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Draft publication

Placing excellence at the centre of research and innovation policy

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EUROPEAN COMMISSION

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Placing excellence at the centre of research and innovation policy

***Innovation Union and European Research
Area (ERA) Stress Test***

February 2014

Directorate-General for Research and Innovation

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Executive Summary

Possibly more than in other parts of the world, the recent “Great Recession”¹ has taken a heavy toll in Europe: not just in terms of waste of human resources and financial means; but also in terms of growing distrust amongst EU Member States and between European citizens and EU governance. It is within this context of urgency, that this comprehensive stress test report of ERIAB has been written. It encompasses both the Innovation Union (IU) and the European Research Area (ERA) and is based on the reflections of ERIAB in light of discussions with policy makers from the Commission (DG Research and Innovation as well as other DGs) and international experts.

The starting hypothesis for ERIAB is that the policy debate needs today to refocus its primary attention on the role of private and public investments in research and innovation in contributing to long term economic growth, international competitiveness, and sustainable development and last but not least job creation. European recovery is currently at risk to entrench Europe in a low growth trajectory. The European Commission, with its significantly expanded investment programme for research and innovation over the period 2014-2020 (Horizon 2020) within the context of an overall lower EU budget, provides a good example for all Member States of a **smart** fiscal consolidation process.

In the current environment of potential economic recovery, both the ERA and IU need a renewed and full **investment commitment** from Member

¹ The term “Great Recession” has been used by economists and journalists to describe the long lasting recession that began end 2007 and lasted till 2013. The word “great” seems at first sight justified given the length and global impact of this recession comparable to the Great Depression of the 1930s.

States. In the weaker (euro-crisis) countries such investment commitment will have to go through a more effective use of social cohesion policies and the smart implementation of European structural funds (smart specialisation strategies or S3); in other countries such investment commitment needs to focus on establishing the essential complementarities between Horizon 2020 and national research and innovation policies.

However, a purely quantitative commitment to investment in research and innovation is insufficient. The quality of such investments is essential and can be best summarized by the word: **excellence**. Excellence is what matters in research *and* innovation. Excellence is what matters for participating in global science networks, for addressing societal, so-called grand challenges, for innovation and thus for industrial competitiveness. Putting excellence at the heart of research and innovation policy, including the use of structural funds (ESIF), is what will raise the efficiency and efficacy of such policies both at national, European and the world level.

Ultimately it is **international cooperation** based on research excellence which will be imperative to successfully address global challenges as climate change, energy, water and food security and urbanisation. International organisations responsible for these issues can serve as interlocutor for the European Commission. At the same time, identifying fields of specific common interest (i.e. eco-innovation, seismology, climate change impacts, risk assessment, urbanisation) of Europe and other regions of the world will increase prospects of success and mutual benefits. Taken together, focussing research and innovation on grand challenges has the potential to integrate Europe's research and innovation capacities; and to lead to more comprehensive innovation strategies, integrating research from basic science to innovations on the market and in

society. Sustaining Europe's **international research competitiveness** means also strengthening Europe's attractiveness for researchers from abroad. Again this can only be based on a long term commitment to excellence. Such commitment will increase the international participation in Horizon 2020 as well as the international flow of researchers to Europe.

The impact of the “Great Recession” on disparities in knowledge creation and absorption capacity across the European Union is striking. The emerging **innovation and knowledge divide** represents a major problem for Europe which needs to be addressed urgently. The heterogeneity of Europe's regions requires more place-based smart specialization strategies (S3) tailored for regions that reflect their absorptive capacity and regional characteristics. Less research-intensive regions should enhance the innovation capacity of domestic firms with a focus on the promotion of growth and new jobs. Prioritised investment in education and training to deliver social inclusion and an absorptive capacity for innovation outputs is essential to underpin measures to stimulate Research and Development and innovation investments in all types of regions but even more so in regions in receipt of ESIF.

Globalisation, the grand challenges and the rapid development of technology, particularly of ICT, have made the conditions for research and innovation as well as for business profoundly more complex and dynamic. To cope with this, the need for new organisational structures and **new business models** for both research and innovation as well for public administration is an absolute necessity. The Commission and the Member States need to increase their attention to this under new and existing funding programs.

While today the pressures from the financial crisis have been reduced, fundamentally, sources of capital in Europe have become more risk-averse

focussing on the need for short-term liquidity (government bonds) and short term yield (corporate bonds and infrastructure projects) rather than on longer term returns, which is the province of equity. Much of this risk-aversion stems from new regulation that has been designed to stop financial institutions from taking excessive risks. Unfortunately a 'one-size fits all' approach has created rules that incentivize, if not directly, prohibit large pools of European capital from taking risk particularly in relation to European small and medium enterprises. A final ERIAB recommendation is to increase support for European high growth enterprises (gazelles) to attract **equity rather than debt financing**; in particular from sources of capital that enable companies to remain domiciled and grow their intellectual capital in Europe.

Introduction

There is by the end of 2013, an air of economic optimism blowing through Europe. After having witnessed what some economists have called the “Great Recession”, following the 2008 global financial crisis, European economies seem today on the verge of economic recovery. Even if there is, as yet, little convincing evidence, there seems to be a broad consensus emerging amongst policy makers, both national and European, that it is now time to start refocusing on the long term structural aims of the Europe 2020 strategy². A continual focus only on fiscal consolidation will not pave the way to a successful future of Europe.

The crisis has forced Europe over the last years to address as a matter of extreme urgency many of the missing elements in its governance of the euro. This has consisted of a complex and painstaking institutional reform process set in motion over the last two years based on the realisation that a further deepening of European integration would be essential to safeguard macro-economic stability within the monetary and, more broadly economic union. Hence, the lively debates among member states' national policy makers and the European Commission (EC) over the last year about the further need for “smart” fiscal consolidation, as opposed to purely accounting fiscal consolidation; for reform of the governance of banks across Member States (MS) with the concept of a banking union alongside the monetary union taking gradual shape.

² To recall: these include raising the employment rate of the population aged 20–64 to at least 75% by 2020; achieving the target of investing 3% of GDP in R&D; reducing greenhouse gas emissions by at least 20% compared to 1990 levels, increasing the share of renewable energy in final energy consumption to 20%, and achieving a 20% increase in energy efficiency; reducing the share of early school leavers to 10% and increasing the share of the population aged 30–34 having completed tertiary education to at least 40%; reducing the number of Europeans living below national poverty lines by 25%, lifting 20 million people out of poverty.

Possibly more than in other parts of the world, the crisis has taken a heavy toll in Europe: in terms of the huge waste of human resources with currently almost 27 million unemployed of which 6 million are between the ages of 15 to 24; in terms of waste of financial means with company and business failures as well as public debt at unprecedented levels; and last but not least in terms of the emergence of growing distrust between citizens within and across European countries and regions, a growing disillusion and disenchantment with the European integration project and the longing with many citizens for national identity and national policy making³ over the remote political system of the EU.

It is within this context of urgency, that this comprehensive stress test report of ERIAB has been written. In contrast to our initial stress-test of November 2012, this comprehensive stress test now encompasses both the Innovation Union (IU) and the European Research Area (ERA). It is based on the reflections of ERIAB in light of discussions with policy makers from DG Research and Innovation (DG RTD) as well as with other DGs and international experts.

The starting hypothesis for ERIAB is that the policy debate needs now to engage with the growth policy priority accompanying current economic optimism and refocus its primary attention on the role of private and public investments in research and innovation in contributing to: long term economic growth, international competitiveness; sustainable development which includes in addition to economic aspects both an ecological and a social dimension; and last but not least job creation. European recovery is

³ Evidence based on survey analyses point to the fact that support for the EU is increasingly confined to an elite of sophisticated European citizens more knowledgeable about the EU, independently of the national contexts in which they live, whereas for most other citizens support for the EU is derived from evaluations of national politics and policy. See K. Armingeon and B. Ceka, The loss of trust in the European Union during the great recession since 2007: The role of heuristics from the national political system, *European Union Politics*, August 6, 2013.

currently exposed to the risk that Europe falls back into a low growth trajectory: satisfied with a 1 % growth and a 1% of GDP investment in R&D. At the same time, the crisis has fundamentally altered conditions. The world is very different today from what it was in 2007. Europe is, internationally as well as domestically, no longer in the same position as it was when the Europe 2020 strategy was designed. The policy debate certainly when it addresses the question on how knowledge and innovation can enhance Europe's future growth and employment cannot just consist of picking up the debate from where it was before the crisis.

Before coming up with some specific recommendations, we first review some of the most salient features of the current research and innovation environment in Europe.

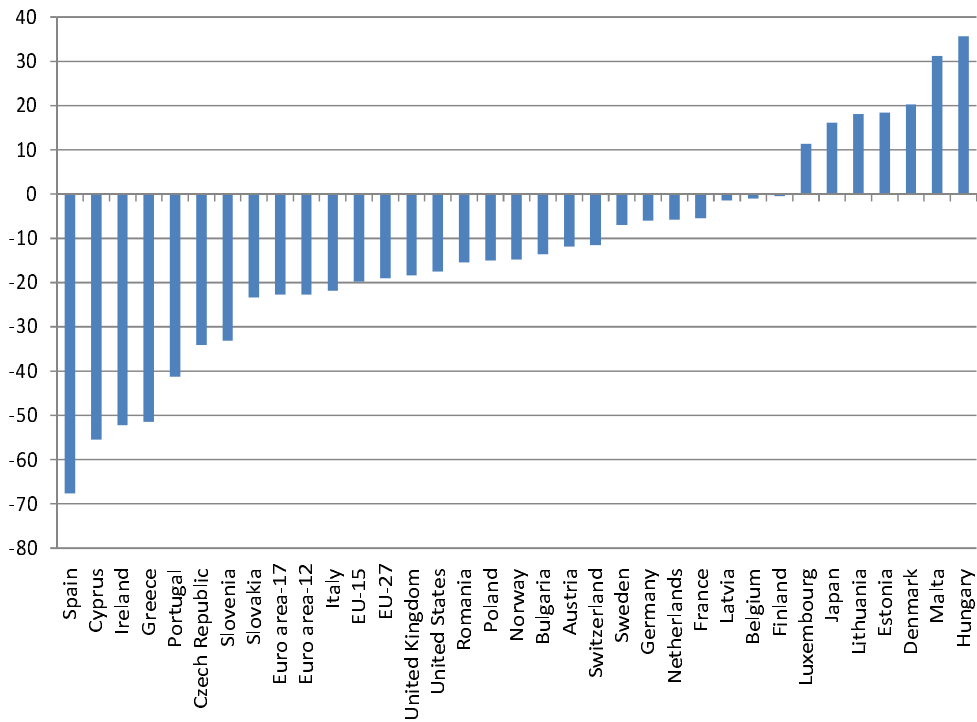
1. The challenging research and Innovation environment of the twenty tens.

The impact of the financial crisis on disparities in knowledge creation and absorption capacity across the European Union over the last five years has been striking. In retrospect, and from a national political perspective understandably, Member States under the strongest budgetary pressures appear to have 'consolidated' their public spending mostly in areas where cuts in public spending raised the least immediate opposition and which at best – in ERIAB's view at worst – affected the growth of the economy in the long term.

As the figure below illustrates, since 2009 when the financial crisis started hitting hard public deficits, public investments were dramatically cut in many European countries⁴, in particular the peripheral Eurozone crisis countries.

⁴ For completeness, the data for the US and Japan are also included in Figure 1.

Figure 1: Public gross fixed capital formation (growth rates in volumes: 2009-2013)



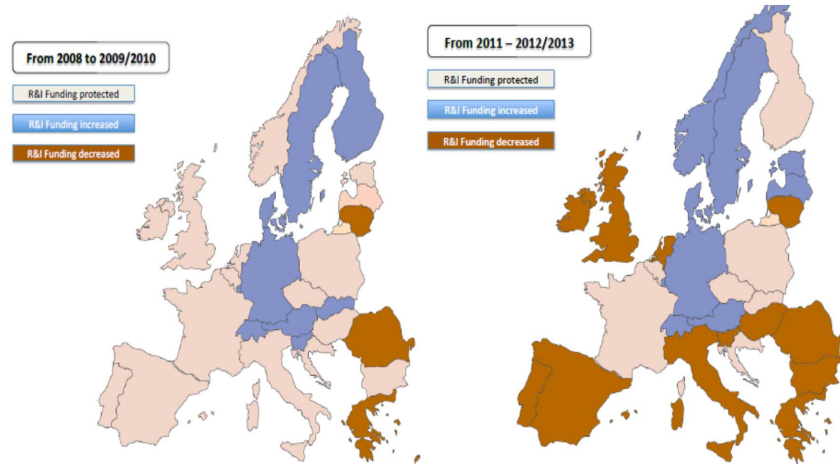
Cuts of more than 50% in Spain, Cyprus, Ireland and Greece and of more than 20% in Portugal, Czech Republic, Slovenia, Slovakia and Italy. Unfortunately, it is precisely public investment which appears the most significant indicator for explaining long term economic growth. Underlying this relationship, one finds of course public investments in research and support for innovation.

The research carried out by Technopolis and Idea Consult in support of ERIAB shed some interesting new light on recent trends in public investments in research and innovation⁵.

At the outbreak of the financial crisis in 2008 reductions in public investment in research were relatively limited. Most MS succeeded through a number of temporary support measures in keeping research activities safeguarded from major public investment reductions. However, as the recession prolonged and the toll of fiscal austerity started to spread across all public outlays, public expenditures for research and innovation support were also cut in many more MS. As illustrated in Figure 2 below from the Technopolis/Idea Consult study³, in the period 2008-2009/2010 it were only Greece, Romania and Latvia that witnessed a significant decrease, more than 10%, in their R&I budgets. However, when looking at the 2011-2012/2013 period for a much larger number of countries including now also Ireland, Portugal, Spain, Italy, Hungary, Bulgaria, Latvia, Slovenia and even the UK and the Netherlands R&I budgets turned now into a negative trend.

⁵ See: Izsak, K; Marikianidou, P.; Lukach, R.; Wastyn, A. (2013): The impact of the crisis on research and innovation policies. Study for the European Commission, DG Research and Innovation by Technopolis Group Belgium and Idea Consult, mimeo.

Figure 2: Trends in public funding to research and innovation 2008-2009/2010 and 2011-2013



Note: The calculations are based on the analysis of trends in GBAORD and in Erawatch-TrendChart funding figures and country reviews.

Cyprus: 2008-2009 R&I budget protected; Cyprus: 2011-2013 – R&I budget increased; Malta: 2008-2009 R&I budget increased; Malta: 2011-2013 – R&I budget increased

Source: Technopolis/Idea Consult: Impact of the Crisis on Research and Innovation Policies, 2013, mimeo.

Interesting from this perspective is the continuing and increasing support given to research and innovation over the whole crisis period 2009-2013 in countries such as Germany, Austria, Estonia, Denmark and Sweden (the blue coloured countries in both figures in Figure 2). In those countries, this public priority given to research and innovation support predates actually the financial crisis. It raises the question to what extent the continuous public support for research and innovation in those countries has been a significant factor behind the stronger resilience and adaptation of those economies to the “great recession”, while at the same time providing them

with a less stringent national macro-economic fiscal consolidation framework.

These diverging trends in public investments in research have also been observed in the EC's innovation indicators report, published in 2013. The report based on data for 2010 and 2011 pointed to the first signs of the emergence of an innovation, and more broadly knowledge divide. At the same time, there is now substantial evidence on the rapid growth of student migration, and of highly qualified personnel from the Southern parts of Europe to the Northern parts follows a similar trend. Furthermore, the Technopolis/Idea Consult study³ reveals that those countries where a negative net-migration occurred were the ones that decreased public spending on general human resource development most. Greece, Ireland, Latvia, Lithuania, Poland, Portugal, and Spain saw an overall decrease in public funding on human resources that amounted to more than 10% between 2008 and 2012.

Paul Collier, the British development economist, described this process as the appearance within Europe of “*submerging*” economies as opposed to the growth and catching up at the global level of “*emerging*” economies. The term “*submerging*” appears well chosen: ultimately the financial crisis has affected the long term capacity of a number of MS to invest in their knowledge creation and absorption capabilities. While the current generation in those countries is likely to be more educated than their parents' generation, the lack of employment opportunities implies that this human capital might well evaporate quickly. As is well known from labour studies, underutilized human capital is subject to obsolescence⁶.

⁶ A similar phenomenon has also been identified within the US, where a recent FED paper by Reifschneider, Wascher and Wilcox, *Aggregate Supply in the United States: Recent Developments and Implications for the Conduct of Monetary Policy* (IMF, Nov. 7-8, 2013) notes “the unusual length and severity of the Great Recession together with the fact that unemployment has been atypically concentrated among the long-term unemployed, seem likely to erode the skills

Combined with a structural declining trend in the labour force participation rate because of the ageing of the population, the high unemployment and low participation rate of youngsters is likely to negatively affect long-term productivity growth in those countries.

Confronted with such rapidly diverging long term knowledge capacities across Europe, the notions of a European Research Area (ERA) and of an Innovation Union (IU), based on the opposite principles of growth convergence and a sheer automatic catching-up process among European MS and on intra-European knowledge mobility, need to be re-assessed. Those notions, developed and implemented gradually over the last decade, were probably subject to the least Eurosceptic critique in both the European Council and European Parliament. By and large they reflected a view that national research and innovation policies were likely to benefit most from European scale and scope. Advantages accruing to certain MS (and not to others) were considered an outcome of a competitive intra-European process based purely on excellence and hence in principle complementary to national policy: a clear win-win case of subsidiarity. The much harder question to answer is to what extent autonomous national research policies would still be needed, particularly in the large number of small European MS, given the expanding European framework was rarely raised.

The result is that we have today a strong European commitment to both research and innovation with a significantly expanded new Horizon 2020 programme within the context of a decreased overall EU budget, illustrating the EC's (and EP's) strong commitment to its own pattern of

and workforce attachment of some unemployed persons. Historically, there has been much less evidence of hysteresis in US labour markets than in European ones, but... the severity and unprecedented characteristics of the recent recession suggest the possibility that the United States will not remain free of hysteresis type effects this time."

what could be called “smart fiscal consolidation” while being confronted within many MS with a declining public priority given to research. Time, hence, for some more radical reflections on the diversity of overlapping policy tools within the ERA. A diversity in policy tools illustrating not so much the growing complexity and global nature of research, but rather the geographical diversity in having access to policy support based either on national or European borders.

By contrast, in the case of European structural policies, so-called “social cohesion” policies, the policy aim focused on achieving standard of living convergence across the EU. The fact that the advantages would accrue to certain MS (and regions) and not to others, would be considered first and foremost an illustration of intra-European solidarity based, as in the case of development cooperation, on a more or less one-directional knowledge transfer. As these policies have gradually shifted towards regional innovation and knowledge capacity building, they have today in absolute volume started to outperform in many European regions, the regional capacity to match such European financial support with own investments. Here too it is time for more radical reflections on how to increase the impact and effectiveness of such policies within the framework of the Innovation Union. To address effectively these contradictory trends it is essential to bring back investment in research and innovation (whether at European, national or regional level) to the centre of Europe’s long term macro-economic policy aims. From this perspective, the “never waste a crisis” aspect of the past sovereign debt euro-crisis should include the pursuit over the remainder of this decade of **smart fiscal consolidation** policies accelerating structural, pro-growth reforms in MS.

2 ERIAB's 2013 Stress Test: putting excellence at the centre of research and innovation policy

In the initial ERIAB stress test (November 2012) of the Innovation Union, the argument was put forward to complement the concept of the European Research Area (ERA) with that of an Innovation Union (IU), as initiated by the European Commissioner Máire Geoghegan-Quinn, called for a further deepening process of European integration in new areas such as “entrepreneurship, higher education, access to (venture) capital, labour mobility, private-public sector partnerships in public sector innovation, etc.” which appeared crucial to knowledge creation and diffusion, and in particular to innovation.

In the current Stress Test we pull together those reflections and ideas within a more comprehensive framework including now both the ERA and the IU. The framework chosen focuses on three central features affecting today both research and innovation:

- First of all the resilience of the ERA and the IU with respect to the challenges of globalization affecting research and innovation;
- Second, the increasing diverging pressures on knowledge accumulation and innovation within the European Union; and
- Third, the asymmetries in the organisational challenges raised on the one hand on the supply side, particularly in relation to the ERA and the complementarities with national (regional) research policies; and on the other hand on the demand side, particularly in relation to the IU with the emergence of new business models and the process of open innovation.

2.1 Going Global: the challenge for European research and innovation

On 14 September 2012, the Commission adopted a Communication entitled '[Enhancing and focusing EU international cooperation in research and innovation: a strategic approach](#)' (COM (2012) 497). The Communication set out a new strategy for international cooperation in research and innovation, in particular with a view to implementing Horizon 2020. Doing so, research and innovation strategies reaching out beyond Europe became gradually more coherent – step by step. Yet, in line with the expectations within Horizon 2020, they should now be further and significantly increased.

Three major goals should be guiding the EU's commitment to strengthen international research and innovation cooperation beyond Europe:

- First, *international cooperation addressing grand challenges*: International scientific cooperation is imperative in order to address global challenges such as climate change, energy, water and food security and urbanisation successfully.
- Second, *international research competitiveness*: Strengthening Europe's excellence and attractiveness in research and innovation is decisive in order to remain competitive in an international environment. Avoiding brain drain to other strong research and innovation regions as well as attracting talents from all over the world will be a determining factor here.
- Third, *international economic competitiveness*: Strengthening Europe's economic competitiveness implies the support for European enterprises to become able to attract international financing and to build up corresponding networks.

Addressing these three objectives require **smart** strategies. The EU's history, its passion and future need for more international cooperation of research and innovation on the one hand and Europe's own self-interest in sustaining its international competitiveness will have to be carefully balanced.

It leads us to formulate the following broad set of recommendations:

International research and innovation cooperation is mandatory to address global challenges.

International scientific cooperation is imperative to address global challenges as climate change, energy, water and food security or urbanisation processes successfully. Focussing international research cooperation on global public goods and public interests will allow for internationally shared added values. International organisations responsible for these issues can serve as interlocutor for the EC. At the same time, identifying fields of specific common interest (i.e. eco-innovation, seismology, climate, risk assessment, climate change impacts) of Europe and other regions of the world in view of regional strategic alliances (China and the Far East, the US, the Mediterranean) will increase prospects of success and mutual benefits. Taken together, focussed research and innovation cooperation addressing grand challenges has also the potential to integrate Europe's research and innovation capacities.

Moreover, focussing research and innovation on grand challenges will ultimately lead to comprehensive innovation strategies, integrating research from basic science and technology all the way to innovations on the market and in society. Comprehensive energy research strategies

launched during the aftermath of the Fukushima incident of 2011 in many countries can be taken as examples.

These comprehensive innovation strategies will need to adopt an approach on how to drive innovation towards specific grand challenges in a global context. From the recently concluded, Research and Innovation Futures Project (RIF)⁷, the authors suggest on the basis of a plausible transformative scenario for the future, that break-through innovations with a view on the grand challenges may become possible amongst others through the inclusion of a variety of actors (public, private and civil) in a more open and flexible innovation process. Research agenda's will need to be more open-ended as the nature and our understanding of the grand challenges will be changing over time. Public bodies will need to take on the role of 'orchestrating' collaboration, or create incentives for multi-actor collaboration, to facilitate such a move and direction towards innovation. Kuhlmann *et al.* propose the use of 'tentative governance' which captures "*provisional, flexible, revisable, dynamic and open approaches that include experimentation, learning, reflexivity, and reversibility*".⁸

The nature of this 'tentative governance' reflects the nature of the grand challenges, as our understanding of the challenges is continuously changing as is the scientific and technological capacity to respond to them. A more normative approach to the matter is echoed in the emerging policy discourse on Responsible Research and Innovation (which features as a cross-cutting issue under the new EU Framework Programme for Research, Horizon 2020). This discourse highlights the requirements of policies to become anticipatory

⁷ RIF project – Research and Innovation Futures 2030: From explorative to transformative scenarios, see <http://www.rif2030.eu/>.

⁸ Kuhlmann, S., Stegmaier, P., Konrad, K., Dorbeck-Jung, B. (2012): *Tentative Governance—Conceptual Reflections and Impetus for Contributors* to a planned Special Issue of Research Policy on "Getting hold of a moving target—the tentative governance of emerging science and technology".

(with the demand to institutionalise foresight) and responsive to public values which underlie the grand challenges⁹

Increasing Europe's international research competitiveness is urgent.

Excellent research is seeking international cooperation and will be subject to fierce competition independently of particular policies. Moreover, international mobility has become a precondition for successful research careers and excellent universities are increasingly recognised by their high percentage of foreign faculty.

National and EU-authorities should increase the support for the international flow of researchers. Distinctively increasing international participation in Horizon 2020 as well as strengthening the portability of ERC grants by enlarging the proportion of time that can be spent outside of Europe can contribute to this goal. Even a system of total portability could be envisaged with specific countries – as long as symmetrical solutions offering reciprocity also regarding intellectual property rights are respected.

Benefitting from capacities of other leading research and innovation regions primarily means attracting their talents to Europe. Increasing international research competitiveness means strengthening Europe's attractiveness for researchers from abroad. Pooled Member States' money to be invested in large research facilities has the potential to foster Europe's attractiveness for researchers from abroad. Despite initiatives taken under ESFRI, Europe as a whole still fails in coordinating sufficiently research infrastructure investments on a European level.

⁹ See the contributions in: Richard Owen, John Bessant, Maggy Heintz (2013): Responsible Innovation. Managing the Responsible Emergence of Science and Innovation in Society. Chichester: Wiley and in particular Richard Owen: Responsible Research and Innovation: Option for Research and Innovation Policies in the EU, study in support of the advisory work of ERIAB

In the short run supporting research and innovation in developing countries may appear to have primarily the character of development assistance and a one-directional knowledge transfer. However, this can provide a basis for sustainable cooperation and market opportunities in the long run. To invest in developing countries of today, means investing in emerging markets of tomorrow. Thus, it appears to be particularly important to allow young researchers moving back to their developing home countries to keep their ties to Europe and thus to sustain an attractive academic network.

Europe has to become ready to cope with globalization in order to maintain international economic competitiveness.

The financial and economic crisis and particularly the reasons leading to this crisis have been taken as starting points for strengthening innovation strategies. Looking back on the first years of implementing the Innovation Union, we recognise how much has been delivered regarding strategies, financial support as well as proposals for legislative instruments. However, impact on the ground and particularly on the demand side of research and innovation has not yet materialised sufficiently. Europe's overall competitiveness has not yet substantially improved. On the contrary new competitive challenges, such as in the energy field have emerged. Europe appears from this perspective still too much inward looking and concerned about getting organised and not yet prepared to cope with globalisation with the many foreseeable, and unexpected new challenges accompanying this process.

Due to the crisis, some of the financial value chains have collapsed and the risk capital market has been shrinking – in Europe as well as in the US. Fundamentally, sources of capital in the developed world have become more risk-averse, focussing on the need for short-term liquidity

(government bonds) and increasingly short term yield (corporate bonds and infrastructure projects) rather than longer term returns, which is primarily the province of equity.

However, there is a lot of money trapped on corporate balance sheets in emerging markets due to tax systems of various countries. It has to be mobilized and attracted to Europe. Hence, strengthening Europe's economic competitiveness implies the support for European enterprises to attract international financing and to build up corresponding networks. The use of private sector managed funds of funds can provide instant access to venture capital and thus strengthen innovation.

2.2 The growing innovation and knowledge divide within Europe

As already discussed above (section 1), the emerging innovation and knowledge divide within Europe represents today a major problem which will need to be addressed urgently.

There are three main issues giving rise to concern here: the nature of the innovation divide which emerged already before the crisis; the “real economy” impact of the financial crisis which appears to have affected the long term capacity of a number of countries/regions to invest in their own knowledge creation and absorption capabilities; and third the effectiveness and resilience of the Innovation Union and the ERA which might well have to be re-assessed within the framework of a growing innovation and knowledge divide within Europe.

The following reflections/recommendations follow from the discussions within ERIAB:

The heterogeneity of Europe's regions requires place-based strategies to boost R&D investments.

Regional policies focusing on the increase of R&D investments should take into account the large diversity of European regions and the need for adopting place-based approaches. For many regions, the 3% R&D/GDP target may indicate more a necessary long term direction of development rather than a fixed and reachable target by 2020. In particular, some of the poorest regions display such low levels of R&D investment that it would be wishful thinking to expect them to come even close to the headline target within the next programming period.

Within cohesion policy it is growth and sustainable development convergence that matters not necessarily R&D convergence. Cohesion regions should focus on enhancing the innovation capacity of domestic firms rather than just creating R&D facilities.

So-called cohesion regions should in the first place focus on the promotion of growth and new jobs. Thus – as research results on the identification of potential gaps and synergies have shown – priority should be given to fostering innovation in regional enterprises and to the promotion of entrepreneurial activity instead of trying to build public regional R&D infrastructures at any rate. Furthermore, the promotion and education to entrepreneurship is not an automatic guarantee of entrepreneurial growth. The understanding of innovation should be more pragmatic and based on the recognition of existing regional potentials. The current concept of innovation being promoted and targeted in European policy is still too much dominated by high-tech activities. Broadening the definition of 'innovation' will be critical to ensure that these regions can 'buy-in' to smart growth goals in place-appropriate ways. Knowledge-and service innovation

could be suitable concepts to enhance regional innovative capacity. Exploiting the more 'bottom-up' innovative potential in Europe, potentially a significant source of growth for 'lagging regions', requires close attention and support. A place-specific and broader definition of innovation should be developed as a priority.

Building up a competitive higher education system remains, however, a top priority in many of these regions. A successful higher education system cannot survive without direct links to top level research and innovation. Instead of investing in very expensive high-tech research infrastructures, more attention should be paid to develop extensive contacts between Europe's best universities/research institutions and the universities in less developed regions. Increasing research and education contacts across Europe is of course positive but should not go in just one direction with the most talented young researchers from new MS moving ultimately to the richer parts of the EU and not returning. Pushing to enlarge the number of ERA Chairs by ESIF might represent an interesting opportunity here. We recommend further development and prioritization of widening activities like Twinning and Teaming, especially in the context of trying to bridge the otherwise growing regional innovation divide in Europe.

Ultimately investing in Europe's cohesion regions in Europe, just as investing in the developing countries of today, means investing in emerging markets of tomorrow. Thus, it appears to be particularly important to allow and facilitate young researchers to move back to their home countries to keep their ties to the more advanced regions of Europe and hence sustain an attractive academic network.

From a regional perspective, innovation absorptive capacities are absolutely key. There is a need to develop appropriate regional-based

measure(s) of absorptive capacity in order to guide appropriate area-based Smart Specialisation Strategies

Human capital is a critical element (even as the main investment focus for ESIF) that must be addressed here. Public awareness and social inclusion are mandatory for strengthening the absorptive capacity of innovation. Human capital is THE critical element and therefore ESIF should be extensively used to invest in it instead of investing only on buildings and equipment.

The new policy mix offered by Horizon 2020 and ESIF seems to be appropriate for transition regions.

Transition regions share the potential for expanding their R&D *and* innovation capacity at the same time. They should be the main target regions for the “staircase to excellence” and a smart mix of Horizon 2020 and ESIF policy instruments. These regions have the need to tap into global flows of knowledge and to strengthen all parts of the regional innovation system in order to increase the diffusion and absorption of new scientific and technological knowledge. The region specific policy mix thus needs to gear new knowledge into new products and to foster firm academic spin-offs in order to strengthen the regional base of innovative firms.

- Smart Specialisation Strategies should be considered a learning/evolutionary process with mid-term check points to allow a dynamic process/strategy.
- Horizontal coordination at region/MS and inter-DGs levels will be required to facilitate mixed funding approaches where appropriate.

- Public procurement should be utilised as a driver for area-based innovation and solutions.

More developed regions may benefit in particular from KETs based policy actions.

Regional smart specialisation strategies may provide for the more developed regions adequate means of contributing to the EU ambitions on smart growth in terms of R&D expenditure. Currently, there are a number of high-performing KETs based economic clusters in parts of Europe characterised by specialised facilities and critical mass of actors. These should be supported to enable them to compete globally. However, there should not be an expectation that all parts of Europe would promote KETs-based economic activities as a source of future growth. Targeted actions for these specific parts of the European space must be developed and implemented with this in mind.

Innovation oriented competence development needs to complement measures to stimulate R&D and innovation investments in all types of regions.

Regional innovation capacity does not exclusively stem from strong investments in research and development. Education and training are equally important to enhance the absorptive capacities of enterprises for innovations and to broaden the regional knowledge base. Thus the role of universities and other (public) research organisations/institutes appears critical in encouraging and supporting the innovation agenda in Europe. Education and training should be part of the innovation policy mix in all regions. Such education and training should not be limited to the young generation, but involve actively local communities to create an "innovation

attentive" environment, thus laying the foundation for social inclusion. The specific focus may vary between the different types of regions: while transition regions could benefit most from an increase of the regional knowledge base, less developed regions could take most out of targeted entrepreneurial training actions fostering firm formation rates and contributing to the growth of the local population of enterprises.

Reduced administrative burdens are needed to attract and mobilise firms to regional innovation policy actions.

One of the main obstacles for successful participation of firms in innovation projects in the current structural funds programming period is the existence of high administrative burdens. Thus regulatory complexity can put, as experiences from regional funding agencies show, severe constraint to regional innovation policy programming. This applies generally to all projects funded under Structural Funds regulations, especially when State aid is involved, but in particular also to innovation projects, which due to their complex, risky character and lack of tangible outputs do not fit very well into the current regulatory environment. As detailed funding rules for ESIF will be under the command of member states there is for the next programming period again an inherent risk of "gilding" simplified EU rules. Thus it will be essential to ensure that simplified EU rules will actually materialise at the level of regions implementing ESIF measures.

Regional/national policy coordination will need to improve significantly to allow for synergies between Horizon2020 and Cohesion Funds

The aspired synergies between Horizon 2020 and ESIF do imply a strongly increased need for smart policy coordination as policy interactions may reach down to project level. As experience from recent RIS3 development

processes has shown this will be a very challenging task for all member states and regions. New smart governance models will be needed at national and regional level to cope with the new possibilities that funding rules will allow in the upcoming programming period. Adequate organisational development efforts will be needed to overcome existing administrative silos and to break down barriers between the administrative entities involved. Particular attention should thus be paid to the provision of specific EU support for capacity building and training. In addition support could be given by external experts and peers from other regions to accompany the organisational development processes.

- In addition the following general observations can be presented: Innovation (SSS) strategies need to be differentiated and tailored for regions that reflect their absorptive capacity and regional characteristics (spanning the mix of product service process innovations).
- There is a need for improved socio-economic data at a regional level to inform policy development.
- New business models are now required to effectively monitor and evaluate publically funded research & innovation systems.

2.3 New organisation/business models in research and innovation

Already in the 2012 ERIAB stress test attention was drawn to the way information and communication technologies (ICTs) have dramatically altered the exchange of knowledge globally; the internal and external organisation of research; the scope of national versus international spill-over effects; the locational advantages and more broadly the role of national and regional innovation policy making, to name only a few of the changes observed. As we put it last year: in so far as national and regional

innovation policies are rooted in the vision that the domestic or “local” efficiency/productivity problems are of an internal structural nature, such competitiveness visions have become increasingly challenged by the way ICTs have broken down nationally and internationally, the distinctions between high and low tech sectors. The policy challenge is now how to deal with the increasing fragmentation of value chains and the increasing heterogeneity of required knowledge inputs. This requires strong international cooperation in research and a stronger focus on the deployment of ICT based technologies.

The fragmentation of value chains creates similar scale impacts on both the organisation of research and the way in which innovation takes place. In both cases it is the shift from simple Internet technologies to WEB 2 whereby information processes are being organized differently and new usages emerge based on individual and/or collective end-user involvement. Doing so the whole world has become a potential source of networking, sharing, accessing and producing information with the emergence of new ways of data mining: e.g. mining elements of tacit knowledge such as experience sharing, social bookmarking, etc. that were not undertaken until very recent times. These changes have dramatically transformed the way both research and innovation are carried out today. This holds for science and research institutions, business enterprises as well as public administration.

Below, we briefly discuss each one of those.

2.3.1 Science 2.0

The transformation described above has led to a number of relatively radical changes affecting the way research is being carried out today, also

referred to as Science 2.0¹⁰. The most significant features can be summarized as follows:

- An explosion of scientific institutions in the 'old science and research centres' and in 'new knowledge centres' as part of the globalisation of science. China but also India plays here a central role having today already the biggest STEM student population, and being likely to have in the near future a larger research population than Europe or the US. Overall at the world level, there are today operational the largest amount of active scientist ever, which also implies a huge need for platforms to make a career, to publish etc. Some 11,000 articles were submitted to Nature in 2012, of which 800 were accepted. As in Science the acceptance rate is below 10%.
- The need for science to come up with quicker solutions for grand challenges, pushing the scientific process to deliver faster. The pressure from an increase of input into the system (people and problems) looking for output (publications and solutions) is probably the biggest driver behind the changes observed. "Cheap" ICT/web2 technologies facilitate this. Digital natives (i.e. all new students and researchers) will by default not resist but will feel increasingly blocked by the older generation of scientists with old, but often obsolete reputations¹¹.
- Research on "grand challenges" is itself confronted with the complexity of the challenge; the required inter-disciplinarity in achieving knowledge development; and the need for further knowledge development to build

¹⁰ See amongst others; Jean-Claude Burgelman, David Osimo, Marc Bogdanowicz, Science 2.0 (Change will happen...), *First Monday*, July 5th, 2010, Vol 15:7.

¹¹ See a.o. Soete, L. Science in the global participatory knowledge society, Dies Natalis lecture, January 10th, 2014, <http://www.maastrichtuniversity.nl/web/Main/AboutUM/Events/DiesNatalis2014ALoveStory.htm>

up extremely large data sets, whereby data will always be scarce because specific to context, time and /or use. Yet, the massive exchange of data at the global level, offers today also opportunities for a “scaling up” of the serendipity effect¹², reflected in amongst others new scientific and technological breakthroughs and disruptive innovations. At the same time, the development of machine learning and data mining software is today so developed that the analysis of large data sets is not just particularly useful from a scientific perspective but also relevant to researchers as “innovators”. A run of a data algorithm can deliver a paper in Nature, it can also form the basis of a new company.

- All this has important (policy) implications for the organisation of the scientific process and for scientific institutions. Let us list a few without trying to give an immediate answer on each of those.
 - The up-scaling of serendipity at a global level.
 - The growing demand for research integrity and accountability of science and research within societies.
 - The change in the nature of publishing is challenging existing metrics with respect to the scientific impact of research output.
 - The development of new careers paths and reputation systems questions existing methods of scientific reputation.
 - The explosion of data and scientific actors are driving towards a Science 2.0 mode of operation, yet have an impact on the entire research cycle, from the inception of research proposals to publications and contributes to the rise of open innovation. These raise a list of rather fundamental questions as to the method and organisation of science. We only list here some:

¹² See Osimo, D. and K. Szkuta, Science 2.0: discussing the best available evidence, 23rd January 2013

- The shift in scientific method driven by high availability of data and the possibility to crowd source the basic analysis of data through citizen science.
- The production and evaluation of scientific outputs will change and will have, therefore, among others, an impact on existing institutions of science (research organisations, research councils, universities, building up curricula etc.).
- New players as scientific publishers will emerge in the value chain with open access journals and traditional scientific publishers will try to change their business models.
- Bringing science closer to society raises questions about the funding of citizen science projects.

2.3.2 Innovation 2.0

Over the recent decade the business environment has evolved to one with profoundly more complex industry dynamics and to some extent fading industry boundaries. Today the basis of competition is capabilities and knowledge. Technology, especially ICT, has radically altered the requirements for building and managing a successful business. Value creation across industries is increasingly based on combinations where various technologies are bundled together with intangible value creation and new business models. There are many examples of where new ground breaking products/services have needed new innovative business models before becoming commercially successful. There are also examples where existing technology have been used in combination with new business models to create a commercial successful case. Also the whole field of manufacturing requires adoption of new business models that are more responsive to swings in demands or input costs and faster product cycles. In view of successful service- and business model innovations (BMI), it is important to realize that a number key enabling competences are important drivers of innovation and then of course to promote those. Knowledge

development on a broad basis, including technologies, economics, social science and behavioural and management sciences is thus needed. Open innovation environments governed by a holistic approach can be one of the keys to success.

It is also important to point out that the role of new business models in driving innovation is not only confined to the business sector but is equally important for the public domain, public procurement can here play a crucial role. However, utilization of public procurement as a way of driving innovation also needs to have a larger focus on e.g. services. One can also anticipate that solutions to many of the grand challenges lies not only in developing new technology but also to get the results adopted as much as possible and thus generating maximum benefit to society.

Service innovation in itself holds an enormous potential that simply cannot be ignored by Europe. New emerging business models are predominantly service based, outsourcing trends create a constant demand for services, the Internet is opening up new opportunities to capture value from services on a global scale, consumers have more time to spend on leisure-time services, the aging population has spending power and there is a growing need for services in general. Opportunities to capture value from service innovation are almost endless. Besides economic gains, innovative services play a vital role in tackling societal challenges and environmental issues throughout Europe. Significant development of service innovation support activities has happened on a national level but, there is still work to be done to make full use of the potential particularly on a European level.

Is the IU structured to meet these challenges? Compared to the readiness to address other challenges where the solution lies in finding answers to questions originating from the search for new knowledge or from a clear demand in society the answer is no. More is needed.

ERIAB's Recommendations include:

The Commission and the Member States should develop a stronger evidence base for service innovation and business model innovation policies.

This will require the systematic development of metrics, tools, methodologies and systems for monitoring, evaluating and conducting an impact analysis. This work should recognise the systemic and social dimensions of service- and business model innovation, especially within the context of addressing societal challenges. There is a need for directed research efforts that addresses business models and services in relation to innovation strategies, organisational structures and technological and non-technological innovations should be treated equally. To make a long term effect also these subjects needs to a larger extent to be included in the educational system.

The Commission should enhance service-innovation policy by integrating demand- and supply-side policy instruments.

European Innovation Platforms and other forums for defining and monitoring the implementation of a high-level policy agenda can play an important role in this process.

The upcoming calls in Horizon 2020 need to in at least two of the three main pillars address both services and BMI

In addition, competitions and awards can be an effective way to increase the awareness of and interest in service innovation and innovative business models. The Commission should consider establishing European

competitions or awards recognising service innovation and innovative business models.

2.3.3 New public administration models

Many theoretical and empirical studies reveal the guiding principles of how public administrations work: based on the rule of law, within clearly defined (mostly annual) budgets and organized hierarchically under the responsibility of an elected political body.

The management approach of New Public Management introduced in Europe in the beginning of the 1990's did not change these key principles; they still remain valid. However, the way public administrations work internally has been further developed. The traditional input and cost based steering of public administrations has largely been replaced by output- and impact oriented management systems – hand in hand with global budgets instead of detailed budget lines. As a consequence, reporting and controlling is not limited to finances anymore but include discussions on achievements with regards to output and impact. These systemic changes followed the overall goal to enhance effectiveness and efficiency of public action and to allow more objective based cooperation of administrative entities. The new way of public management works perfectly well within hierarchical structures, as many evaluations show. Public administrations have learned to make use of their enhanced managerial freedom to achieve their objectives more effectively and more efficiently. Moreover, they increasingly outsource tasks in order to benefit from working principles of the corporate sector.

However, questions remain. The hierarchical structures of public administrations still hamper cooperation between different administrative entities. Moreover, successfully managing hybrid organizations as public

private partnerships still poses a lot of questions. And finally we are facing the fact, that the interface of public administrations and political decision making has not yet been adapted to meet the needs of cross cutting political issues. The acceleration of change together with increasing interdependencies and a growing complexity of political issues and so called “wicked problems” increases the challenge of responding – be it by mitigation, adaptation or innovation.

In other words:

We are in need of new business models also in the public sector.

A redesign of political decision making and of the way we work at the interface of science, society and the corporate sector will be decisive.

2.3.4 Equity versus debt

As illustrated in this last case, business model or public administration innovation almost always requires collaboration between customers and suppliers, and/or their channel partners. It involves shifting risk and investment between parties. Experimentation, testing and fine-tuning therefore requires access to capital. Existing companies or public administrations provide such funds from a cash generating part of their business/activities as part of their core investment in the future. New companies on the other hand have to rely on external capital from governments, business angels or venture capitalists to support their experimentation until a new business model is proven. Hence, while funding per se is not a bottleneck in BMI, the ability of a company to sustain losses while it gets its business model refined, is a major constraint on the length of time an innovative SME can experiment.

In particular, a new business model could be proven on a small scale, but the new company demonstrating it may not yet have achieved the scale of turnover and margin to cover the investment in sales and marketing and overheads that is needed to grow the company to global success and profitability. This 'late stage venture' opportunity is funded well and widely in the US market but is systematically underfunded in Europe.

Part of the reason for the underfunding of 'late stage venture' is the over reliance by European governments, financial institutions and smaller companies on debt instruments. Young, high growth companies (in the US a category called 'gazelles') need to invest to grow, and hence incur losses. These losses are incompatible with debt funding, particularly from banks. The young companies need equity at several stages to support their growth – but this is in limited supply in Europe – at the later stages of venture, at the growth stage, at pre-IPO and at IPO itself.

The consequence of these breaks in the 'equity value chain' is that the innovative SME in Europe, and its shareholders must either 'sell out early', to capture some value from their original idea and investment; or 'migrate the company to the US' where later stage venture capital, and subsequent IPO capital is more readily available. In either scenario, the original high risk investment in innovation is only modestly rewarded and the subsequent job creation and skill development that the innovative company enables happens outside of Europe.

While today, at the end of 2013, the severe cyclical pressure from the financial crisis have been reduced, fundamentally, sources of capital in Europe have become risk-averse, focussing on the need for short-term liquidity (government bonds) and increasingly short term yield (corporate bonds and infrastructure projects) rather than longer term returns, which is the province of equity. Much of this risk-aversion stems from new

regulation that is designed to stop our financial institutions from taking excess risk – namely Solvency II (insurers), CRD IV and Basel III (banks) and pending pension legislation. Unfortunately a ‘one-size fits all’ approach has created rules that incentivize, if not directly, prohibit large pools of European capital from taking risk on smaller European enterprises.

Meanwhile, the rest of the world is awash with liquidity. Sovereign wealth funds have built up in profitable nations have hundreds of billions of assets; corporations have built up cash reserves which are trapped on corporate balance sheets outside their home markets (particularly ex-US) due to tax systems of various countries. Attracting a small amount of this cash to Europe, and particularly in ‘equity instruments’ rather than debt could transform the risk capital markets could transform the prospects for European ‘gazelles’.

Our concluding key recommendation is to increase support for European high growth enterprises (gazelles) to attract ‘equity’ financing rather than ‘debt’ financing

Equity in particular from sources of capital that enable companies to remain domiciled and grow the company’s intellectual capital in Europe. This could be done in a number of ways, two of which are outlined below:

- *Attract capital from outside Europe to invest in European gazelles:* Use a proportion of the 2.77Bn financial instrument allocation in Horizon 2020 to catalyse the formation of public/private partnerships (funds of funds) which focus exclusively on funding European focussed venture and growth capital funds. The aim would be to target those who invest capital directly into companies (primary investment) as opposed to purchasing shares to rejuvenate companies (secondary or buy-out investment).

- *Encourage a small allocation of capital from European financial institutions to gazelles:* This recommendation could be implemented similar to the US ERISA changes of 1983 that kick-started the US venture industry. Carve out and reduce the capital adequacy requirements for institutional capital from banks, insurers and pension funds which is invested in funds managed by EuVeca qualifying managers who themselves invest in primary rather than secondary capital.

Annex I: EUROPEAN RESEARCH AND INNOVATION AREA BOARD (ERIAB)

The European Research and Innovation Area Board (ERIAB) was established in 2012 in order to have independent advice for DG Research and Innovation on Research and Innovation Policy. ERIAB's work focuses on the Innovation Union's policies and the completion of the European Research Area.

MEMBERS

Prof. Luc SOETE–*Chair*, Rector of Maastricht University, (NL)

Dr. Barbara HAERING – *Co-Chair*, Chief Executive of Econcept Inc., Zürich, (CH)

Prof. Hans-Jörg BULINGER– *Co-Chair*, Former President Fraunhofer Gesellschaft, München, (DE)

Ms. Manuela ARATA– President of the Genoa Science Festival, (IT)

Prof. Genevieve BERGER- Chief Research and Development Officer at Unilever, London, (UK)

Prof. Anna Czlonkowska – Second Department of Neurology, Institute of Psychiatry and Neurology, Warsaw, (PL)

Ms. Anne GLOVER – Chief Executive of Amadeus Capital Partners Ltd., London, (UK)

Dr. Peter HEFFERNAN – Chief Executive of Marine Institute, Galway, (IE)

Prof. Toivo MAIMETS– Director, Institute of Molecular and Cell Biology, University of Tartu, Tartu, (EE)

Dr. Jan-Erik SUNDGREN –Senior Adviser to the CEO, Volvo Group,
Göteborg,(SE)

Prof. John WOOD – Secretary General, Association of Commonwealth
Universities, London,(UK)

TASKS

(a) to advise the European Commission on European Research Area Issues, to provide recommendations on priorities and actions and in particular on how to increase the innovation impact and to evaluate the relevant part of Innovation Union Flagship initiatives on a continuous basis;

(b) to deliver opinions on the development and realisation of the European Research Area and the Innovation Union at the request of the Commission, or on the Board's own initiative;

(c) to provide the Commission with an annual report on the development of the European Research Area and of the Innovation Union;

(d) to reflect on new trends in the European Research Area and the Innovation Union.

ERIAB identified issues to be tackled in the course of the review of the European Research Area and the Innovation Union. These issues are summarised in Annex II. The current stress-test does not cover all issues in full detail. Therefore, the table provides an overview for possible review-work for the future.

Annex II: Overview Matrix of the Comprehensive ERA and IU Stress-test

	2. Going Global	3. Innovation Divide	6. Demand Side
Innovation Union	<ul style="list-style-type: none"> • Impact of the crisis: prioritisation of public spending • internationalization and increasing fragmentation of value chains • on which issues to compete/cooperate at international level, or build strategic alliance • responsible innovation in international context (diverging/converging standards) 	<ul style="list-style-type: none"> • Structural funds: how can they be used for innovation policy? (Capacity building etc). • Smart specialization • Quality of public spending 	<ul style="list-style-type: none"> • Innovation in business models and open innovation • Public procurement and public sector innovation • Public Private Partnership • Regulatory framework • Funding of disruptive/high risk innovative projects • EIP's
	1. Going Global	4. Knowledge Divide	5. Supply Side
ERA	<ul style="list-style-type: none"> • Reinforce the alignment between national and EU funding • International cooperation • Research infrastructures (e.g. ESFRI, ITER) • Science diplomacy • Grand challenges in international perspective • ERC as Global Research Council or new institutions (as current Global Research Council) 	<ul style="list-style-type: none"> • Excellence vs. cohesion: is ERA sustainable in the long run if it will not lead to social cohesion • Fragmentation of the creation of knowledge • Effectiveness of the national research (funding) system 	<ul style="list-style-type: none"> • Attractiveness for talents • Creating 1 million jobs in Research • Lack of common standards for education, influence on mobility • Dissemination (Science in Society)

