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Research Area

Preparing Europe for a New Renaissance

A Strategic View of the European Research Area

First Report of the European Research Area Board – 2009

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A new resolution: to make the European Research Area a byword for creativity, excellence and efficiency – and the catalyst for a new Renaissance in the way we think, act and research globally.

FOREWORD BY JANEZ POTOČNIK

At the first meeting of the new European Research Area Board (ERAB) I emphasized that there was a need for a paradigm shift in the way Europe undertakes research and that I looked to ERAB to provide advice on how this may be achieved. I thus warmly welcome their first report, produced within a year of their formation, which is a visionary strategy for what the European Research Area should aspire to. The ERA is not just a political concept; it has to be a reality to deliver solutions for the future of all our citizens and for the future of the world as we know it. Future generations will see this as a pivotal moment and the penalties for ignoring what is before us are immense. There are uncomfortable challenges facing us and it is vital that we take notice of them. ERAB are right to see that both publicly and privately funded research is one of the main foundations for seeking solutions to these grand challenges. Yet the report acknowledges that excellent research in a number of disciplines needs to be brought together to advise the political process. The words ‘excellence’, ‘openness’ and ‘mobility’ are recurrent themes in the report and these virtues need to be firmly held when political expedience and local issues are at stake. We cannot bury our heads in the sand and one of the key messages of the report is that both researchers and society at large need to be fully engaged with and realize the consequences of the wider challenges facing us.

This holistic thinking and approach epitomized the first ‘Renaissance’, where scholars and artists

moved relatively freely around Europe among the centres of learning and culture. While this privilege was the domain of a few at that time, it should be our ambition, in the new ‘Renaissance’, that this should be the expectation of all citizens, especially in the field of research and innovation.

The report does not seek to dictate detailed solutions at this stage, but rather to highlight what the ERA will look like in the future if it is fit for purpose in achieving its aims. As we move into the second decade of the ERA, it is essential that we raise our ambitions for what can be done through a properly functioning ERA.

This report will likely stimulate new discussions on how national programmes are combined successfully with those that are best done on a wider base, whether as part of the ERA or of a wider global effort. Barriers are already breaking down with the impact of remote research in virtual research environments and the rapid developments in social networking. This is a time of tremendous transition in the way researchers and their supporters undertake their work within an increasingly open culture. This is a time of great opportunity that will involve high risks. Not to do anything would be the greatest risk and therefore we need to look closely at how European-funded research and innovation can best be managed so that risk taking is encouraged. Alongside this will be the need for light touch accountability coupled with a strict code of behaviour that holds researchers to society’s account.

Photo European Parliament



**‘This is a time of great opportunity that will
involve high risks.’**

Janez Potočnik, European Commissioner for Science and Research

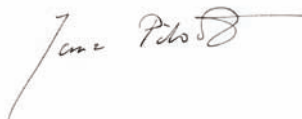
ERAB also highlights the need for an independent voice of research ultimately linked into the political process and which speaks on behalf of Europe, gives independent advice, serves as a focal point for societal engagement and provides an analysis of the impact of possible future scenarios. It is essential that political decisions are based on available evidence and knowledge, and this question certainly deserves attention in the future.

Finally, we cannot avoid the problem of imbalance in research opportunities and expectations within the ERA between various Member States. This issue has to be dealt with separately from the pursuit of excellence and world-class research. Measures to assist all Member States to train and attract the best researchers have to be addressed if the movement of people and the general lifting of standards and ambitions are to be achieved. This means that the role and functioning of universities and other research providers needs urgent attention. In addition, the opportunities that already exist for participation in global large-scale infra-

structures have to be grasped. How these are managed and funded is of vital importance if we are to see the growth of excellence without stagnation.

ERAB are now continuing to look in detail at some of the core issues of this report and they are now committed to producing a series of position papers that will address how this current strategic vision could be realized.

The challenges before us require a paradigm shift in thinking. This is the time for the new 'Renaissance' persons to grasp the opportunities before them.

A handwritten signature in black ink, reading "Janez Potočnik". The signature is written in a cursive style with a long horizontal line extending to the right.

Janez Potočnik
Commissioner for Science & Research

EXECUTIVE SUMMARY

Our world is changing. We face mounting challenges: of global warming, scarce water, energy shortages and healthcare, to name a few. Their solution will require new ideas, discoveries, talents and innovations – the fruits of research. To achieve them, we must start by changing the way we do research. We must reorganize, to create a truly open European Research Area marked by free movement of people and ideas. We must rethink the way science interacts with politics and society, so our governance is based on best-available evidence. We must rewrite the social contract between the researcher and society, so that freedom of thought is balanced by responsibility for action. We must open our markets, our companies and our knowledge institutions so they work together more productively. Above all, we must create an environment in which the best ideas thrive, the brightest people prosper, and our excellence is rewarded – while at the same time improving the cohesion of our society.

These are big demands, and imply fundamental change in the way we think, work and research – indeed, change as great as any in our history. We call this change a ‘new Renaissance’, deliberately invoking the memory of a comparable revolution in thought, society and science.

In this, the first annual report of the European Research Area Board, we lay out a broad view of

what we need to do in order to accomplish this Renaissance. As a ‘vision’ paper, it aims high; it paints a picture, in broad strokes, of where we think the European Research Area needs to go by 2030 – for the sake of the EU, and of the world at large. It identifies six broad areas in which we believe action must be taken:

- the creation of a united ERA
- the solution of our Grand Challenges
- the interaction of science and society
- the collaboration of public and private sectors in open innovation
- the encouragement of excellence, and,
- the promotion of cohesion.

We set milestones by which we can measure our progress in the years ahead. And in coming months, we will be elaborating on these six points in our research, communications and meetings with key stakeholders of the ERA.

But above all, as an independent board named to advise on the progress of the ERA, we launch this urgent appeal: If we succeed in creating a truly open environment for research and innovation to flourish across the ERA, we will fulfil our obligations to catalyze the new Renaissance and improve our species’ chances of survival. If we do not, if we fragment into competing disciplines, industries, nations and regions, we will miss our historic responsibility to Europe and the world.

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A 'new Renaissance'

As we move towards nine billion people on one planet, many of our familiar patterns of society will have to change. Too many people will have to share too few resources. Today, a third of the world's population is underfed; by 2025, on present trends, three billion people will lack adequate water supplies.¹ Growing problems – of climate change, healthcare, sustainability – must be solved. The impact of globalisation on our livelihoods and on the quality of our lives will deepen. These are difficult issues, which will force us to develop new ways of living, acting and thinking.

Research and innovation will be cornerstones of this new era; and, together with new regulations and fiscal frameworks, they will be our greatest asset for addressing these challenges with respect for future generations. New, sustainable energy sources will have to be devised that do not destroy our planet. New medicines, therapies and methods of prevention have to be developed to make appropriate and affordable healthcare available to all. New communications technologies and virtual ways to interact will be needed for clashing cultures to grow towards better understanding and to build durable foundations for peace. We will see new products, new services, new industries, new jobs and potentially new ways of living emerging. New economic models will be required to manage it all. Research in the social sciences and the humanities will be at least as important to our future as the physical or engineering sciences.

This is within the realm of the possible, and will provide new opportunities for growth, jobs and progress. Within our own lifetimes we have seen how science and technology, when allied with political will, can help improve our lives dramatically. Since 1990, the probability of an average child on this planet dying before the age of five has dropped by about 25%.² Literacy is rising while poverty, at least until recently, has been falling. Agricultural productivity, energy exploitation and communications technologies deemed impossible just a generation ago are now routine.

As we consider these challenges, we seek parallels in history. In the European Renaissance of the 15th and 16th centuries, new ideas in agriculture, commerce

ERAB now calls for a ‘new Renaissance’, a paradigm shift in how we think, live and interact together, as well as a paradigm shift in what the role and place of science should be.

The ERA is necessary

Action required by 2030 on 6 fundamental themes

The European Research Area comprises many people and institutions – but unless they work together, in a borderless marketplace for talents and ideas, they will be ineffectual.

We are concerned by the fractured state of the ERA today: still too much driven by inward-looking national priorities, too much centralism and sub-optimal institutional and legal frameworks. In view of the challenges our planet and Europe face, we must act, and act now. Otherwise, Europe will not only become marginalized in a global market, but will fail to contribute to solving our greatest challenges. As a result, bold leadership along six policy themes is needed to achieve a fully functioning ERA by 2030:

1. A united ERA to permit ideas and people to move freely across a dynamic and open society.
2. An ERA driven by societal needs to address the ‘Grand Challenges’, such as climate change, energy supply, water resources, ageing societies, healthcare and sustainable prosperity for all.
3. An ERA based on a shared responsibility between science, policy and society, where public policy is based on evidence and underpinned by a ‘new social contract’ between science and society that emphasizes responsibility for action as well as freedom of thought.
4. An ERA of open innovation between all public and private stakeholders so as to strengthen our research base and our economy.
5. An ERA to deliver excellence where risk-taking in research, regardless of its public or private origin, will be the guiding principle for the ERA policy.
6. An ERA of cohesion across the continent to allow all European research actors to take part in the knowledge-based society.

Our growing technological dependency, our problematic relationship with the effects of globalisation, our mounting demand on finite resources – all of these are occurring together and will force social, economic and political change.

and governance brought greater prosperity, which in turn fostered the arts. Trade with the Near and Far East opened minds. The very notion of scientific method emerged in this period, led by Copernicus, Kepler, Galileo, Vesalius and others. Likewise scientific libraries began appearing; and what we today recognize as scientific disciplines started to form in astronomy, anatomy, botany and mechanics. New technical skills emerged in architecture, printing, shipbuilding and farming. These new insights and skills shook the established order and laid the groundwork for the prosperity brought by the Industrial Revolution, and our own age of the Knowledge Economy.

Today we see the need for a similar paradigm shift, which we call a ‘new Renaissance’. Our growing technological dependency, our problematic relationship with the effects of globalisation, our mounting demand on finite resources – all of these are occurring together and will force social, economic and political change. We cannot yet see the precise contours of that change. But we can see that it will have to be as profound, as great, as the transition half a millennium ago from an agrarian to an industrial society. Fighting climate change, to pick just one of the grand challenges on the horizon, will require as much effort in terms of changing our ways of living and working globally as it required the Middle Ages to get rid of feudalism. And just as in that ‘first’ European Renaissance, we now need new ways of thinking, to enlighten new solutions. The good news is that this too is emerging: already, what were once discrete disciplines are crossing over. Biology, computing and chemistry merge into systems biology, to understand the most elemental bodily functions. Meteorology, chemistry and physics combine to model the climate, and avert disaster. A science of complexity is emerging, treating interdependent, data-intensive systems of which we see the first fruits in the MRI scanners or the Internet – with the latter, we can literally see a new approach to virtual research crossing national boundaries.

That is why ERAB now calls for a ‘new Renaissance’, **a paradigm shift in how we think, live and interact together, as well as a paradigm shift in what the**

role and place of science should be. A new, holistic way of thinking is required as technological answers alone are not the end-solution to a given problem. Science and research have to look at the systemic effect of any action rather than merely the localized gain. We need to develop better tools to predict trends, to supply evidence for decisions. We need to train a broadly educated citizenry, better able to participate in public debate on the benefits and risks of research and technology. At present, barely one in four – just 23% – of adults in the EU have achieved tertiary education³. We need to provide an ERA-wide marketplace for innovation that is free, open to all comers, and characterized by a more harmonious partnership between the public and private sector. We will need to harness our talent much better to solve the Grand Challenges of our age, in concert with researchers around the globe. We need to create an environment that permits risk-taking and rewards excellence – while still emphasizing the individual's responsibility to society at large, and the cohesiveness of the ERA overall. Above all, we need to restore trust between science and society, with a new social contract based on the '3 Rs': **rigour** in decision-making, political or scientific; **respect** for our fellow man, scientist and the environment; and **responsibility** for our own actions as scientist and as citizens.

We need to restore trust between science and society, with a new social contract based on the '3 Rs': rigour in decision-making, political or scientific; respect for our fellow man, scientist and the environment; and responsibility for our own actions as scientist and as citizens.

If there is concerted action to develop its strengths in a global research area, Europe will be able to play a key role in this new Renaissance. The European Research Area, a vision introduced in 2000 to express the concept of a common market for ideas, technologies and researchers, still has some way to go. Making it real will mean Europe enjoys a continent-wide common market to nurture and reward our best ideas, our most talented citizens – in short, our excellence. If not, Europe's relevance in the world will shrink. Indeed, this is happening already. As other regions of the world step up their R&D investments, the EU's relative importance to world innovation is slipping: its global share of patent applications, for instance, has dropped 14% over the past six years. That this happens is in itself unavoidable, given the rise of new powerhouses in science and research such as India and China. It does, however, impel us to keep our science and research system at the cutting edge. The good news

is that we have the resources of talent and ideas required. We have, for instance, over 4,000 institutions of higher education in the EU, with 17 million students, 1.5 million staff – producing, for example, nearly a million mathematics, science and technology graduates a year.⁴

Ours is a broad view. As an advisory body, we have a mandate to sketch a view of Europe’s future in research, and to suggest ways to achieve it. In this document, we set out that view – of the relationship between research and society, between public and private sector, between the parts of Europe and the whole, and between Europe and the world. We believe it an important contribution to our common future to stimulate thought and action on these two basic questions: *Where do we want to go, and how do we get there?*

¹ European Commission, DG Research. ‘The World in 2025: Rising Asia and Socio-ecological Transition: Reflection Paper.’ 5 January 2009.

² UNICEF. State of the World’s Children 2009.
<http://www.unicef.org/sowc09/statistics/tables.php>.

³ DG Research, European Commission (2009). ‘A more research-intensive and integrated European Research Area.’ Science, Technology and Competitiveness, key figures report 2008/2009.

⁴ Ibid, DG Research (2009)

‘Where there is no vision, the people perish.’

(Proverbs 29:18)

The way forward – 6 fundamentals

‘Europe will not be made all at once, or according to a single plan. It will be built through concrete achievements which first create a de facto solidarity.’

Robert Schuman

How to catalyze this new Renaissance?

Europe’s strength today is in the diversity of its people and cultures, while at the same time it is the third-largest population bloc in the world, after China and India. Europe has great research traditions, famous universities and great thinkers. With our democratic traditions and caring society, our diversity offers new ways to solve problems. Largely due to past EU programmes, we have made great progress in collaborating with one another. The 6th Framework Programme, for example, involved some 74,000 participants. There are also many outstanding research collaborations operating outside the EU framework. Our oft-criticized emphasis on the public sector has, in the current economic turmoil, been shown to be a plus.

But Europe’s problems are also significant. Our research universities, though often prestigious, are underfunded: in 2002 the EU spent 1.1% of GDP on higher education, compared with 2.6% in the US.⁵ Mobility of researchers is hampered by outdated tenure, pension and social security systems. Much research is done in ‘splendid isolation’ due to rigid university structures and the predominance of national priorities. We have a crowd of innovation clusters – more than 2,000⁶ – but many are too small to matter economically or scientifically at the global level. For 30 years we have been unable to agree on a common EU patent system; the annual cost of duplication of effort in the courts alone has been estimated to rise, on current trends, to between 148 million euro and 289 million euro by 2013.⁷ A multinational trying to site a new research facility in the ERA, or a small university spin-off trying to expand beyond home, encounters a patchwork of conflicting national regulations and tax regimes. A fundamental cultural problem holds us back: in most of Europe, failure in research or business is seen as a badge of shame rather than a certificate of education, a step on the way to future success. Until our institutions

and decision makers learn to accept risk, they will not inspire success. Above all, our untapped reservoir of talented young people, especially in the newer Member States, is probably our greatest underexploited asset.

Commission R&D funding comprises less than 5% of total public research spending in the EU, and less than 2% of total R&D spending, public and private. Its flagship R&D programmes are increasingly criticized for having acquired too much bureaucratic baggage; this must be corrected. The European Research Council is seen as a model for global, competition-based excellence. The recently launched European Institute of Innovation and Technology and the Joint Technology Initiatives look promising.⁸ National efforts at university reform are also in progress, but are slow and in many cases under-ambitious. So although there is some movement in the right direction, much more is needed to allow researchers to get on with their jobs; they need greater freedom from bureaucracy.

So, much remains to be done to make a new Renaissance by 2030 possible.

ERAB proposes to concentrate policy on six fundamental pillars of the ERA by 2030. For each of them we suggest milestones indicating progress.

⁵ European Commission (2006). 'Delivering on the Modernisation Agenda for Universities: Education, Research and Innovation,' Communication from the Commission. COM(2006) 208 final, 10 May 2006.

⁶ Ibid, European Commission (2006).

⁷ Harhoff, Dietmar. 'Challenges Affecting the Use and Enforcement of Intellectual Property Rights.' Report for the Forum on the Economic Value of Intellectual Property, UK Intellectual Property Office, 10 June 2009.

⁸ A compilation of recent policy initiatives can be found at: European Commission. 'The European Research Area Partnership, 2008 Initiatives.' http://ec.europa.eu/research/era/pdf/era-partnership-2008-initiatives_en.pdf

1. A united ERA

...to permit ideas and people to move freely across a dynamic and open society.

Since 1957, with the signing of the Euratom treaty, cooperation on research has been a concrete achievement of the EU – a force for peace and growth. Today, Europe faces mounting economic difficulties, and a consequent fascination with leaders and policies that put the immediate, local interest first and the longer-term common interest second. ERAB warns against emerging research nationalism and advocates that unless we complete a common market in research and innovation, unless we make the European Research Area a fully functioning reality, our progress will stagnate.

The ERA Milestones

We will know the ERA is a united market for research in 2030 when we see:

- The EU's share of ERA-wide public, non-military research funding doubles to 10%.
- A significant increase in the coordination of scientific research grant programmes across the ERA, to at least 10% of funding from a very low base today.
- Mobility triples, with up to 20% of EU doctoral candidates working outside their home country.
- The fiscal regime for R&D and innovation incentives is optimized across the EU.

A united ERA is a place where there will be no barriers to either researchers or ideas moving freely from country to country, private to public sector (and vice versa), or between disciplines. The ‘fifth freedom’ – the freedom of knowledge across borders within the EU – will become integrated into the existing rights, guaranteed by Treaty, of people, capital, services and goods to move freely. An open, ERA-wide network, online, will provide a simple clearing house to promote ideas and find technologies across borders; networking and visualisation tools will make collaboration easier and cheaper. Open competition between researchers, institutions and systems will be the ERA rule. Whether for a grant, research contract, professorship or appointment, all may apply and the best will win – and those in less attractive institutions may ‘vote with their feet’ and move to wherever they judge the opportunities for success to be greater. A young researcher will be able to earn a degree in one country and easily move to another to work and teach; indeed, a growing population of researchers will earn PhDs with a truly European dimension, obtained by working in more than one Member State (‘Euro-PhDs’).⁹ An industrial researcher will be able to bring his or her managerial knowledge into an academic setting, or lead a public research institute, and vice versa. Mobility will be the rule, not the exception.

By 2030 an open, fair market for innovation will pull new ideas, talent and investment from around the world. Enshrined in community law will be a common, inexpensive system for protecting intellectual property, on the principle of open sharing of pre-competitive knowledge and strong protection for competitive innovations. Enlightened public procurement policies, combined with standardisation and smart regulation, will help stimulate demand for emerging technologies. State aid rules for research will be clarified. Tax incentives for R&D, and for investment in innovative companies, will be harmonized across Europe so that risk-capital can flow to wherever business logic dictates rather than to wherever rival administrations create temporary havens. We realize

this is politically sensitive, given the way Member States guard their fiscal independence; nevertheless, it is time for action.¹⁰

We must think globally, be competitive globally, and be sensitive to local needs. E-science tools that link our researchers, businesses, investors, politicians and the general public to one another and to the rest of the world will help. We must train our students to think and manage internationally. And Europe needs to see China, India, the US and other parts of the R&D world as partners in a global research area, not threats. Our universities must attract the brightest brains from around the world, and our markets the best-of-class competitors; a global research space requires 'brain circulation'. Thanks to our expertise in transnational projects within Europe, we are home to ever-more international research facilities, the keystones of new, global scientific bridges. A 2006 roadmap for infrastructure projects agreed by all Member States is a bold statement of intent in this respect and we need to realize as many of them as quickly as possible.¹¹

⁹ In 2005, 6.9% of doctoral candidates were ERA-nationals studying in another ERA country. DG Research (2009.)

¹⁰ In 2005, indirect fiscal incentives for R&D ranged from 0.05% of GDP to 0.1% - a 20-fold range. OECD, STI Outlook 2008, March 2008.

¹¹ European Strategy Forum on Research Infrastructures. 'European Roadmap for Research Infrastructures. Report 2006.' <http://cordis.europa.eu/esfri/roadmap.htm>

A united ERA is a place where there will be no barriers to either researchers or ideas moving freely from country to country, private to public sector (and vice versa), or between disciplines.

2. An ERA driven by societal needs

... to address the ‘Grand Challenges’, such as climate change, energy supply, water resources, ageing, healthcare and sustainable prosperity for all.

Never before in history have we had so large a technical workforce, working on so many different kinds of problems. That is fortunate, because never before have we had so difficult a set of problems, the solution of which will determine our very survival.

Climate change is frightening – but Europe has already shown political leadership in international action and in experimenting in market incentives to fight it. But now our decision makers are to move beyond grand words and

The ERA Milestones

We will know the ERA is driven by societal problems in 2030 when we see:

- **A third of public, non-military research is geared to grand societal challenges, with a multi-disciplinary approach.**
- **30% of all scientists, including humanities and social sciences, are trained in research fields relevant to the Grand Challenges.**
- **Multi-disciplinary academic training is generalized to educate our research community into the complexity of the Grand Challenges, without diminishing the importance of discipline-based expertise.**
- **The tools of ‘e-science’ are deployed throughout the ERA, permitting international collaboration so that all researchers will see themselves as part of the global research system.**

into concrete mitigation measures: new technologies for alternative energies, energy conservation, transport systems and sustainability demand a holistic research approach from the start. As part of the ERA, we must organize our research and institutions to deliver solutions; new agencies, and specialized research institutes with a focus on project management, are needed to hasten the work. But public funding can only catalyze this; private capital is needed to achieve economy-wide results. And for that, the basic framework of the ERA as an open, united marketplace is fundamental.

Our research community, and thus the ERA, is part of the global research environment facing common problems. The ideal of the university as ivory tower has toppled, and is being replaced by an image of the open, digitally networked, knowledge institution working in collaboration with industry and society. We will develop new university structures to permit the multi-disciplinarity on which the greatest new insights will depend – to break away from our inward-looking regional, institutional or disciplinary cultures so as to be able to address the complexity of the Grand Challenges. We expect to see some further clustering of universities to gain leadership in one or more fields.

From the past we know that technological solutions alone do not solve the problems we face. Over the next generation, economic and behavioural research must therefore help us devise better ways to manage the economy, regulate markets, measure prosperity and live in a more responsible way. New medical research must improve our healthcare systems and prevent, rather than merely treat, the suffering and expense of illness in an aging population. Sustainability, in chemistry, energy, transport and all forms of industry, is needed; indeed, research itself should be sustainable. Research in the humanities and social sciences will help us find the way to re-organize our lives and cultures to adapt and thrive. Indeed, Europe's strength in the humanities and social sciences, drawing upon its rich cultural heritage, may prove its greatest contribution to our global challenges.

**... never before
have we had so
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very survival.**

3. An ERA based on a shared responsibility between science, policy and society

...where public policy is based on evidence and underpinned by a 'new social contract' between science and society that emphasizes responsibility for action as well as freedom of thought.

As both publicly and privately funded science advances, its importance to our economy and culture will rise; if only by osmosis, public knowledge of technology and risk will also rise, as will the perceived need for policy makers to

The ERA Milestones

We will know the ERA is a shared responsibility in 2030 when we see:

- The EU has a fully functioning, independent Chief Scientific Advisor, supporting its decision-making with the best available evidence, horizon-scanning and future scenario planning.
- A more educated citizenry is trained in science and technology issues to be able to participate in policy debate.
- All outputs of public, non-military funded research will be available via 'open access' to all concerned and interested.
- Half of all scientists and research policy makers, across all disciplines and at all levels of the science system, are women.
- The EU spends up to three times as much as in 2005 on its higher education, or 3.3 % of GDP.
- A universal code of scientific ethics is adopted by the whole European research community, enunciating social responsibilities as well as intellectual freedoms.

understand them. The gulf is as wide as ever between those undertaking research and innovation, and both politicians and the general public. This must be tackled if trust in new innovation is to be gained. The speed of innovation will increase and this acceleration of change will pose additional challenges for our societies. We therefore must increase our awareness of the extent to which scientific and technical innovations affect social and economic processes. It is also important to be proactive to plan future scenarios. We therefore have to scan the horizon to define emerging grand challenges or societal needs and see what science and technology could contribute to address them. Our complex societies need scientific research to support long-term evidence-based decision-making in society. To achieve this it is necessary to have a professional, systematic and continuous process of forward-looking activities. To guarantee a need-based approach the various users of these horizon scans should be involved as well. We need a chief scientific/innovation advisor who can speak with authority on behalf of the EU. We need a ‘people exchange’ so researchers and policy makers can spend time in each other’s worlds. In short, we also need more people with scientific backgrounds embedded within the political process at all stages.

In order to gain a greater trust between science and society, we need a new ‘social contract’ between them that emphasizes not just the researcher’s freedom of thought but also the responsibility of scientific action. We have learned that every powerful new technology can have bad as well as good consequences, and researchers can no longer ignore the ensuing political debate over how their discoveries will be used. The scientific innovations we need to address the Grand Challenges will create opportunities we can barely envision today. If, for example, insights in life sciences are coupled with information and communication technologies on a nanometre scale, the world of artificial intelligence will expand in new dimensions. Scientific excellence, therefore, must be paired with social awareness and responsibility. Integrating ethical, social, and economic dimensions will make scientific endeavours even more valuable and relevant to society. At the same time, however, there should be a code of conduct for policy makers – standards for respecting fact and the product of research.

Integrating ethical, social, and economic dimensions will make scientific endeavours even more valuable and relevant to society.

All this requires a more enlightened populace – and that means researchers must become better at and more eager about explaining what they do. Communications training must become part of standard research training. A communications plan should be a prerequisite for research grant applications; it is no longer enough for ‘dissemination of results’ to use the classic channels (journals, websites) only. Where there is disagreement about the outcomes of research, the public must be able to interrogate the data meaningfully. And so school curricula must improve; it is hard to believe that, within the EU in 2003, 20% of 15-year-olds were classified as attaining only the lowest level of literacy.¹² Diversity of gender and ethnicity must rise, to reflect society at large: Only 32% of our scientists and engineers are women at present¹³, and instruments need to be in place for all scientists to adjust work-life balance. Science must and will be seen throughout society as valuable, modern and attractive.

¹² European Commission. ‘Progress towards the Lisbon objectives in education and training.’ Commission Staff Working Document. SEC(2006) 639. 16 May 2006.

¹³ Ibid, DG Research (2009).

Science must and will be seen throughout society as valuable, modern and attractive.

4. An ERA of open innovation

...between all public and private stakeholders so as to strengthen our research base and our economy.

At present, there is an imbalance in the ERA between public and private sector innovation. Simply put, business in the EU spends too little on research – 1% of GDP compared with 1.69% in the US and 2.62% in Japan.¹⁴ Private risk capital is also scarce: Europe generates only a third the capital the US has with

The ERA Milestones

We will know the ERA is a common market and thriving place for open innovation in 2030 when we see:

- A pan-European ‘Open Innovation’ charter is signed by all major stakeholders.
- A pan-European label, ‘Open Knowledge Institution’, for higher education and research acts as a gold standard for excellence in innovation in the ERA.
- Overall R&D funding rises to 5% of GDP, of which industrial R&D accounts for 2/3.
- 2% of public procurement ERA-wide is earmarked for innovative and pre-commercial technologies, and is open to European-wide competition.
- Mobility of researchers between the public and private sector is high, and industrial funding of academic research accounts for 1/3 of the overall research budget.
- Risk capital available for early-stage technology development triples, to 0.15% of GDP.

regard to private investment for early-stage technology development (0.05% of GDP, vs. 0.147%).¹⁵ The walls between industry and academia are still too high; mobility of staff between them is low. This then affects the ecosystem for innovation – in every part of the world, a delicate symbiosis between public research and private development. Tales of Europe’s past failures at innovation are tired but true. Yet the problem runs deeper than simple communications between private and public sector alone: we need a robust whole-business model for researchers and industrialists and an integrated innovation system in order to strengthen our ‘put-through’ capacities.

Reform starts with the ‘open knowledge institution’. This is a model of the university, research institute or vocational centre of the future: open to industry, politics and society at large. Knowledge, resources and people flow in and out of the campus and industry. These institutions must be autonomous from government, with the power to set budget, seek funding, set priorities and attract talent. University career structures must change, so that excellence, not time served, is the criterion for advancement in research. Universities should not shrink from rewarding those that concentrate on teaching since they will inspire future generations in their subject. Funding must become more varied and trans-national, based on the need of the challenge rather than the requirements of a preconceived programme. A system whereby each member contributes to a central fund based on GDP would boost public investment. More private funding is also needed. For that, we need new incentives – for instance, tax credits for donations to qualified research universities and institutes. And looking beyond universities, research institutes offer an important benefit: professional project-management and a goal-oriented focus. They should be closely linked to our universities and to industry as part of the open innovation environment to permit easy movement of researchers and ideas.

Private-sector R&D – or rather, the environment in which it operates – must also change. The private sector already spends the equivalent of 1% of EU GDP on R&D, and our pressing social, environmental and economic needs justify a tripling by 2030. But how to facilitate that?

**‘Open innovation’
is key to a fruitful
public-private
partnership in
the ERA.**

‘Open innovation’ is key to a fruitful public-private partnership in the ERA. The term has specific meaning in management theories: a directed system of collaborative R&D between a company and its network of suppliers, university partners, associated small companies and customers.¹⁶ However, we mean it in a broader sense – that the entire system for getting ideas from lab to market in Europe, from input to output, must be open to all players. At present, an array of barriers impedes this free exchange of capital and ideas. Conflicting fiscal policies, from Member State to Member State, fragment the risk-capital markets and make it harder to fund high-risk technology start-ups; they also skew investment decisions by large companies. The lack of a coherent intellectual property system raises costs and magnifies risk. Our innovation clusters are under-sized. Funding – needed to build the research facilities, schools and social amenities that make a cluster attractive – is scattered and uncoordinated. In short, we need a genuine ‘single market’ for innovation in Europe.

We also need to experiment in new forms of public-private partnership – for instance, with the state directing its resources to creating market opportunities that the private sector can grasp. Example: At present, public procurement amounts to 16% of EU gross domestic product; if just 2% of that were earmarked to buy frontier civilian technologies – solar cells with 100-fold efficiency gains, or e-health systems that halve administrative costs and medical errors – the impact on society and the economy would be enormous. We urge faster action on the recommendations of the so-called Aho Report¹⁷ of 2006: To stimulate demand for emerging technologies that we, as society, deem important for our future, the EU should be creating ERA-wide ‘lead markets’ – a term for a coherent set of standards, regulations, procurement policies and other measures that stimulate demand for hard-to-launch emerging technologies.

¹⁴ Ibid, DG Research (2009). By comparison, government spending in the three regions is fairly similar, at 0.63% of GDP for the EU, 0.76% for the US and 0.55% for Japan. Adding other funding sources, total R&D intensity in 2006 was 1.83%, 2.61% and 3.39%, respectively.

¹⁵ European Investment Fund. Technology Transfer Accelerator (TTA), Final Report. September 2005.

¹⁶ Henry Chesbrough, *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Boston: Harvard Business School Press, 2003, ISBN: 1-57851-837-7.

¹⁷ Aho, Esko *et al.* ‘Creating an Innovative Europe.’ Report of the Independent Expert Group on R&D and Innovation appointed following the Hampton Court Summit. January 2006.

5. An ERA to deliver excellence

...where risk-taking in research, regardless of its public or private origin, will be the guiding principle for ERA policy.

To lead the new Renaissance, the ERA must be a beacon of excellence visible across the world.

Though the global market for science and technology expands, competition does, too – and Europe has a quality problem. In academia, for example, the EU produces 33% of global research papers and has 34% of the papers most often cited by other researchers. But the US is far more influential, producing 29% of papers and earning 42% of citations.¹⁸ European universities tell

ERA Milestones

We will know the ERA is a place of excellence in 2030 when we see:

- 50% of EC research funding is going to frontier, high-risk research and development.
- Europe increases its share of top-ranked universities up to 40% of the top-20 and top-100 rankings and increases its most-cited research world wide by a third.
- Funding for public, non-military research is increasingly concentrated in research-intensive institutions.
- At least 50 of our innovation clusters, out of about 2,000 clusters large and small today, are world leaders in scale and quality.
- The governance system for European research funding will be based on a set of arms-length agencies, as part of an 'ERA of Agencies'.

a similar story: by one widely quoted (and oft-disputed) ranking system, Europe has 33 universities in the world's top 100 – but just two, Cambridge and Oxford, in the top 20.¹⁹ Our share of scientific Nobel Prizes has been declining over the past generation. And all the while, China and India have been rising in global research prominence. In fact, it's humbling to look at how small Europe actually is: today, 80% of researchers, 75% of research investment, and 69% patent applications happen *outside* the EU.²⁰

Striving for excellence is the only choice Europe has. When large international companies look where to site a research facility, they look not only for major markets, but also for a strong research and competence base. Yet to date, our research and education funding policies have ignored the fact that proximity of competences matters. That implies some politically unpalatable choices. Not all Member States can have top-20 universities. However, in this age of e-science all facilities can be accessed from anywhere. There needs to be courage in picking the best institutes or researchers and there needs to be even more courage to develop a more-rigorous review process for funding and a methodology to support that process. We need to foster an expectation of excellence at all levels and distinguish excellence in basic research from excellence in innovation and exploitation.

The changing internal dynamics of science challenge the way we reward excellence. 'E-science' transforms how researchers gather data, store them, search them, share them and publish them. Efficiency rises and simulation becomes routine. Science 2.0 is already a term coined, by analogy to the social networking methods of Web 2.0, to describe this new scientific revolution. At the same time, the provenance and curation of data is already becoming a major issue. The questions, 'Who holds the truth in a virtual research environment?' and, 'How to determine excellence in an environment of abundance (of data, researchers, publication outlets, etc.)' imply an ever-greater need for an ethical charter that binds researchers to a common set of principles.

The EU institutions can play a unique role in striving for excellence. European-wide competition enhances the quality of research – and the bigger the

contest, the better the winner. The European Research Council points the way. Its grant competitions attract the best and brightest from across the EU; even applicants it rejects are of such high quality that they rapidly find alternative funding, thanks to the prominence accorded by the ERC screening. This is the ideal mechanism: the EU institutions become the ‘gold standard’ to which all may aspire, but only the best succeed. We hope this model will extend to the newly created European Institute of Innovation and Technology, and see it could be replicated in other EU research programmes, such as for large-scale research infrastructure.

A new governance model for arms-length agencies to deliver research and innovation in Europe is essential for our global position. This ‘ERA of agencies’ will reorient EU research funding into specialized, goal-oriented and excellence-based bodies, but will only deliver excellence provided these agencies are not strangled by a one-size-fits all central bureaucracy.

¹⁸ US National Science Foundation, Science & Engineering Indicators, 2008. Analysed in Veugelers, Reinhilde: ‘Towards a multi-polar science world,’ Science Business, November 2008,

¹⁹ Center for World-Class Universities, Shanghai Jiao Tong University. ‘Academic Ranking of World Universities 2008.’

²⁰ Ibid, DG Research (2009).

A new governance model for arms-length agencies to deliver research and innovation in Europe is essential for our global position.

6. An ERA of cohesion

...across the continent to allow all European research actors to take part in the knowledge economy.

Now we come full circle: we began with a call for a united ERA, and end with its larger significance. Since the 1950s, the European project has been a brick-by-brick, law-by-law construction site – from coal, steel and atoms, to agriculture, products and services. At the core of this ‘grand project’ was and is making life better for the people living in Europe. With the accession of 12 new members in less than a decade, the scale and scope of the project has suddenly enlarged.

The ERA Milestones

We will know the ERA is cohesive in 2030 when we see:

- The share of the EU budget devoted to research triples to 12%
- At least 30% of the structural funds are used exclusively for research and technology development (including fostering partnerships, supporting pre-commercial procurement and investing in large-scale research infrastructures where needed) – double the current allocation.
- More than 75% of the overall EU budget is oriented towards investing in its future as a knowledge-based society.
- The major research institutions of the well-developed regions of Europe work in partnerships, based on excellence, with those of the lesser-developed regions.
- Half of the adult population has achieved tertiary education – double today's rate.

Looked at from the perspective of the ERA, these new members are a special challenge: an untapped pool of talent and long research traditions, but by and large a research infrastructure impoverished by decades of under-investment and bad management. At the same time, even among the older EU members, great disparities persist in research intensity, organization and performance. Research intensity varies among the 27 EU members from 0.42% of GDP up to 3.73%.²¹ The ERA must work to raise the capabilities of all.

Thus, there must be funding to build new campuses or clusters, install new state of the art equipment, and train a new generation of scientists, engineers and entrepreneurs. But it need not come at the expense of encouraging excellence, either in the new or the old Member States.

There are ample funds for cohesion available in the EU's structural and competitiveness programmes, many of which have already been earmarked for research and innovation-related investments. Structural funds could be used for 'innovative procurement' of high-quality services in the less-favoured regions of Europe. This would strengthen social, economic and territorial cohesion while simultaneously spurring R&D and innovation in Europe's clusters of excellence. Then there is the agricultural budget: imagine the impact if today's massive agricultural supports were diverted to another purpose, such as education or research. Instead of reflecting Europe's agricultural past, should the EU budget not be oriented towards Europe's future as a knowledge-based economy, in line with its Lisbon Strategy?

The EU institutions themselves will be our strongest guarantee of cohesion. Greater fine tuning of research and innovation policy between the Member States and Brussels would reduce duplication, and improve research performance.

²¹ Ibid, DG Research (2009.)

The EU institutions themselves will be our strongest guarantee of cohesion.



In conclusion...

These six fundamentals are all means to an end – means that ERAB will analyze in coming months in conjunction with the research community at large. We are now working on specific proposals to accomplish them. We look forward to a broad dialogue with the research community and its stakeholders and in the year ahead a new resolution: to make the European Research Area a byword for creativity, excellence and efficiency – and the catalyst for a new Renaissance in the way we think, act and research globally.

About the European Research Area Board

The 22 members of ERAB were announced in April 2008, to advise the European Commission on research and science policy with a view to creating the European Research Area. Its members are:

Dr. Reinhold ACHATZ, Corporate Vice-president, Siemens AG, Corporate Technology, Corporate Research and Technologies (DE)

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ERAB Chair John Wood with EU Commissioner Potočnik. Above, ERAB members with the Commissioner.

The European Research Area Board is chaired by Prof. John Wood. The Vice Chairs are Dr. Leif Kjaergaard and Dr. Ingrid Wüning Tschol. Together with Prof. Marja Makarow, Prof. Lena Treschow Torell and Dr. Georg Winckler, they form the ERAB Bureau.

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European Commission

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