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Science and innovation

Research, infrastructure and international collaboration

Geneva, October 18-19, 2013

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International conference

Science and innovation
Research, infrastructure and international collaboration

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Steven Pinker, "Science Is Not Your Enemy", New Republic, August 6, 2013.

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OECD Science, Technology and Industry Outlook 2012 Highlights

Short-term shocks – linked to the economic crisis – and long-term shocks – environmental, demographic and societal – have put OECD economies before unprecedented challenges. Under extremely stringent budgetary constraints, governments are mobilising all policy domains to design appropriate responses for reaching strong and sustainable growth. They must seize the opportunities offered by the Internet and global markets, as well as mobilise the main assets of their countries – human capital, knowledge capital, and creativity. In this agenda, innovation policies are given a pivotal role, which they can fulfill only if they adapt to this new context: they need relevance, coherence and inclusiveness in order to achieve efficiency and effectiveness.

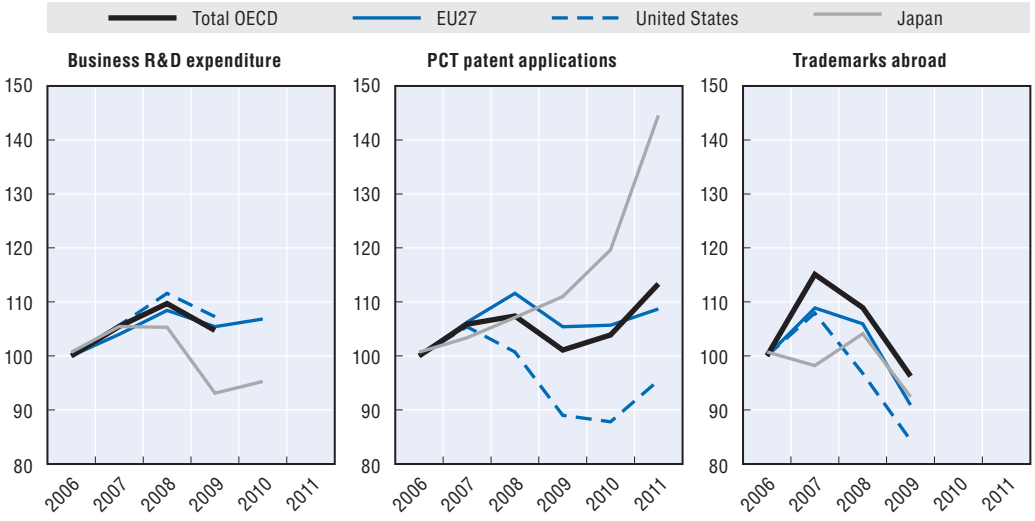
Innovation in times of crisis

The economic crisis which started in 2008 has had a significant impact on science, technology, innovation (STI) domains and policies. It has accelerated a number of trends and magnified certain challenges, most of which had already appeared prior to 2008. A re-examination of STI policies has therefore become more urgent. In this new environment some countries have adapted or have begun to adapt, while others have found it difficult to evolve. As a result, the gap between countries that grow and innovate and those that do not has been widening.

The global economic crisis immediately had a strong negative impact on innovation worldwide (Figure 1). Total OECD-area business expenditure on research and development (R&D) declined by a record 4.5% in 2009; it declined across all major OECD R&D spenders except Korea and France. In 2010 the recovery that occurred in some countries did not always imply a return to pre-2009 R&D levels. This pattern, a dip followed by partial recovery, is confirmed by indicators such as patents and trademarks. Among the countries most active in innovation, there is a striking contrast between Sweden and Finland, which have experienced a drop in terms of R&D and patents, and Korea, which has continued its fast, steady expansion.

Figure 1. **The global economic crisis had a strong negative impact on innovation worldwide**

Business R&D expenditure, PCT patent applications and trademarks abroad (index 2006 = 100), 2006-11



Source: OECD, Main Science, Technology Indicators (MSTI) Database, June 2012 and World Intellectual Property Organisation (WIPO), Statistics on the PCT system, July 2012.

StatLink http://dx.doi.org/10.1787/888932691004

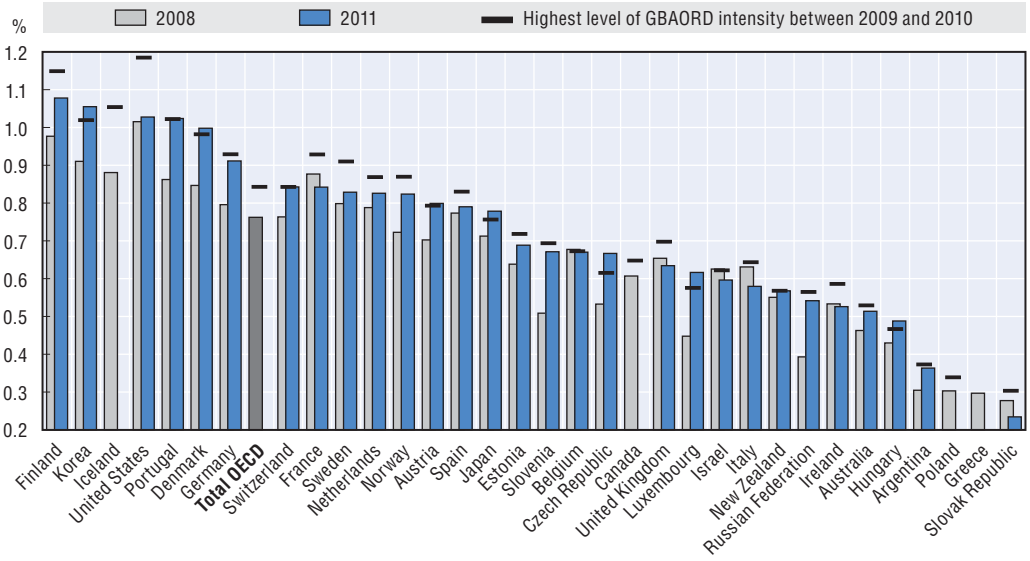
In view of current economic conditions and the rather uncertain outlook, it is likely that in most OECD countries, notably those most strongly affected by the crisis (*e.g.* some southern and eastern European countries), growth in business R&D expenditure will be quite sluggish in the foreseeable future. In countries with relatively solid framework conditions prior to the crisis and which have proved quite resilient in terms of economic growth (such as those of northern Europe and Germany), innovation activities might follow a more positive path. In countries such as France, Japan, the United Kingdom and the United States, however, the perspectives for both economic growth and innovation are more uncertain.

In 2009, the initial shock affected all categories of firms, but while the innovative activities of large multinationals, especially those in high-technology sectors, were back on track in 2010, innovative entrepreneurship has not yet returned to pre-crisis levels. In 2011, both enterprise creation and venture capital investment were still well below pre-crisis levels. Following the dramatic rise in firm failures during the crisis, the renewal of industry and the corresponding reallocation of resources have yet to make significant progress toward enhancing overall economic performance.

Government funding temporarily surged sharply in 2009 in many countries, as innovation was an important component of recovery packages (Figure 2). Government budget appropriations or outlays for R&D (GBAORD) increased by about 9% in the OECD area, with most going to infrastructure investment and to businesses (credit guarantees for small firms, refunds of R&D tax credits, public procurement, etc.). As this partly compensated the reduction in business expenditure, the decline in OECD total R&D expenditure in 2009 was not as large as it would have been otherwise. However, in 2010 and 2011, as governments' budgetary constraints became more severe, many countries substantially moderated or reduced their R&D expenditure (OECD GBAORD declined by about 4% in 2010).

Figure 2. **R&D and innovation have been an important component of recovery packages**

Government budget appropriations or outlays for R&D (GBAORD) as a % of GDP, between 2008 and 2011



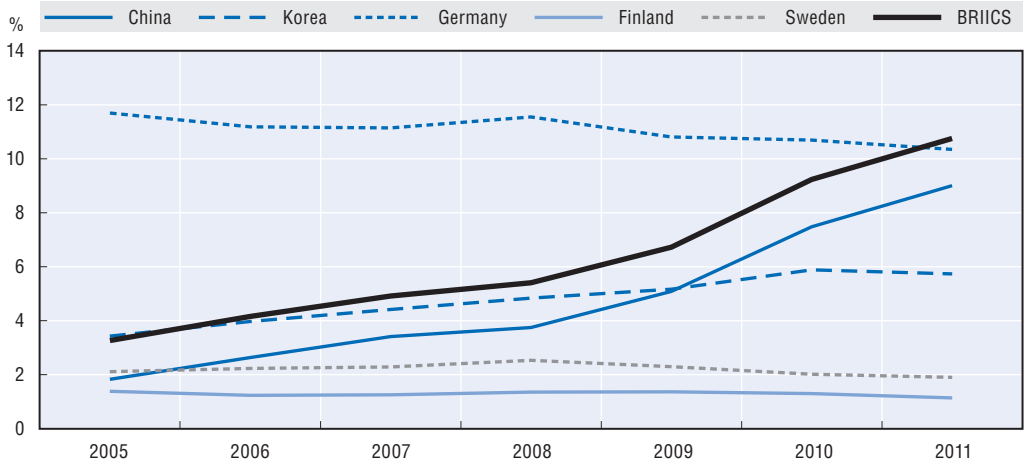
Note: Countries are ranked by descending order of GBAORD intensity in the last year for which data are available.
Source: OECD, Research and Development (RDS) Database, June 2012.

StatLink http://dx.doi.org/10.1787/888932691023

While the crisis triggered stagnation or decline in innovative activities in OECD countries, it did not have that effect in some emerging countries. China still had high GDP growth and a steady increase in innovation activities, as business R&D increased by 26% in 2009 (Figure 3). As a result, China's share in global R&D, which climbed from 7% in 2004 to 10.5% in 2008, jumped to 13% in 2009; the crisis accelerated an existing trend. At the same time, developing countries such as India and Brazil are putting innovation higher on their policy agenda.

Figure 3. **China still had a steady increase in innovation activities**

Share in world PCT patent applications, selected countries, 2005-11



Note: Counts are based on the international filing date and country of residence of the first named applicant. BRIICS include Brazil, the Russian Federation, India, Indonesia, the People's Republic of China and South Africa.
Source: World Intellectual Property Organisation (WIPO), Statistics on the PCT system, July 2012.

StatLink http://dx.doi.org/10.1787/888932691042

The changing context of STI policies

The economic crisis has affected the innovation policy agenda both in terms of objectives and instruments. Rather than leading to new objectives or instruments, however, it has changed the balance of those already in place, generally with a view to maximising their impact on economic growth and saving resources. More broadly, the current context has intensified tendencies which were already at work before: innovation policies have to be relevant (to address economic or societal goals), coherent (with each other and with other policies), and inclusive (in terms of scope and of the concerned actors).

More than ever, restoring growth and competitiveness is the main objective of innovation policies. OECD countries need more growth, not least to address the persistent sovereign debt crisis and to tackle unemployment. In knowledge-based economies innovation is a major driver of growth. Because emerging countries increasingly challenge developed countries on knowledge-intensive segments of markets, developed countries need to climb the value added ladder. This calls for innovation.

Government budgets are under pressure, as the public debt crisis has shown that market actors are reluctant to fund government deficits further. Savings need to be found, and in most countries STI budgets are not exempt from cuts. Government action must become more efficient and more effective through a rebalancing of the instruments used, changes in governance, and more extensive use of *ex ante* and *ex post* evaluation.

Policies to address societal and environmental challenges are also increasing in importance. Urgent environmental challenges include addressing climate change, moving towards green growth and tackling natural disasters. Pressing societal objectives include ageing and health. Given stringent budgetary constraints, governments are realising that innovation is needed to address these challenges in the medium to long term.

A broader view of innovation towards service activities, beyond science and technology, is also progressively pervading policies, including those concerned with public services (*e.g.* in education).

Addressing societal and global challenges

Green growth and the environment: Reducing global greenhouse gas (GHG) emissions and protecting environmental assets (clean air, water, biodiversity) call for innovation and the large-scale adoption of green technologies. Otherwise, it will be very difficult and very costly to sustain growth trajectories of the past decades while not depleting humanity's "green capital". OECD governments and emerging economies therefore view R&D activities and incentives for the diffusion and adoption of green technologies as a priority. Renewable energy programmes aim to reduce both GHG and dependency on oil (the price of which has recently risen sharply). Environment and energy feature high in the innovation strategy of most countries.

Ageing and health: Populations in most OECD countries, including in some emerging economies, are ageing, in many cases quite rapidly. An ageing workforce will likely constrain economic performance as well as increase strains on health services, long-term care systems and public finances. Science and technology, particularly ICT applications,

will play an important role in helping the elderly remain as healthy, autonomous and active as possible. The health challenge is not only confined to meeting the needs of an ageing population, but also to the needs of the whole society. Innovation is needed to develop the best science, deploy effective treatment, and contain the surging costs of treatment and equipment.

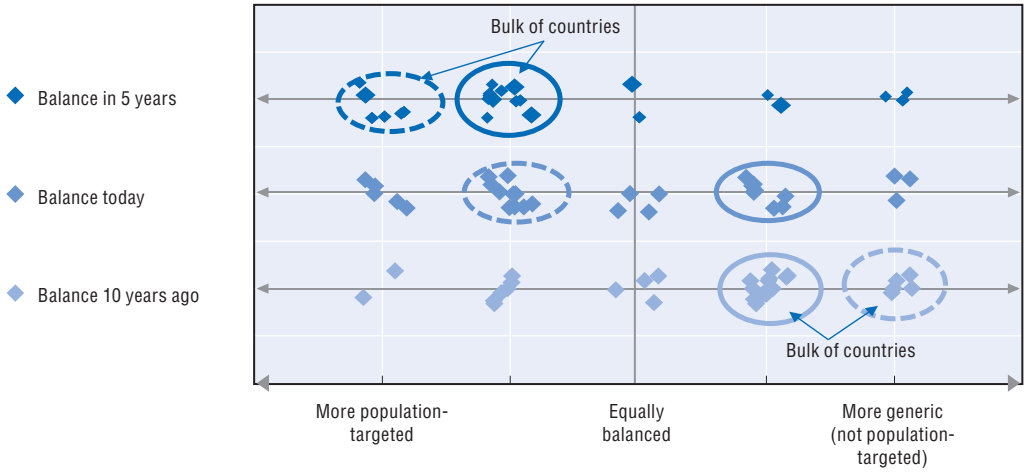
Innovation for development: Once considered the preserve of developed countries, innovation is now conducted by many emerging countries and their share of innovation worldwide is increasing. A world-class science base is not a condition for innovating. The notion of innovation encompasses much more than high technology; it includes lower technology, service industries and social innovation, all of which are needed at all levels of development. Innovation can contribute to addressing urgent challenges such as providing access to drinking water, eradicating diseases and reducing hunger. "Inclusive" innovations have a more direct impact, as they make new products more affordable for low- and medium-income households or allow the poor to modernize their often "informal" and low-productivity business.

The changing instruments of innovation policies

Instead of a radical shift, the innovation policy mix has experienced a progressive evolution by which certain instruments are being used more widely while others have been receding. In a number of countries, targeted instruments are gaining importance as compared to generic ones: this is related to the emergence of important, targeted policy themes (*e.g.* new firms, social challenges), and to the budgetary crisis, which forces governments to concentrate spending under pressure (Figure 4).

Figure 4. **Targeted innovation policy instruments are gaining ground in OECD countries**

Changing balance in the policy mix for business R&D and innovation between population-targeted and generic instruments, based on country self-assessments, 2012



Note: Population-targeted refers to instruments targeted towards specific populations, *e.g.* types of firms, SMEs or new-technology-based firms, specific sectors, etc.

Source: Country responses to the *OECD Science, Technology and Industry Outlook 2012* policy questionnaire.

StatLink http://dx.doi.org/10.1787/888932691061

Tax incentives: The general trend has been to increase the availability and simplicity of use of R&D tax incentives, which are now available in more than two-thirds of OECD countries as well as in many non-OECD countries.

Demand-side policies: Demand-side innovation policies including public procurement of innovation, standards and regulations and lead markets and user-driven innovation initiatives – are gaining ground in OECD countries. They reflect the trend in innovation policy to address the full extent of the innovation system and cycle.

Entrepreneurship: Intensified financial and structural efforts (*e.g.* removal of administrative barriers) have been implemented by many countries in the context of the economic crisis.

Clusters and "smart specialisation": Clusters bring together firms, higher education and research institutions, and other public and private entities to facilitate collaboration on complementary economic activities. "Smart specialisation" is a policy framework to help entrepreneurs and firms strengthen scientific, technological and industrial specialisation patterns while identifying and encouraging the emergence of new domains of economic and technological activity.

Patents and IP markets: Patent subject matter (software, genetic material, business methods) and patent quality have been much discussed over the past decade. Important reforms have been implemented and patent offices have focused on improving quality. Intellectual property (IP) markets seem to be on the rise including various types of transactions (licensing, sales) and actors (intermediaries, funds, etc.). Government are involved through regulation (notably antitrust) and, in certain countries, through public patent funds.

Information and communication technology (ICT) infrastructure: Governments can facilitate the establishment of high-quality infrastructure (broadband networks) and ensure that its management (pricing, etc.) is conducive to adequate use.

Raising the effectiveness of public sector research

Commercialisation of public sector research: This goal has taken on greater urgency in the aftermath of the economic crisis as public funding has become scarcer. A major tendency is the professionalisation and increasing scale of technology transfer bodies (through the regrouping of smaller ones). Spin-offs (*e.g.* in the context of incubators), contract research, and patenting and licensing remain the main instruments, together with mounting attention to open science.

Open science: As science becomes more commercialised, and as ICTs make access to knowledge technically easier, many governments want science to diffuse broadly and flow to society and the economy. This implies providing the necessary technical infrastructures (databases, etc.) and legal framework (IP).

Internationalisation: Ensuring the insertion of national actors into global knowledge networks is an important policy goal. Relevant instruments include a legal framework and financial incentives that encourage the mobility of researchers and international research co-operation to address global challenges.

Management and funding: The higher education sector in most countries continues to evolve towards a more decentralised mode of organisation, in which universities are endowed with autonomy and responsibility. This trend is consistent with a model in which research funding is based more on competitive grants than on institutional funding.

Strengthening the governance of innovation policies

The increasing variety of objectives, instruments and actors (regions, specialised agencies, public-private partnerships, etc.) requires new ways of co-ordinating innovation policies to ensure coherence of design and implementation and to maintain government control.

Recent changes in the governance of STI systems include the tendency to put specialised, partly autonomous agencies in charge of various missions (*e.g.* allocating funding to public research institutes and universities) and the emergence of regional policies that supplement national policies and boost cross-regional competition.

National STI strategies have been developed and implemented in many countries. They articulate the government's vision of STI's contribution to social and economic development and the corresponding investment and reform agendas.

STI policy evaluation has attracted policy attention recently because governments are devoting significant resources to R&D and innovation at a time of fiscal crisis. Many governments have consolidated evaluation frameworks, streamlined evaluation procedures (sometimes through the establishment of a single dedicated agency) or reinforced co-ordination of evaluation units. Some countries have worked to harmonise practices by defining common methodologies and consolidating indicators, and a few are building data infrastructures and expert communities.

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Brussels, 20.9.2013
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REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT

EUROPEAN RESEARCH AREA PROGRESS REPORT 2013

(Text with EEA relevance)

{SWD(2013) 333 final}

REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT

EUROPEAN RESEARCH AREA PROGRESS REPORT 2013

(Text with EEA relevance)

1. INTRODUCTION

ERA reforms as a strategic contribution to growth and jobs

Reforms of national research systems are at the heart of the European Research Area (ERA). More effective national research systems, together with Horizon 2020 which will be exemplary on delivering on all ERA priorities, will help to provide answers to the European societal challenges ahead. ERA reforms are even more urgent in the context of the recent economic and financial crisis which requires rapid, efficient and growth-generating solutions.

European research is key to ensure the future competitiveness of our economies and generate economic growth, as acknowledged by all Member States when adopting the 3% of GDP target of investing in research and development. While private investment in research is crucial for achieving the target, national authorities should provide for structural reforms to increase such investment. Research is an essential component of the European Semester process in which Member States identify their national budgetary and economic reforms.

As a strategic contribution to the Europe 2020 strategy[1] and notably smart growth in Europe, on 17 July 2012 the European Commission adopted the Communication on 'A Reinforced European Research Area partnership for Growth and Jobs'[2]. It called for urgent structural changes across Europe in a partnership between Member States, Stakeholder Organisations and the Commission for a timely delivery of concrete measures to increase the level of excellence of Europe's public research system.

Strong political steer is needed within the European Semester

The ERA reforms must be rooted in the governance cycle of the European semester in order to set national research policies in the broader economic context. As recognised by the Council[3], Member States are invited "*to identify the national reforms and actions needed for achieving the ERA in the context of the Innovation Union, according to their national specificities, and to present these reforms and their subsequent implementation when reporting on national ERA measures, where appropriate in the National Reform Programmes starting from the 2013 European Semester*". A strong political steer at the European Union level, involving Associated Countries where appropriate, is crucial to ensure the development of a fully functioning ERA.

The Research and Innovation landscape in Europe is diverse, featured by different institutional paths and governance structures. Member States and regions should reform their research systems according to their own strengths and national specificities. In the 2013 European Semester cycle, several Member States have already included a dedicated ERA section or referred indirectly to ERA in their National Reform Programmes (NRP).

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1 COM(2010) 2020 final

2 COM(2012)392 final

3 C 17649/12, RECH 467, COMPET 773

The ERA Communication has been endorsed by the Council[4] and welcomed by the European Parliament[5]. The need to address ERA as a '*priority objective for facilitating growth and economic, social and cultural development in the EU, as well as scientific excellence and cohesion between the Member States, regions and societies'* has also been recognised by the European Economic and Social Committee (EESC) and the Committee of the Regions (CoR).[6]

Strengthened involvement of ERA stakeholders

Research stakeholders play a decisive role in building up a strong ERA Partnership. They know best the difficulties researchers are encountering in access to, progression and conduct of scientific careers. While Member States should create the favourable policy environment for ERA to flourish, research funding organisations and research performing organisations should take responsibility for implementing ERA in their daily business.

The five European research Stakeholders' Organisations with which the Commission has signed a Joint Statement, followed by four Memoranda of Understanding and one unilateral statement, on the same day as the adoption of the ERA Communication[7], committed to call on their members to make sizeable progress in the relevant ERA priority areas by the end of 2013 and to deliver a concise Progress Report by December 2013

A stakeholder platform has been set up by the Commission to follow-up on the implementation on the commitments, exchange information and to address common issues.

The first ERA Progress Report

The ERA Progress Report 2013 presents for the first time an overview on the political context, steps taken and first achievements in the 28 Member States as well as in a number of Associated Countries[8]. The Staff Working Document accompanying this report, ERA Facts and Figures, presents factual information at both national and European level for the ERA priorities. It provides a baseline preparing an in-depth assessment of progress on ERA in 2014.

ERA structural reforms and policy making can only be based on a robust monitoring system providing accurate information on national policies and on their implementation by research funding and research performing organisations. The ERA monitoring mechanism is an evolving process which is built in close collaboration with the Member States and Stakeholder Organisations. Further improvements will be made, including on methodology and the quality of data.

2. ANALYSIS OF THE FIRST ERA PROGRESS REPORT: MAIN RESULTS AND GENERAL TRENDS

In a context of continuous pressure on national R&D budgets, ERA structural reforms should help use limited resources more efficiently and therefore maximise the return on investment in research while increasing its effectiveness at national and EU level.

EFFECTIVENESS OF NATIONAL RESEARCH SYSTEMS

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4 idem. It also pleads for "monitoring of ERA progress in close connection with the European Semester, as well as top-level steering by the Council (…)"

5 ITRE Committee 19/6/2012

6 EESC INT/662-CES2075-2012_00_00_TRA_AC and OJ 2013/C 62/4

7 EARTO, EUA, LERU, NordForsk, Science Europe. One year later, CESAER joined the Partnership by an unilateral statement

8 3 Associated Countries (Switzerland, Iceland and Norway) have been analysed on the basis of their voluntary contributions

Competitive research funding contributes to the efficiency of public money invested in research. Whether competition is ensured through open calls or by allocating funds based on performance, it induces organisational changes and enhances the quality and worldwide recognition of institutions and their researchers. The share of competitive funding and of performance based institutional funding is increasing in Europe. Likewise, a majority of Member States increasingly apply the core principles of international peer review[9] and several use foreign peer reviewers to seek greater independence in evaluations, or to raise domestic standards, while adjusting the process to the specificities of the field and national context.[10] This is also the case at European level, where international peer expertise is the core principle of funding allocation in the Framework Programmes (FPs).

While the balance between competitive and non-competitive funding is a matter of national choice, competitive funding and performance based institutional assessments should be at the core of research funding decisions in Member States, applying the core principles of international peer-review.

TRANSNATIONAL COOPERATION

Europe needs critical mass to efficiently address grand challenges and to make the best use of available resources in Europe. Joint activities allow to mobilise cross-border complementarities to avoid unnecessary duplication of efforts, to exploit synergies and to carry out large scale research that cannot be addressed by a single country.

The EU Framework Programme is the most powerful instrument supporting transnational cooperation of research teams among the Member States and Associated Countries[11]. Importantly, it also strengthens transnational coordination of national research programmes through the numerous ERA-Net coordination schemes. FP7 supported new large scale initiatives:

– 5 Article 185 Initiatives were launched, one of which involves all 28 Member States. In July 2013, the Commission proposed to amplify and strengthen them, mobilizing some 3500 M€in total, of which some 1400 M€through Horizon 2020[12] and

– 10 Joint Programming Initiatives have been launched since 2009. Five of them now have joint Strategic Research Agendas and seven of them have launched or planned joint calls.

– Furthermore a number of significant Inter-governmental Organisations play an important role in support of transnational cooperation through co-ordinating and funding research on an intra-European and international level. For instance with the strong support of their Member States, the European Inter-governmental Research Organisations[13] that are members of EIROforum, provide some of the best research infrastructures in the world. Aligning the scientific community's needs and Member States' support is a key component to the success of the EIROforum.

Several Member States' research funding agencies have bilateral or multilateral agreements or specific transnational cooperation models such as the Lead Agency procedure[14]. However, most of those initiatives are bottom up and of limited size. The Framework Programme and

9 http://ec.europa.eu/research/era/docs/en/voluntary_guidelines.pdf
10 Commission Staff Working document (CSWD)"ERA Facts and Figures", p. 14-15.
11 MS received approximately €29,4 billion and AC €2.9 billion of EC contribution in 2007-2012
12 COM(2013) 494 final
13 CERN, EFDA-JET, EMBL, ESA, ESO, ESRF, European XFEL and ILL
14 CSWD "ERA Facts and Figures", p. 17.

European Space Agency funding excluded, less than 1% of national public research and development funding is spent on transnational research in Europe, and initiatives towards increased interoperability of national research programmes are still relatively scarce[15].

In order to achieve higher impact of research with the limited public research funds available, it is essential not only to open transnational funding, but mainly to strategically align different sources of national and other funds at EU level. Some Member States have adopted national strategies taking into account the joint priorities agreed in Horizon 2020 or in the Strategic Research Agenda of the Joint Programming Initiatives in which they participate. The level of alignment is however too low to solve the major societal challenges that Europe has to face.

Member States should better align national research programmes in order to implement commonly agreed strategic research agendas in the context of joint programming. They should also improve interoperability between national programmes in order to facilitate further cross border research cooperation.

As a consequence of a joint programme by Member States, more researchers can collaborate in nationally funded transnational research activities that address major societal challenges, as is demonstrated for example in the European Energy Research Alliances of the SET Plan[16].

RESEARCH INFRASTRUCTURES

Recent mapping exercises[17] have demonstrated the large number of research infrastructures throughout Europe and have made the landscape more transparent. The ERA monitoring also shows that the conditions for cross-border access to research infrastructures are not always reported and harmonised amongst Member States.

There is a need for more transparency of the conditions for transnational access to research infrastructures.

Horizon 2020 will continue to integrate and open up key existing national research infrastructures of pan-European and regional interest to all European researchers, from both academia and industry, and to ensure their optimal use and joint development. The European Strategy Forum on Research Infrastructures (ESFRI) is a successful example of a strategic instrument to develop the scientific integration of Europe. Together, the Commission and the Member States are making progress in the implementation of the Innovation Union commitment to complete or launch, by 2015, 60% of the 48 priority infrastructures as identified in 2010 by the ESFRI. The increased use of the ERIC regulation for setting up European RIs is a good illustration of an instrument leading to more comparable governance structures and clear access conditions.

National financial commitments remain crucial to support a long term vision and participation in global research infrastructures of European interest, even more so in times of economic crisis. Almost two thirds of the Member States have developed national research infrastructure roadmaps[18], which contribute to the defragmentation of the research infrastructures landscape in Europe. There is, however, still scope for better alignment with the ESFRI roadmap. Horizon 2020 will continue to facilitate and support the preparation, implementation, long-term sustainability and efficient operation of the research infrastructures identified by ESFRI and other world-class research infrastructures.

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15 JOREP Study (Joint & Open Research European Programmes) for the European Commission, 2013

16 COM(2007) 723 final

17 e.g. Research Infrastructures in ERA, ESF member organisation forum, March 2013

18 CSWD "ERA Facts and Figures", p. 18

Member States should address financial, management and political barriers for the development and implementation of research infrastructures. They should align research infrastructures roadmaps and coordinate their development.

The European Commission will develop a Charter for cross border access to, and use of, research infrastructures in order to achieve more transparency and harmonised conditions for transnational access to research infrastructures.

OPEN LABOUR MARKET FOR RESEARCHERS

A genuinely open and attractive European labour market for researchers is an essential factor for the completion of ERA.

Open, transparent and merit-based recruitment ensures that research systems are able to select from the widest possible pool of talent, thereby generating excellence and fostering mobility. More than 200 universities and research institutes are actively engaged in the 'HR Excellence in Research' exercise, and the vast majority are reviewing their recruitment processes. The use of the EURAXESS Jobs Portal to advertise research positions across the EU also represents a substantial step forward and has helped to match supply and demand across borders. However, the principles of open recruitment extend well beyond the right to know about and apply for positions. Around 40% of EU researchers indicated that they were 'dissatisfied' with open recruitment practices at their institution. In some countries the share was more than 50%[19].

2012 saw a growth in divergence in innovation performance among Member States. In this environment, coupled with cuts to research budgets in the countries most affected by the financial crisis, open recruitment and career progression become all the more important to create the conditions for more balanced growth across Europe.

A co-ordinated effort is needed by Member States and institutions to ensure that all research positions are subject to open, transparent and merit-based recruitment practices.

Differences continue to exist between Member States concerning the portability of grants and access to national grants. Few Member States report that their national funding mechanisms provide for portability of grants. Access to national grants and fellowships is often hampered for non-residents except where such funding serves the interest of the national research system. Although several initiatives[20] have been adopted, their impact remains limited across the EU.

Member States should remove barriers preventing the implementation of access to, and portability of, national grants, and research funding organisations must intensify cooperation to facilitate the process.

Fast-track immigration can act as a decisive factor in attracting the best global talent to Europe. In March 2013, the Commission proposed a recast[21] of the 'Scientific Visa Directive' that will set clearer time limits for national authorities to decide on applications, and provide researchers with greater opportunities for mobility and access to the labour market after their stay.

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19 CSWD "ERA Facts and Figures", pp. 21-22.

20 i.e. 'Money follows Researcher' and 'Money follows Cooperation Line'

21 http://ec.europa.eu/dgs/home-affairs/e-library/documents/policies/immigration/study-or-training/docs/students_and_researchers_proposal_com_2013_151_en.pdf

Europe has relatively few researchers employed in industry while at the same time it trains an increasing number of PhDs. Although the nature of doctoral training is diversifying and more graduates embark on careers outside of academia, many are ill-prepared for the labour market.

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, notably to encompass all of the Principles for Innovative Doctoral Training, as endorsed by the Council[22]. Moreover, a number of Member States have made good use of structural funds to support the training of doctoral candidates.

Member States, research funding and research performing organisations are encouraged to promote a wider uptake of the innovative doctoral training principles, including, where appropriate, through use of the European Structural and Investment Funds.

To help widen participation in ERA, the Commission is proposing the establishment of "ERA Chairs" under Horizon2020 to support universities and other research institutions to achieve the level of research excellence required to be competitive at international level. A pilot call was launched under FP7 to which more than 100 institutions responded.

GENDER EQUALITY AND MAINSTREAMING IN RESEARCH

European research still suffers from a substantial loss, and inefficient use, of highly skilled women, and from a lack of gender dimension in research content. If the number of female PhD graduates has grown significantly in recent years in practically all sectors, women in research remain a minority and the number of women heads of institutions in the higher education sector is very low[23].

In terms of policy initiatives, the picture in Member States remains very heterogeneous. Gender equality is generally regulated at the level of overall labour market provisions. Few Member States appear to have specific provisions to ensure gender equality within their legal framework for research. In half of the Member States incentives are developed to encourage young women to embrace a scientific career and support female research careers. Fewer Member States set targets particularly for gender balance in groups and committees. Very few encourage institutions to adopt and implement Gender Equality Plans[24].

Little attention is given by Member States to the integration of the gender dimension in national research programmes, although appropriately addressing both women and men's needs, behaviours and attitudes, may enhance the quality and relevance of research and innovation outputs.

Member States should implement comprehensive strategies of structural change to overcome gender gaps in research institutions and programmes.

In FP7, the Commission has funded the setting up and implementation of gender equality plans in research performing organisations. In 2013, the ERA-NET GENDERNET will be launched to support cooperation between Member States and Associated Countries.

In Horizon 2020, the European Commission will continue supporting structural change in research institutions. Compared to FP7, gender equality and the gender dimension in research

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22 Council conclusions on the modernisation of higher education, 11/2011, http://register.consilium.europa.eu/pdf/en/11/st16/st16746.en11.pdf

23 She Figures 2012: women represent 46% of EU PhD graduates, 33% of researchers, 20% of senior academic staff; gender unbalance is more striking in decision-making, where 15.5 % of heads of institutions and 10% of rectors in HEI are women. http://ec.europa.eu/research/science-society/document_library/pdf_06/she-figures-2012_en.pdf

24 Commission SWD "ERA Facts and Figures", p.26.

and innovation content will be more systematically operationalised at the various stages of the Horizon 2020 programmes.

OPTIMAL CIRCULATION AND TRANSFER OF SCIENTIFIC KNOWLEDGE

Open access to publicly funded research results

Knowledge is essential in ERA. Publicly funded knowledge must be available for researchers and the private sector, to enhance the knowledge base, diminish regional discrepancies and promote innovative solutions to societal challenges.

Unrestricted and free of charge access to publications is backed by a growing number of universities, research centres and funding agencies across Europe. Almost all Member States have set up legal and administrative conditions in support of Open Access to publications, and some of them are also promoting Open Access to data[25].

Member States should continue deploying efforts in implementing Open Access to publications, and continue setting an adequate policy framework for Open Access to data, while taking into consideration IPR issues, notably in the case of private sector involvement in research.

Horizon 2020 is leading by example, by making Open Access to research publications mandatory for the funding of research and innovation at EU level.

Digital dimension of ERA

Digital means are essential for knowledge creation, access and transfer. Some Member States have already taken action to promote digital ERA in order to facilitate seamless online access for research resources, services and collaborations[26].

All Member States should ensure that conditions are in place to support: seamless online access to digital research services for collaboration, computing and accessing scientific information; the federation of electronic identities for researchers, which facilitates researchers' cross-border access to services and resources; and harmonised access and usage policies for e-infrastructures and digital research services in order to enable collaborations by multinational research consortia with both public and private partners.

Knowledge transfer and open innovation

Knowledge transfer is an ERA key area where governments and stakeholders are very active, considering its crucial role in the economy, notably for recovery. While these supportive efforts in Member States are commendable, national measures are still fragmented, which hampers, in turn, overall open innovation and knowledge transfer efficiency at national level[27]. Strategies which provide structure, stimulate, facilitate and as such ensure that public research contributes to open innovation and knowledge transfer, have an important role to play in the knowledge-based economy.

Member States need to further define, implement and assess national knowledge transfer strategies to deliver a structural and cultural change in the research and innovation system and as such increase the economic and social impact of research.

Science and innovation policy have become more and more interconnected. Scientific knowledge is increasingly produced in a dynamic collaborative manner, which in turn leads to

[25] Commission SWD "ERA Facts and Figures", p. 28
[26] idem p. 32
[27] idem p. 29-30