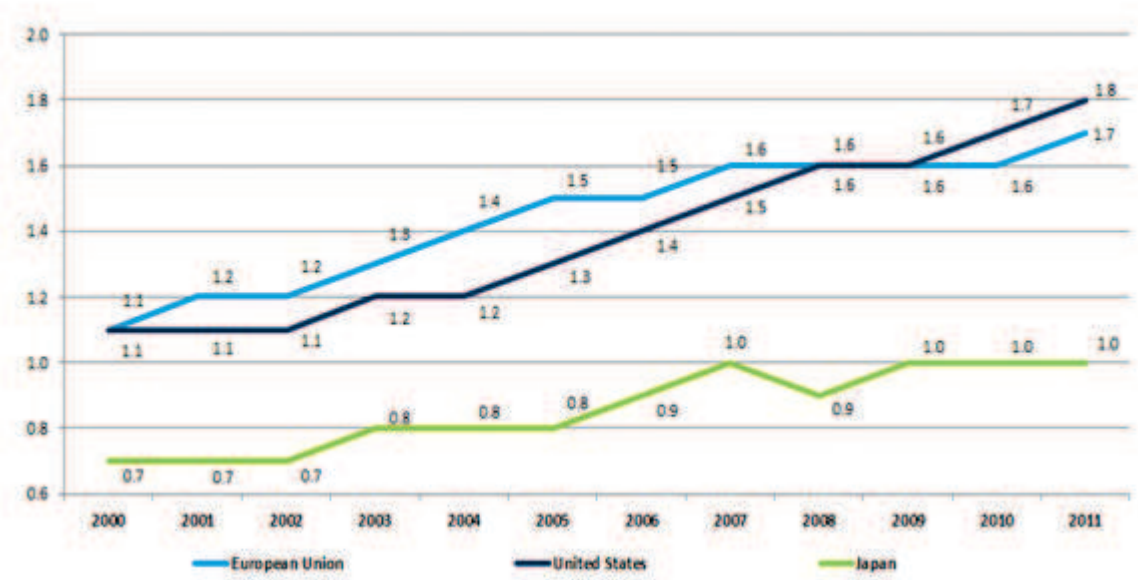
Europe has relatively few researchers employed in the private sector. They make up only 45% of total researchers compared with 78% in the US, 74% in Japan and 62% in China. At the same time Europe continues to train an increasing number of PhDs (from around 72,000 graduates in 2000 to 115,000 in 2011), at a rate similar to the US and well above

[22] http://ec.europa.eu/euraxess/index.cfm/rights/europeanCharter

[23] http://ec.europa.eu/euraxess/index.cfm/rights/strategy4ResearcherOrgs

Japan (see Graph 15). Although the majority of PhD graduates will embark on careers outside of academia (evidence shows that in France, Germany and the UK over 50% of all PhD degree holders now take up jobs outside academia), early stage researchers are often inadequately informed about career paths outside of academia and are not equipped with the necessary skills to work in industry and other relevant employment sectors.

Graph 15: New doctoral graduates per thousand population aged 25-34, EU-27, US and Japan, 2000-2011



Source: Eurostat Education Statistics

The seven Principles for Innovative Doctoral Training (IDTP), endorsed by the Council in 2011, aim to foster excellence and a critical mind-set and provide young researchers with transferable skills and exposure to industry and other employment sectors. Their wider uptake has been explored through a study[24] on the implementation of the principles in 2013 (with on-site visits to 20 universities in 16 countries) and Marie Skłodowska-Curie actions support. The study concluded that the principles are well-accepted, subscribed to by all target groups at institutional, doctoral, policy and non-academic levels and are considered as a 'guiding tool'. They are, however, 'not commonly known in the documented form. Similar ideas or principles, often worded differently, form the basis of doctoral training across Europe', although the understanding and implementation of the principles varies. Research excellence seems to be the 'leading' principle, based on quality assurance and attractiveness of the research/institutional environment.

Progress can be observed in several Member States although the challenge remains in the wider roll-out in terms of reach, financing and sustainability and the engagement of industry in PhD training. Examples of good practice include the German Research Foundation which has set up programmes such as research training groups (Graduiertenkolleg) or the graduate schools in the Excellence Initiative to increase the quality of doctoral training. Here the projects have to adhere to principles similar to the

[24] http://ec.europa.eu/euraxess/pdf/research_policies/IDT%20Final%20Report%20FINAL.pdf

IDTP to receive the funding. Quality assurance is actively pursued in the Vienna Biocenter where a new position, the Scientific Coordinator, has recently been created to ensure the quality of the programme. The coordinator will also initiate changes to the programme e.g. regarding the curriculum (for example, integrating transferable skills training into the curricula in the context of an introductory training course), internal communication and information provision. Interdisciplinarity is at the heart of doctoral education at the University of Ljubljana. In doctoral training the teaching as well as the research is interdisciplinary. Promoting interdisciplinarity has contributed to an increase of intra- and inter-institutional cooperation and some efficiency gains have also been reported. At the Tallinn University of Technology (Estonia), doctorate holders are encouraged to go abroad for a post-doc period and indeed need to do so in order to apply for funding.

The Marie Skłodowska-Curie actions will enable around 25,000 doctoral candidates to be recruited by 2020 to high-quality programmes in Europe. These will provide experience outside academia, hence developing increased employability skills amongst PhD holders.

The European University Association (EUA)'s Council of Doctoral Education (EUA-CDE) has been a strong advocate and promoter of doctoral education and training reforms through its 'Salzburg Principles', 'Salzburg II Recommendations' and has contributed to the development of the 'Principles for Innovative Doctoral Training'.

3.3.4. Removing the barriers to international mobility

The researcher population is highly mobile internationally. Around 31% of EU post-PhD researchers have worked abroad (EU or worldwide) as researchers for more than three months at least once during the last ten years.[25] In terms of impact, the perception among the majority of researchers is that the mobility experience is largely positive. For example, 80% of internationally mobile researchers felt that the mobility had a positive impact on developing their research skills. More than 60% believed that mobility had (strongly) increased their 'research output' (quality of output, citation impact, patents, number of co-authored publications, etc.). And 55% of researchers thought that career progression had increased as a result of their mobility. It is important to note, however, that a significant proportion (40%) of mobile researchers perceived their mobility experience as having had a negative effect on two particular aspects, namely their 'job options' and 'progression in their remuneration'. The reasons behind this are as yet unclear but include issues such as a lack of recognition of mobility and 'forced' mobility.

EU-wide, 68% of doctoral candidates are nationals studying in their own country.[26] A further 8% are EU nationals studying in another EU country. The remaining 24% are from outside the EU. France (35%) and the UK (31%) have relatively high proportions of non-EU doctoral candidates as a percentage of all doctoral candidates in their respective countries. The highest number of non-EU doctoral candidates enrolled in the EU came from China (7,523) followed by Brazil (3,400), the United States (3,243), Mexico (3, 206) and India (2,903). Numbers from China and India have increased significantly in recent years.

The Commission, in cooperation with Member States, has initiated a wide range of initiatives to facilitate researchers' mobility and increase the attractiveness of Europe as a

[25] MORE2 Study on mobility and career paths of researchers
[26] Eurostat Education Statistics

destination for leading researchers. These include measures to facilitate access to information on mobility via EURAXESS, the 'Scientific Visa' package facilitating administrative procedures for third country researchers entering the European Community as well as Marie Skłodowska-Curie actions and Destination Europe Events.

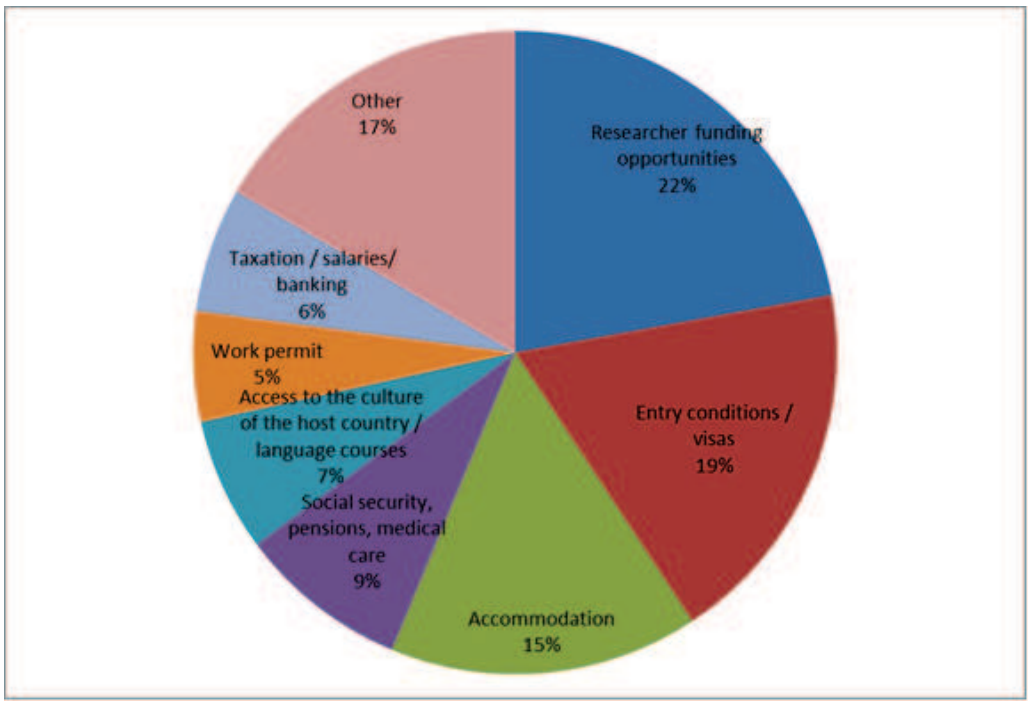
In addition, many Member States have introduced national mobility schemes to boost different types of researcher mobility (inward, outward and cross-sectoral). Many of these schemes promote inward mobility from both EU and non-EU countries providing financial incentives for early stage researchers. The KOLUMB Programme (Poland), for example, awards fellowships to the best young scholars to enable them to stay (from 6-12 months) at the world's leading research centres. Non-financial incentives include measures promoting 'dual careers', such as the Dual Career Network (France, Germany and Switzerland). Some countries provide tax incentives to facilitate researchers' mobility in Europe while others such as Ireland offer special visas to attract researchers to engage in research.

3.3.4.1. EURAXESS

EURAXESS continues to play a key role for researchers wishing to pursue their careers in Europe. More than 200 EURAXESS Service Centres in 40 European countries are responding to the increasing demand for information and assistance with more than 900,000 queries in the past six years. In 2013, EURAXESS Ireland launched a new Industry User Interface for business users. Companies can advertise vacancies, search an online database of researchers' CVs, access the fast track research visas system and search for funding support opportunities. The Commission is exploring the possibility of rolling this out to other countries so that business users across Europe will have a tailored interface.

EURAXESS Links continue to support European researchers in the US, Japan, China, India, ASEAN region and, as of 2013, Brazil and Canada. Its mandate has been extended to also support non-European researchers wishing to move to Europe. For example, EURAXESS Links information officers act as intermediates between the non-EU country and a EURAXESS Service Centre, thus speeding up the provision of information.

Graph 16: Types of queries received by EURAXESS Service Centres 2010-2013



Source: DG RTD - EURAXESS statistics

3.3.4.2. Visa procedures

Fast-track immigration is an important consideration for internationally mobile researchers and is thus an important factor in helping attract the best global talent to Europe. In March 2013, the Commission proposed a recast of the Scientific Visa Directive that will set clearer time limits for national authorities to decide on applications; provide researchers with greater opportunities to access the labour market during and after their stay, and facilitate mobility within the EU. The proposed Directive is under negotiation by the European Parliament and Council.

3.3.4.3. Social security obstacles for mobile researchers

Mobile researchers face obstacles related to social security, in particular with regard to their pensions. To respond to this need, the Commission is committed to supporting stakeholders in setting up pan-European supplementary pension fund(s) for researchers. A Task Force was created in 2013 to prepare a proposal on the establishment of a pan-European Retirement Savings Vehicle (RESAVER) for professionals employed by research organisations. The Commission has foreseen funding under Horizon 2020 to sponsor the set-up of notably the Institutions or Occupational Retirement Provision (IORP), the insurance scheme as well as the functional administration, including the selection of provider(s). The fund should become operational in early 2015.

3.3.4.4. Cross-border access to and portability of national grants

In January 2014, Science Europe published a 'Practical Guide to Three Approaches to Cross-border Collaboration'. This guide provides Science Europe Member Organisations and other research organisations with information and advice on three optional models of collaboration: Money follows Researcher (MfR), Money follows Co-operation Line and Lead Agency Procedure.

Related to the above, Science Europe Member Organisations have been invited to sign a new 'Letter of Intent' to indicate their intention to implement MfR, where relevant. This is an agreement that can allow a researcher to take the remainder of a grant with them when moving to a new country, and is therefore a model of grant portability. Signatories commit to providing publicly-available information on how this is organised in their institution, thus improving the transparency and visibility of MfR. The Science Europe website will list participating institutions.

3.3.5. Support mobility between private and public sector

Member States have put in place various measures to boost partnerships between universities, research institutions and private companies and to better align the skills acquired with the skills needed. These include the implementation of joint projects, commercialisation programmes, research traineeships in companies, inter-sectoral mobility programmes and industrial PhD programmes. For example, the Danish Industrial PhD Programme aims to offer doctoral training in cooperation with the industry sector. It is a three-year research project and research training programme with an industrial focus conducted jointly by a private company, an industrial PhD candidate and a university. It inspired the European Parliament to fund the kick-start of the MSCA European Industrial Doctorates. The Fraunhofer Society in Germany offers doctoral candidates the possibility of pursuing a PhD in applied research in close collaboration with industry. In addition, in order to be appointed to a professorship in engineering at a university, or a professorship in any subject at a university of applied sciences, applicants need to have gained professional experience outside of academia. The University of Porto has – in cooperation with other Portuguese universities and companies – a PhD programme that is funded by a new scheme of the national funding agency to intensify university-industry collaboration.

It is important to note however that, in terms of intersectoral mobility, only 4% of PhD candidates have experience of working in private industry during their PhD[27]. The extent of moving out of public sector research into the private sector for a short period during doctoral studies or thereafter is still very much the exception, even though it is perceived as potentially beneficial for a researcher's career, access to funding and the exploitation of research results. The topic was addressed at an ERAC Mutual Learning Workshop on Human Resources and Mobility in March 2014 which put forward a series of recommendations.[28]

The European University Association (EUA) has conducted extensive work on the doctoral level, including through the DOC-CAREERS II project which looked solely at how universities work with their regional partners in doctoral education across Europe. The regional focus of the action allowed EUA to identify examples of university collaboration with local SMEs, large R&D enterprises, RTD performers, NGO's and other sectors (health care, cultural, etc.).

[27] MORE2 study
[28] http://ec.europa.eu/euraxess/pdf/research_policies/ERAC%20Final%20Report.pdf