Analysis of Science &Technologies Priorities in

Public Research

in

Europe and the United States of America

Preface

Science and Technology priorities in public research…
This *Analysis of Science & Technology Priorities in Public Research in Europe and the U.S* provides input to the policy dialogue between Europe and the U.S. through an overview on and comparison of public research science & technology (S&T) priorities and some of the related policy processes around. Thus, this analysis contributes to strengthening insights into the S&T policy backgrounds and the mechasnisms of S&T priority setting policies in Europe and the U.S.

Europe and the U.S.
In mentioning "Europe" this report addresses the European Union (EU) as well as its Member States (MS) and the some extend countries associated to the European Union. As much as EU Member States and Associated Countries (AC) are covered, the overview however is limited to information available on individual MS as well as AC, and as such not exhaustive. At U.S. level federal activities and mechanisms are summarized, S&T activities that take place to some extend at U.S. state level are not covered through this report.

The context of this report…
This *Analysis of Science & Technology Priorities in Public Research in Europe and the U.S.* was prepared within the context of the 7th EU Framework Programme Project **"BILAT-USA"**, which is aiming to setting up a sustainable, knowledge based, bi-regional dialogue platform between S&T key players and stakeholders in Europe and the U.S. The BILAT-USA project is a pragmatic approach of strengthening S&T exchange, building on common interest and aiming at mutual benefits in order to support the cooperation between the EU and the U.S.

As such the BILAT-USA project is contributing to the implementation of the EU Framework Programme´s objectives by increasing participation of U.S. research teams in the EU FP through various awareness raising actions, good practice sharing and effective dissemination activities.

Strong partners both in the EU and the U.S., who are key players in the field, are forming a committed consortium implementing the ambitious work plan of the BILAT-USA project. Coordinated by the FFG-Austrian Research Promotion Agency/Division of European and International Programmes, the European partners include the APRE-Agency for the Promotion of European Researc4h, TETALAP-Hungarian Science and Technology Foundation, and INTRASOFT International S.A.
The AAAS-American Association for the Advancement of Science is the BILAT-USA strong partner in the U.S. as the world's largest general scientific

organisation having links to the entire U.S. scientific community including actors in science policy and funding agencies.
The BILAT-USA project is carried out together with the complementary project “Link2US”, providing European research teams with access to U.S. funding mechanisms.

Project is funded by European Union’s Capacities Programme on International Cooperation under the 7th Framework Programme for Research and Technological Cooperation.
Further information on both projects is available at www.EuUsScienceTechnology.eu

Enjoy reading!

Dr. Sabine Herlitschka

Coordinator BILAT-USA Project
FFG – Austrian Research Promotion Agency

BILAT USA

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1 Executive Summary

This analysis contains general information on research & development (R&D) spending and general insights into the priority setting process in EU, EU Member States (EU MS) and the U.S.. Information on thematic as well as policy/horizontal priorities in R&D policies in the EU MS the European Union and the U.S. are provided, concluding with a comparative analysis of thematic and horizontal priorities.

The basis of the comparative analysis is a matrix of thematic and horizontal priorities found in each EU MS, on EU level and in the U.S.. **Environment and Sustainable Development , Energy, ICT, Biotech/Health and Nanotechnologies** are the most important research areas for the majority of EU MS and also reflect priorities in the EU Seventh Framework Programme for Research, Technological Development and Demonstration (FP7).

The U.S. has a strong policy focus on **defense** and **health related research**.

Strengthening **human resources in research** (through mobility, special attention to young and and/or female researchers etc), **international reserach cooperation** and **industry-academia relations** for raising competitiveness and innovation are amongst the most crucial of horizontal priorities for EU and EU MS. On both sides of the Atlantic Ocean there is growing concern about **societal** and **global challenges** fuels investment in R&D in selected areas such as **Climate Change, Environment and Ageing**.

2 Background to R&D policy in EU, EU Member States and the U.S.

2.1 Setting the scene: overall R&D policy in EU and EU MS

Science, technology and innovation are considered as main drivers for economic development and growth. In Lisbon in 2000 the European Council launched the 'Lisbon Strategy', aimed at transforming the EU by 2010 into "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion". As such, it was decided to set a target of 3% of the Gross Domestic Product (GDP) for investment in R&D by 2010 of which two thirds (i.e. 2%) should be financed by the business sector.

In 2005 the Lisbon Strategy was re-launched with the initiative 'Working together for growth and jobs' and in 2006, at a Council meeting in Brussels, it was recognised that Europe should invest more in knowledge and growth.

At the Spring European Councils of 2006 and 2007, one of the four priority areas agreed upon by the EU MS was **more investment in knowledge and innovation**. In 2007 the European Commission launched the Green Paper 'The European Research Area: New Perspectives', a "broad institutional and public debate on what should be done to create a unified and attractive European Research Area".

Towards the end of the first decade in the new millennium, it became obvious that the majority of EU MS (except for Sweden and Finland) would not be able to reach the 3% GDP for R&D investment goal. Despite its mobilizing effect, the financial crisis and other factors impeded this aspiration. The European Commission decided to hold on to the goal and, being faced with the worst financial and economic crisis of the last decades, the competition from the BRIC countries (Brazil, Russia, India, and China), Europe´s vanishing status in the world and challenges of European and global dimension, launched the "Europe 2020" strategy for a smarter, greener and more inclusive growth in Europe. The strategy foresees an implementation along seven axes, the so-called "flagship initiatives". The "Innovation Union" is one of these flagship initiatives and represents the strategic plan for science, technology and innovation in Europe. It aims to improve conditions and access to finance for research and innovation in Europe, to ensure that innovative ideas can be turned into products and services that create growth and jobs.

The Innovation Union focuses on social **challenges of Europe´s citizens** such as climate change, energy efficiency and healthy living. It pursues a **broad concept** of innovation, not only technological, but also in business models, design, branding and services that add value for users. It includes public sector and social innovation as well as commercial innovation. It aims to involve **all actors and all regions** in the innovation cycle.

The policies in the Innovation Union Plan aim at three objectives:

- Transform Europe into a **world-class science performer**;
- Revolutionize the way public and private sectors work together, notably through **Innovation Partnerships**; and
- **Remove bottlenecks** – like expensive patenting, market fragmentation, slow standard setting and skill shortages - that currently prevent ideas getting quickly to market[1]

In March 2000, at the Lisbon European Council, Heads of State and Government set the European Union the goal of becoming "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion" by 2010. Two years later at the Barcelona European Council, which reviewed progress towards the Lisbon goal, they agreed that Research and Technological Development (RTD) investment in the EU must be increased with the aim of approaching 3% of GDP by 2010, up from 1.9% in 2000.

This target has not been achieved by any countries besides Finland and Sweden (see Fig. 2.2), only Germany, Austria and Denmark being close to that goal.

The situation concerning R&D intensity is rather diverse among the EU MS and the majority of countries were not able to reach the 3% Barcelona goal until 2010. However, in the EU2020 strategy it was decided to stick to the 3% goal due to its mobilizing effect. Unless the EU MS are able to step up their efforts and invest more in R&D, the R&D intensity gap to the U.S. and Japan will increase even more. In the same manner, the EU and its MS are facing even stronger global competition from BRIC countries (Brazil, Russia, India and China). The EU2020 strategy and stronger R&D investment have to become a reality if the EU and its MS want to stay competitive, create new jobs, new markets and new innovations.

The Innovation Union can only become reality if broader efforts on EU- as well as EU MS level are undertaken. Currently, levels of R&D intensity in EU MS vary widely, from high R&D intensive countries (more than 2% of GDP) with only 6 MS, average R&D intensive countries (between 2 and 1%) with the majority of MS, and low R&D intensity countries (less than 1%), primarily new MS (see Fig. 2.1).

[1] http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=intro

The situation concerning R&D intensity amongst EU MS is quite different. In Fig. 2.1 R&D intensity for all EU MS is shown and four groups of countries can be identified, according to their level of R&D intensity: High R&D intensive countries (more than 2% of GDP) The average R&D intensity in EU 27 is 1.85% of GDP (according to latest available data for 2007).

Figures 2.2 – 2.4 break up Gross Expenditure on RTD (GERD) according to the sector of performance: Business sector R&D expenditure (BERD), Government R&D expenditure (GOVERD), Higher education sector R&D expenditure (HERD). In Fig. 2.5, Government budget appropriations of outlays for R&D (GBAORD) in EU MS are shown. GBAORD measures the funds committed by federal/central government for R&D to be carried out in one of the four sectors of performance (business enterprise, government, higher education, private non-profit). The data are usually based on budgetary sources and reflect the views of the funding agencies. GBAORD data has the advantage of being more in time and reflecting current government priorities. Also here it becomes obvious that most of EU MS are further away from the 3% GDP for R%D objective.

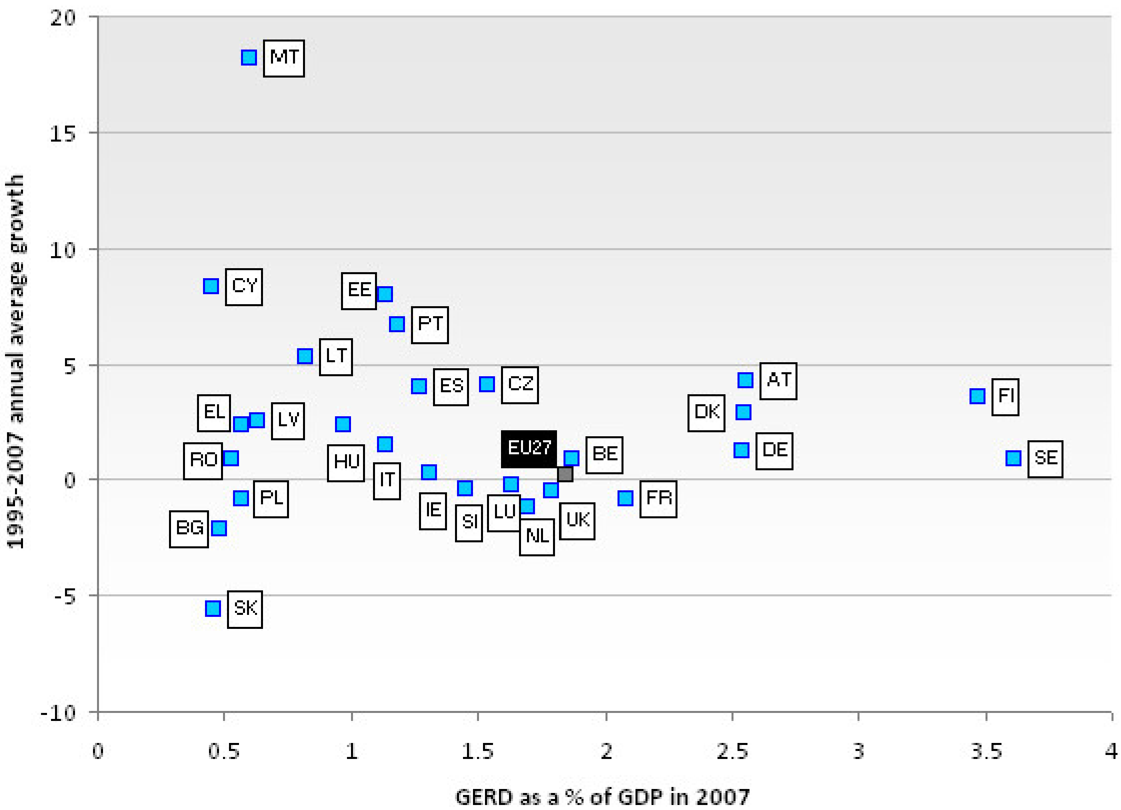

Figure 2.1 R&D intensity in EU 27 (GERD as of % GDP in 2007)

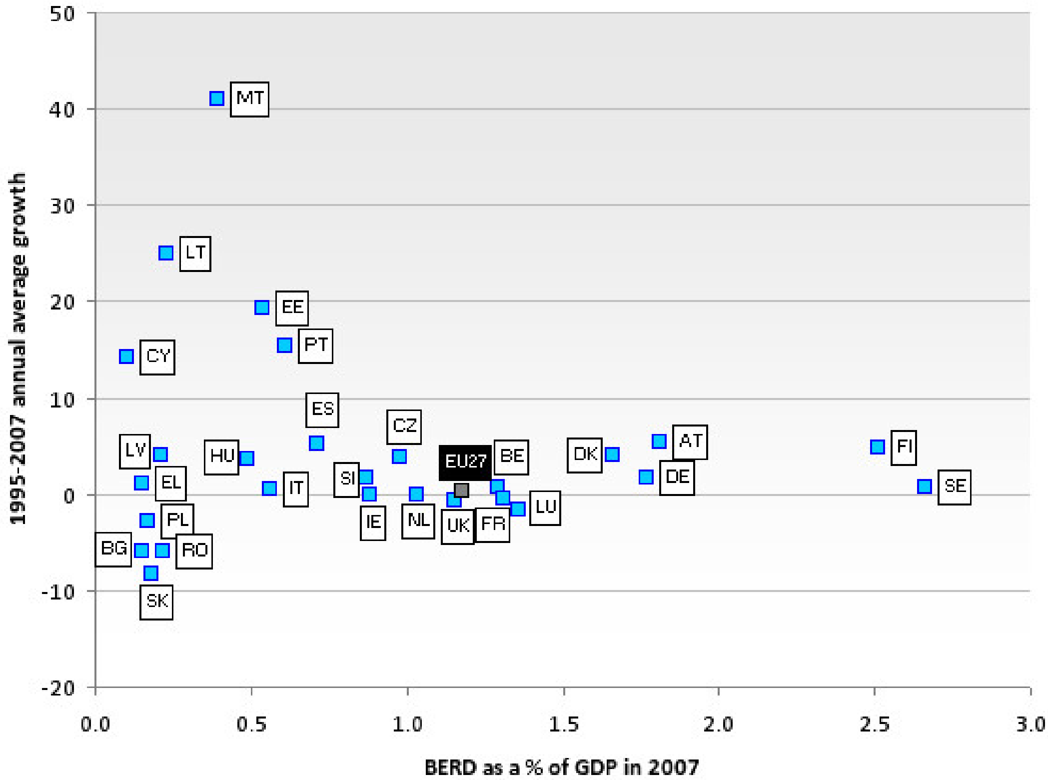

Fig 2.2 R&D intensity by business sector performance in EU MS in 2007.

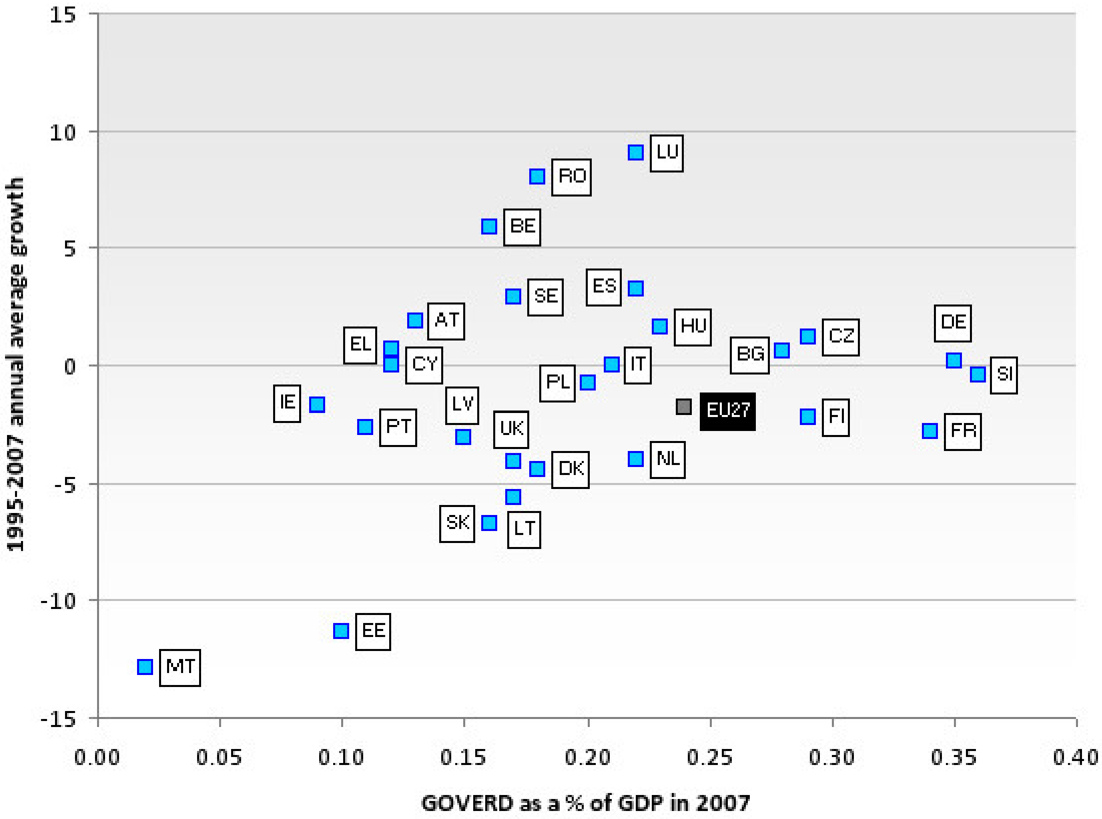

Fig. 2.3 R&D intensity by government sector performance in EU MS in 2007

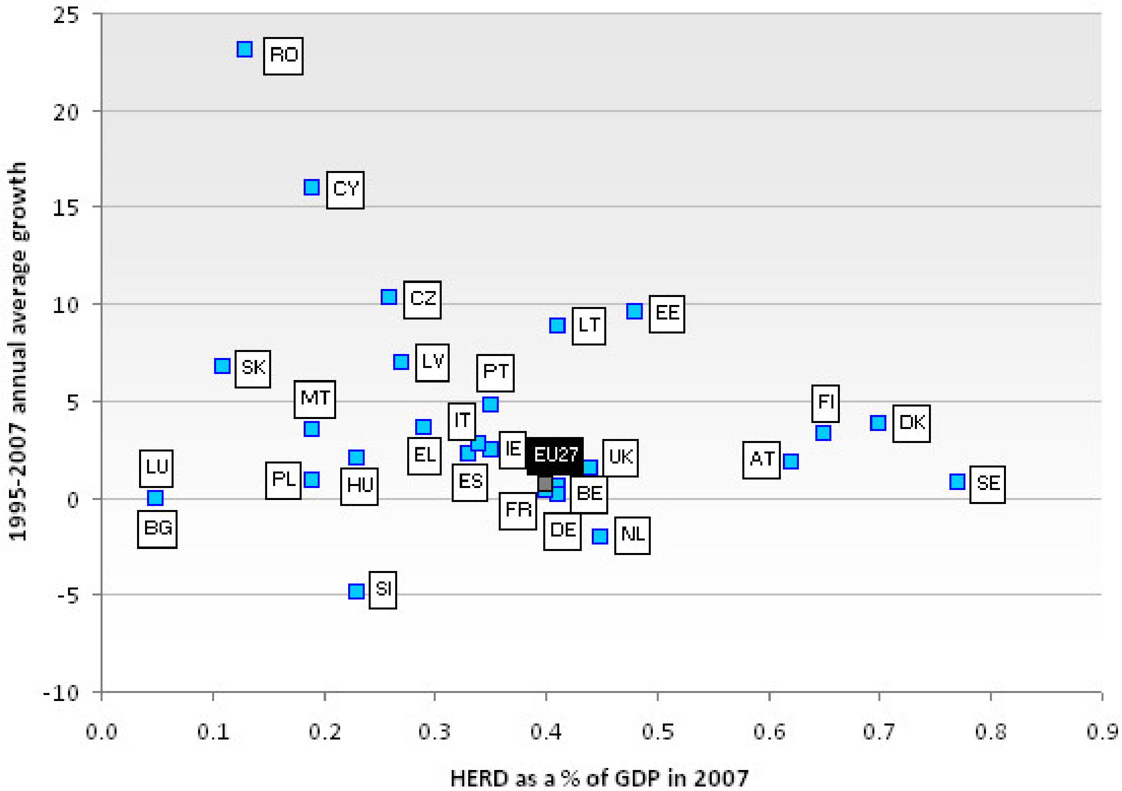

Fig. 2.4 R&D intensity of Higher Education sector in EU MS in 2007

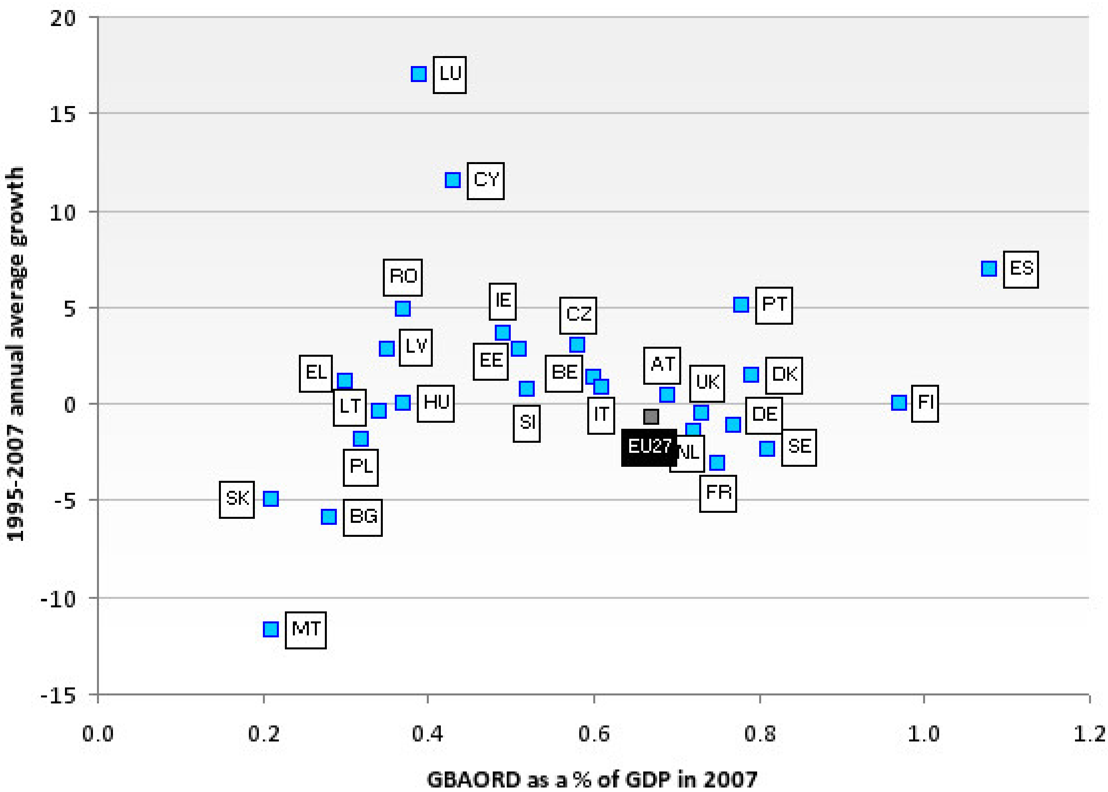

Fig. 2.5 Government budget appropriations or outlays for R&D in 2007 in EU MS

2.2 General R&D policy In the U.S.

In the U.S. no single research budget is available on federal level. Instead, research, including basic research, has to compete with investments for other purposes because it is financed through the overall budgets of 24 federal departments and independent agencies. Many departments and agencies are inolved in promoting different missions and supporting different disciplines in research.

In addition, the research system is strongly mission-oriented. National security and public health receive the biggest amount of investment in R&D.

The Department of Defense (DOD) is the largest funder of federal R&D, followed by the National Institutes of Health (NIH), the National Aeronautics and Space Administration (NASA), the Department of Energy (DOE), the National Science Foundation (NSF), the Department of Agriculture (DOA), the Department of Commerce (DOC), and the Department of Homeland Security (DHS). Taken together, these eight agencies fund approximately 98% of federal R&D. Most important funding source for basic, non-military research is the NIH

The size, complexity and lack of cerntralized government bodies, together with the strongly mission-oriented approach in science make a centralized decision making system and priority setting difficult.

Currently, 58.5% of federal budget for R&D go to defense related research, 41.5% to civilian R&D. Basic and applied research each account for 20% of that share, 58% for development and 3% for R&D facilities and capital equipment. The Obama COMPETES act of 2009 has allocated another USD 21.5 billion to R&D.

Innovation and funding basic research for future economic competitiveness has not been an explicit mission though it is often stated as the primary rationale for federal support for research.

The current Obama Administration has presented its strategy “Innovation for Sustainable Growth and Quality Jobs”, which intends to lay the foundation for the innovation economy of the future. The diagram below depicts the three main pillars of the new strategy:

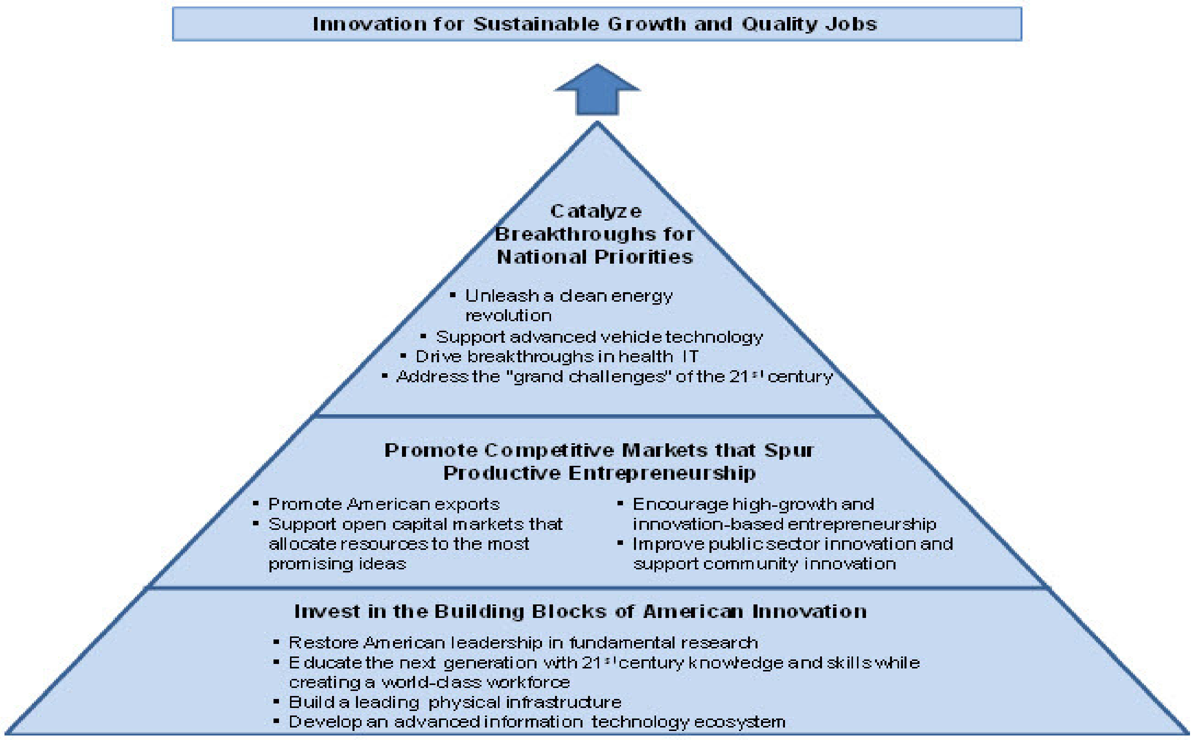

Fig.1: Graphical representation of Obama´s long term RTD strategy

As mentioned, in the U.S., no single overall science and research budget exists. Many agencies and departments deal partly with R&D and it is only the NSF and the NIH which have research as their sole mission. Centralized decision making and priority setting is therefore not the main approach in the U.S. S&T system. However, with the yearly negotiation of budget for R&D, priorities are also set in order to assure to occupy a portion of the budget for a specific priorities. This decentralized decision making mechanism, where the S&T actors define their budget allocations rather independently, together with the yearly budget negotiations allow for flexibility and possibility to react more quickly to new developments and upcoming issues.
This is one of the basic differences between the EU and U.S. priority setting mechanisms.

Investment in research often goes hand in hand with the political agenda at different times which often reflect emerging social or societal issues and problems, e.g. the Space budget was increased heavily when the Russians launched their Sputnik.

The EU 27 lags behind the U.S. in terms of overall R&D intensity due to a lower level of R&D funded (and performed) by the business sector. The difference in total R&D intensity as illustrated in Fig 2.2 between the EU and the U.S. is almost exclusively due to differences in levels of private sector funding (BERD).

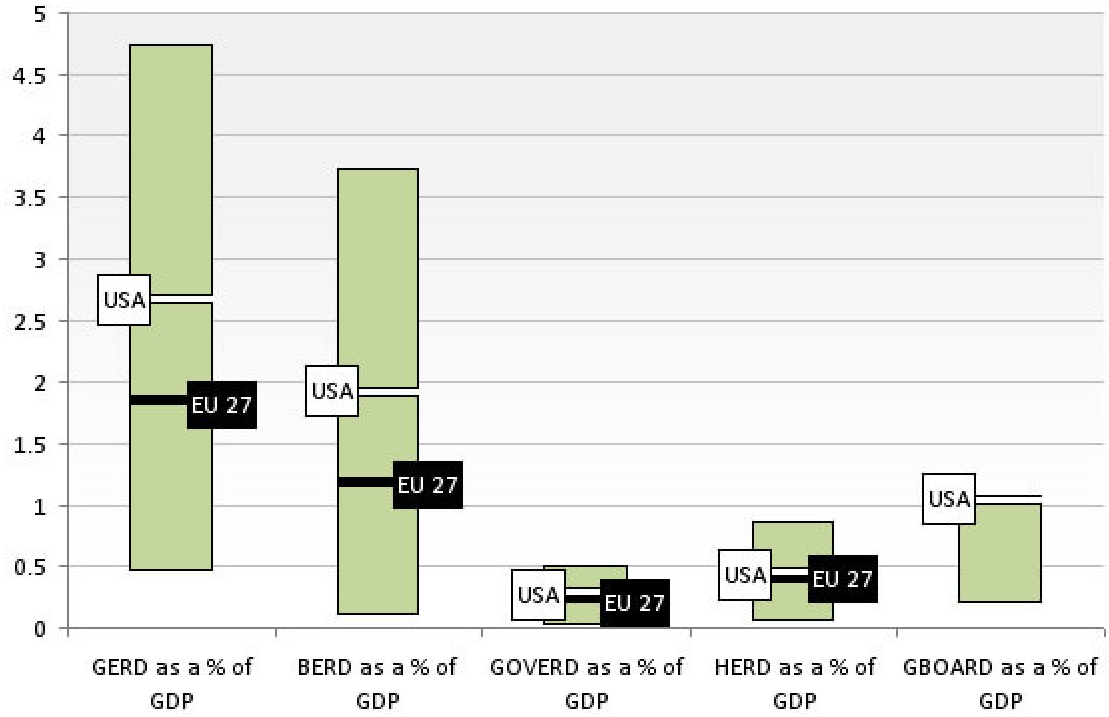

Fig. 2.2. Relative sectoral performance (general, business, government, higher education) of average EU27 and U.S. and government appropriations or outlays for R&D (GBOARD) for U.S. only. U.S. R&D investment levels (approximately 2,6% of GDP) are shown in white, EU27 average R&D investment levels (approx: 1,8% of GDP) in black. The advance of U.S. reflected in GERD figures is primarily based on the stronger busines R&D investment (see level of BERD).

Unless the EU MS step up efforts to invest more and more effectively in R&D, the gap between the U.S. and the EU will steadily increase and competition with emerging economies such as Brazil, Russia, India, and China (BRIC), and will make it even more difficult for EU coutries to be a global player in research and innovation.
The financial and economic crisis of the last years has led to a reduction of public and private R&D investment in the majority of EU countries. The EU does well in trying to join efforts and set targets in the EU2020 strategy knowing that R&D investment is key for future prosperity, social stability and competitiveness.

3 General remarks to the mechanism of priority setting in R&D policy

Priority areas in S&T policies can either be of thematic or horizontal/generic nature, what they have in common is their characteristics as a focal point of effort and importance in the design and set up of S&T strategies.

Thematic as well as horizontal priorities are seen as relevant to build or further strengthen critical mass in specific areas and to develop a favourable environment for research activities at all levels of an R&D system. In general, prioritisation is a necessary process given that, within the boundaries (and even tighter boundaries in economic crisis) of public R&D budget, public money has to be deployed in the most efficient and effective manner. In the end, prioritisation is used as a mechanism in S&T policies to result in competitiveness and socio-economic and sustainable development of a country.

The most relevant criteria for priority setting are:

- Strength in particular research fields: existing research capacities, quality of research in a given field, future promising research fields
- Relevance: contribution to socio-economic development of a region/country/system

These criteria can be assessed through the following methods:

<u>Quantitative measures:</u>

- Bibliometric analysis for assessing the quality in a given research area, e.g. through citation indices, publications,

- Comparative indicators, measuring the relative position of a research area in a country compared to an average: e.g. through measuring investment in R&D. Statistical indicators for measurement are GERD (Gross Expenditure for R&D) and GBOARD (Government budget appropriations or outlays for R&D). GBOARD measures the funds committed by the federal/central government for R&D to be carried out in one of the four sectors of performance –business enterprise, government, higher education,private non-profit – at home or abroad (including by international organisations). The data is usually based on budgetary sources and reflect the views of the funding agencies. They aregenerally considered less internationally comparable than the performer-reported data used inother tables and graphs but have the advantage of being more timely and reflecting current government priorities, as expressed in the breakdown by socioeconomic objectives.
  GERD reflects R&D expenditures as percentage of gross domestic product. This indicator allows for better international comparison.

Consultative/participatory measures:

- Stakeholder consultation, e.g. involvement of public research organisations, Science Councils in the priority setting exercise

- Foresight exercises: for setting priorities in existing research areas and assessing future developments

The final selection of priorities is either done in a top-down decision by the relevant stakeholders in charge of the S&T policy or bottom-up, coming mainly from research performers through defining their own focus areas of research.

The impact of a given priority, especially when it comes to priorities with high relevance for the socio-economic development of a country, depends strongly on the political commitment and naturally, budgetary appropriations to that area.

There are many different ways on how priorities are implemented, some of them are listed below:

- Thematic or horizontal R&D programmes and initiatives
- Structural funding for dedicated research organisations, research councils etc
- Setting up and/or funding of clusters, centres of excellence or competence poles
- Tax incentives, specific stakeholder support (e.g. measures for SMEs)
- Etc.

Nevertheless, selected priority areas can sometimes also result in remaining mere intentions without budgetary allocations to implement them.
Fragmentation in policy-making, lack of commitment and funding and prioritisation lacking a long-term view are other hampering factors in this process.

As said above, besides thematic priorities, cross-cutting, horizontal measures are another means of policy making. Horizontal measures affect the research system as a whole. Their primary objective is to create a favourable environment for conducting research, to address certain structural weaknesses and to ensure in the same manner as thematic areas, the socio-economic devlopment of society, its competitiveness and knowledge base.
Horizontal priorities, also referred to as policy priorities, span from measures to support human resources in research, public private cooperation, research infrastructures and international cooperation. Likewise, they can contribute

to placing science at the heart of society, to facing global challenges as well as to building efficient R&D systems.
Policy priorities are implemented either via direct measures (e.g. block funding in the case of research infrastructure, grants) or indirect measures (e.g. tax incentives for innovation activities).

3.1 Priority setting on EU level

Priority setting in EU R&D policy is defined by the process of decision-making on EU level in general. The European Commisison, the European Parliament and the European Council develop EU policies in a well-balanced game of powers.
In this game of powers, the European Commission, as the executive organ of the European insitutions, has the right for initiative. It proposes new policies deemed necessary for the European Union. In the area of R&D, the European Commission Directorate for Research (DG Research) is responsible for the development and proposal of the Union´s R&D policy.
The European Framework Programme for Research, Technological Development and Demonstration (EU FP) has been, since its introduction in 1984, the Union´s main funding programme for R&D activities. Until the current Seventh Framework Programme (FP7), which runs from 2007 – 2013, it was implemented on a four years basis. Since FP6 (2003-2006) the programme has increasingly become an instrument for policy making.
The process of definition and preparation of the FP7 (2007-2013) started already in 2004, with a public consultation launched by the Commission on how the next Framework Programme (i.e. FP7) should look like. In parallel the Commission undertook intense consultation activities with various stakeholders of the European Research Area (national, regional, academia, business, societal etc). Having this input as basis, the Commission prepared its proposal internally. However, despite the contributions coming from the European research community as well as advisory groups, the impact to the final Commission proposal was eventually quite limited[3].

The setting of thematic priorities in FP7, i.e. of the themes, actitivty and area is a top-down procedure where the Commission and the Council/European Parliament are involved in a co-decisions procedure alike.
The thematic priorities had to be defined along the lines of following policy objectives:

- Contribution to EU policy objectives: sustainable economic growth, dynamic and competitive knowledge-based economy etc.
- European research potential: research in thematic domains with strong potential for excellent research and technological development and for disseminating and oncverting the results into social and economic benefits

[3] Priority Setting in the European Research Framework Programmes, Vinnova Analysis 2009:17, Dan Andree

- European added value: a strong need for additional public funding and for such intervention to be at a European level

The European Commission builds on the input of programme committees when it comes to defining the yearly workprogrammes, where also topics of calls in each themes and specific programmes are developed. The final decision on the topics of the calls is very much a procedure inside the Commission[3].
Therefore one can speek of a predominantly top-down procedure. However, this is not the only defining priority setting mechanism in FP7 – in the case of the Marie Curie scheme of the PEOPLE programme as well as in the IDEAS Specific Programme, bottom-up proposals from researchers compete for funding and no thematic restrictions are set.

3.2 Priority setting on EU MS level

Research policy is defined differently across the EU MS and various approaches (top-down, bottom-up, open consultations, advisory councils) are used in order to set research priorities in the various EU countries. It becomes obvious, that countries often use a mix of different approaches when defining their priorities and that the final decision is often taken top-down on the government level. On the other hand, some countries leave the priority setting (especially of thematic areas) to the research performers:

- **Top-down approach** Centrally decided by the government or other decision-making bodies of the respective research system, **"**: in BG, CY, LI, LV, MT, PT, RO and ES.

- **Participatory approach**, through consultations with stakeholders of the research and innovation system or even through public involvement: in AT, DK, FR, DE, GR, IE, LU, SI.

  However, one cannot draw a strict line between these two approaches. Often policy stakeholders chose a mixed approach, where open consultations prepare top-down decisions. Therefore the list of countries is only a general picture of the approaches chosen.

  In Denmark, the government undertook a public wide consultation (with universities, PROs, research councils, companies, NGOs etc) to define areas of socio-economic importance in its "Foresight 2015" for the future of the country. It was the government which had the last word in prioritising 21 areas, nevertheless, the basis was set by this open consultation. Similar approaches were taken in Germany (for the country´s High Tech Strategy) and Greece for its Strategic Development Plan for R&D&I 2007-2013.

In France, the government also carried out a consultation exercise of stakeholders to develop the Pact for Research, which identifies the coutnry´s research priorities. It was advised therein by the High Council for S&T, being the most important advisory body for S&T in France.

Ireland, Luxembourg and Slovenia based their decisions for the current research strategies on research priorities in their national R&D strategies on the results of foresight exercises. In addition, Slovenia streamlined its thematic priorities along the lines of FP6 (in tte areas of information and communication technologies, advanced (new) synthetic metal and non-metal materials and nanotechnologies, complex systems and innovative technologies, technologies for sustainable development and health and life-sciences).

- **Advisory approach** Research Councils and other consultative bodies give advise on direction and priorities in research policy,: EE, FR, HU, SK, SI, UK.
  In the case of the first five mentioned countries, the government relies on input from a high-level national advisory body, such as the Estonian Research Competency Council or the French High Council for S&T, for policy decisions. A somewhat more differentiated situation can be found in the UK.
  In the UK a wide network of committees and advisory groups provide input for the formulation of science and research policy. Advisory bodies providing advice and information on the spectrum of general to highly specific S&T concerns are located at various levels of the government policy making system, from Cabinet level, through Parliament and departmental levels, down to a range of *ad hoc* and standing committees, both official and unofficial.

- **Bottom-up approach** Research priorities are mainly defined by the research performers themselves,: FI, MT, NL
  Overall policy priorities are still dealt with from top-level, nevertheless e.g. in Finland, suggestions for new programme funding lines come from the universities or PROs. In Malta, university departments draw up the distribution of their funds according to their needs and research areas of interest. The Dutch government leaves priority setting as far as possible to the actors involved.
- No information available for: IT, BE

3.3 Priority setting in the U.S.

3.3.1 Priority setting on federal level

On federal level, the Office of S&T Policy of the President (OSTP) is the main advisory organ directly attributed to the President. It develops the annual budget for R&D, which is negotiated in the Congress yearly, and gives broad directives in priorities to departments and agencies. The OSTP also channels the input from other departments and advisory bodies, which have a say in the development of the yearly R&D budget and in priority setting:

- National Science and Technology Council (NSTC): strategic function in setting research agenda and coordinating federal policies and interagency programs in S&T.

- President´s Council of Advisors on S&T (PCAST): formulates policy in many areas where S&T and innovation is key in strengthening American economy and policy for American people

- National Science Board: gives advise to the president on national science priorities. It is primarily charged with oversight of the NSF.

The actual priority setting process is linked to the budgetarty negotiations for S&T: departments and agencies put forward detailed budget proposals to the administration, i.e. to the OSTP within the White House and to the Office of Management and Budget (OMB), has the real decision power). The content of the budget proposal reflects the priorities set for the specific budget year. Priority setting is actually a work of compromise taking place over several months of negotiations between senior leadership of various departments, agencies and the OMB. The OMB is heavily involved in deciding which priorities make it into the final budget request to the Congress and the level of funding.

3.3.2 Priority setting at the NSF

The National Science Foundation (NSF) is the only federal agency whose mission includes support to all fields of fundamental science and engineering except for medical sciences (which is covered by the NIH).

The mechanism of priority setting involves several steps:

- Core programs of NSF are generic, researchers submit proposal in research areas that they determine themselves. Thus, in aggregate, new trends and priorities emerge in a bottom-up manner.

- Funding is also decided on the basis of merit, thus whether the research proposed contributes to education, or solving societal issues, etc.

- Program Officers at NSF decide how the proposal fits into overall priorities of the NSF

- Multiple advisory committees, that serve to aggregate opinions and current findings from their communities to deliver formal advise to the management on new trends, opportunities and priorities

- Through expert meetings, seminars, workshops etc with the scientific community, the NSF organises regular feedback sessions to gather knowledge on current topics of interest in the scientific communities

- Lately, the NSF introduced a new funding programme to support high-risk "transformative" research, as a response to the growing demand for important scientific and engineering breakthroughs.

3.3.3 Priority setting at the NIH

The National Institutes of Health (NIH), the world´s largest single funder for biomedical research, supports disease-related research as well as basic research and has a programme for research staff development as well as for technology transfer.
Strategic planning and priority-setting at the NIH is a highly consultative process involving many constituencies that generate and provide input on public health needs and research gaps, opportunities and priorities. Strategic planning takes place at many levels. Most important, the U.S. Congress, through the NIH authorization and appropriations processes, sets funding levels for the NIH institutes (20) and research centers (7), establishes the missions for some institutes and centers (ICs) and directs the NIH's attention to particular areas of research interest or emphasis. It also establishes priorities for improving the health of the Nation that must be addressed by the NIH[4].

To conclude, it is obvious that approaches to priority setting differ widely between the geographical areas under scrutiny. Also, one has to bear in mind that often a mixed approach is applied, where e.g. an open consultation initiaties reflection on R&D priorities but the final decision is taken on top level. In the U.S. S&T system, one can find a strongly mission-oriented approach, which sets the broader framework for the majority of funds to be deployed. However, inside this framework as well as inside the major research institutions of the U.S. (NIH, NSF) priorities are developed on the basis of demands and input from the scientific community. In addition, annual negotiations for the S&T budget allow for a rather flexible approach to direct S&T priorities to respond to upcoming demands and issues. This implies stornger flexibility than can be seen in many EU countries or on EU level, with the multi-annual budget allocation for the EU FP.

[4] Priority Setting in US Science Policies, Vinnova analysis 2009, Kerstin Elliason

4 Thematic policy priorities

4.1 Priorities on EU level

4.1.1 EU thematic priorities

The Seventh Framework Programme for Research,Technological Development and Demonstration Activities (FP7) is the European Community's main instrument for funding R&D activities in Europe, reflecting all aspects of EU research policy. Running from 2007 to 2013, the program has a budget of 50.521 M€. The broad objectives of FP7 have been grouped into four Specific Programmes: Cooperation, People, Capacities and Ideas.

FP7 sets clear demarcations between funding for generic, bottom up research vs thematically oriented research areas. The specific programmes of the FP7 reflect clear funding lines for generic (Capacities, People) and bottom up research (Ideas) vs thematic research (Cooperation).

The majority of FP7 funding is allocated to the Cooperation programme with 324 M€ (Fig. 4.1 below).

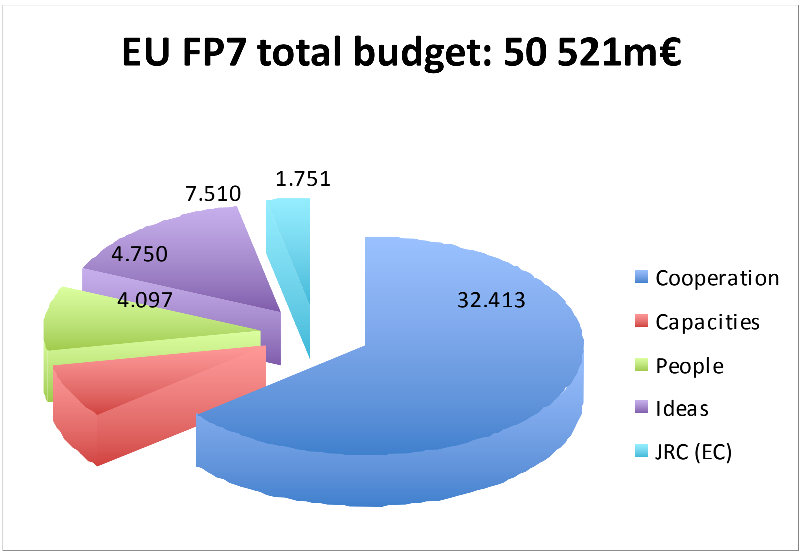

Fig. 4.1: Total EU FP7 budget in M€ for 2007 to 2013, split into the FP7 Specific Programmes Cooperation, Capacites, People, and Ideas including the specific budget dedicated to the Joint Research Centres (JRCs) of the European Commission.

The Cooperation programme encompasses 10 thematic areas, which reflect the most important fields of knowledge and technology where research excellence is particularly important to improve Europe's ability to address its social, economic, public health, environmental and industrial challenges of the future.[2]

The ten themes are:

- Health
- Food, Agriculture and Fisheries, Biotechnology
- Information & communication technologies
- Nanosciences, nanotechnologies, materials & new production technologies
- Energy
- Environment (including Climate Change)
- Transport (including aeronautics)
- Socio-economic Sciences and the Humanities
- Space
- Security

Health, Food/Agriculture/Fisheries and Biotech, ICT and Nanotech receive the highest share.

Although the themes represent seperated research areas, coherence between them is maintained through multi-disciplinary and transthematical activities.
Activities funded under the Cooperation programme focus mainly on applied research, except for the theme Socio-economic sciences and humanities, which by its nature is basic research. New in FP7 was the introduction of the thematic area of Security. On the contrary, security, military and defense research have traditionally been major R&D sectors, which also have ever since received large chunks of the S&T budget in the U.S.

4.1.2 EU Policy priorities

The European Research Area (ERA) is the policy framework in which R&D activities are embedded on the European level. The concept of ERA has been introduced in the year 2000 with the objective to overcome the fragmentation of research in Europe along national and institutional barriers, enable the free circulation of knowledge and researchers in Europe (the fifth freedom) and ultimately, to contribute to the sustainable development and competitiveness of Europe. The ERA encompasses regional, national and European level activities, but under this chapter only European policies and activities will be discussed.

[2] http://cordis.europa.eu/fp7/cooperation/home_en.html

The five policy priorities ERA is built upon are Mobility of researchers and higher attractiveness of ERA for foreign researchers, world-class research infrastructures, transnational funding activities to be able to solve major societal challenges, international cooperation, and knowledge transfer. Since 2007 various initiatives under the five pillars of ERA were initiated as well as constant refining of the ERA concept was undertaken through the ERA Green Paper and the 2020 vision for ERA. Currently, the Commission is preparing the launch of a new initiative to create an "Innovation Union" as part of the Europe 2020 strategy. Thus, to summarize, the above mentioned R&D policy priorities are encapsulated in the overall innovation union strategy.

The policy priorities of ERA are being implemented via a vast range of programmes and initiatives:

- Enhancing mobility and attractiveness for foreign researchers to conduct research in the EU – through the PEOPLE programme
- Enhancing research capacity in European regions and of SMEs, enhancing private-public partnership, international cooperation – through the CAPACITIES programme
- Supporting research at the forefront of knowledge, enabling break -throughs in basic research – through the IDEAS programme
- Boosting the competitiveness of SMEs and European companies – through the Competitiveness and Innovation Programme (CIP)
- Enhancing public-private partnerships: JTIs, PPPs, EIT (KICs)

The FP7 is, as its predecessor FP6, increasingly a policy tool for the realization of ERA. The diversity of instruments and initiatives and the structure of the FP7 reflect the policy priorities as well as thematic priorities of EU R&D.

4.2 Priorities on EU MS level

4.2.1 Generic vs thematic funding

In the majority of EU countries (AT, CY, CZ, DE, DK, FR, GR, IE, LI, MT, NL, PL, PT, SI, SE, SK, UK) research policy is predominantly of generic nature.
Public funds are primarily allocated as block-funds to universities and public research organisations (PROs) and towards non-oriented (e.g. through grants) and bottom up research (either competitive or as block funding again).

In BE, BG, EE, ES, FI, IT, LU, LV thematic funding makes the bulk of share of GBOARD (50% or above). Interestingly in the case of RO and HU, thematic funding reaches levels of 63% or even 85% of GBOARD respectively.

Two interesting trends can be identified:

1. Shift from **generic towards a more thematically oriented funding**: in FR, DE, MT, NL and PL. In Germany, the major pulic research organisations (like e.g. the Max Planck Association, the Fraunhofer Institutes etc.) receive block funding from the government but may distribute these funds according to their own decisions. Nevertheless, thematic orientations gain importance: the "High Tech Strategy" of 2006 and its revamp of 2010 High-Tech Strategy 2020 clearly identify thematic areas of importance for the innovation and competitiveness capacity of the German R&D+I system.
2. **Emphasis on generic funding** in order to maintain and strengthen overall R&D base: in IE, SE and UK

4.2.2 Thematic priorities in EU MS

When analysing the thematic priorities of all EU countries, 4 top themes shared by all EU MS can be identified:

- Energy, Environment and sustainable development
- ICT, Telecommunications and Electronics
- Biotechnology and Health
- Nanoscience/-technology and material research

Other priority areas are:

- Agriculture, Food and Forestry: BE (Walloon region), BG, EE, FI, FR, GR, EI, IT, LV, LI, NL, PL, PT, RO
- Security research: CZ, DE, FR, GR, PT, RO, SI, UK
- Transport and logistics: AT, BE (Walloon region), FR, GR, IT, PL, PT, ES
- Service sector: important in FI, LU, NL, RO
- Space: BE (federal level, Walloon region), FR, DE, GR, RO
- Cultural Heritage: BG, EE, GR, IT, LV, LU
- Social sciences (incl. Socio-economic sciences) and Humanities: CY, CZ, FR, GR, LU. NL, PL, RO, SE
- Lifesciences: CZ, HU, IE, NL, RO, SK, ES
- Geosciences (incl. Marine sciences): BE (federal level), FR, IE, PT
- Mathematics: FR, IE
- Physics: FR, IE,
- Chemistry: FR, IE, LV

Annex I presents a matrix of thematic priorities including a more detailled description of specific research areas for EU, EU-MS and the U.S..

4.2.3 Policy priorities in EU MS

There are some thematic priorities which are of concern to the majority of EU countries:

- All EU countries explicitely mention human resources in research and mobility as a top-priority of their R&D policies, emphasis ranging from increasing the quantity of researchers and PhDs, support for female researchers to enhancing trans-sectoral and international mobility.

- International Cooperation
- Industry-Academia Cooperation
- Competitiveness and Innovation
- Basic research and excellence
- Grand societal problems
- Structural adaptations of the national R&D system

Annex II presents a matrix of policy priorities for EU, EU-MS and the U.S..

4.3 Priorities In the U.S.

As mentioned earlier, defense and health related research are the top priorities on federal level in the U.S. Investment in science, energy and climate change, security and health are high priorities in the 2010 fiscal year budget. The figure below presents the shares of S&T total budget for 2010 amongst to the biggest departments dealing with S&T. The department of defense (DOD) receives the biggest share of R&D budget, followed by the NIH and the NASA. This distribution of funds reflects the strongly mission oriented approach in the U.S. S&T system.The Obama Administration plans to further invest more in areas of global concerns, such as climate change and clean energy.

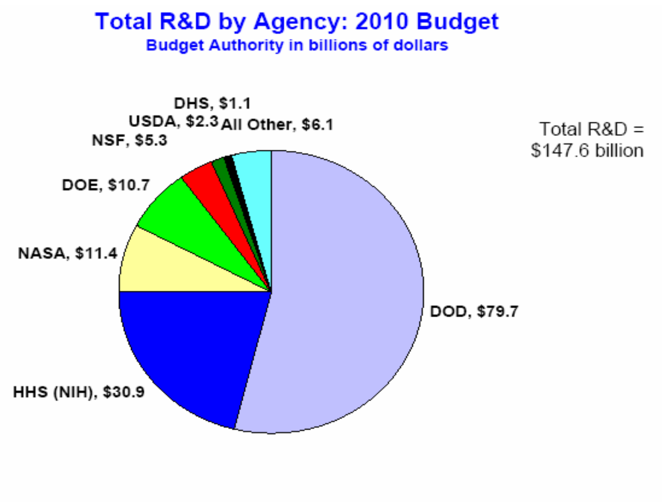

Fig 4.3: Total R&D expenditure by agency. DOD= Department of Defense, HHS: Health and Human Services, NASA: National Aeronautics and Space Administration, DOE: Department of Energy, NSF: National Science Foundation, USDA: U.S. Department of Agriculture, DHS: Department of Homeland Security.

5 Comparative Analysis

In this chapter, a comparative analysis will be undertaken between thematic and horizontal priorities in EU, EU MS and the U.S..

Table 5.1 and 5.2 show a matrix of countries vs thematic and horizontal priorities.

Tab 5.1 Thematic priorities in EU, EU MS and U.S.

	APPLIED RESEARCH												BASIC SCIENCE FIELDS					
	Environment & SusDev	**ICT**	**Service**	**Engineering, Technology**	**Biotech& Health**	**Energy**	**Material, Nanotech**	**Security**	**Transport and Logistics**	**Space**	**Agriculture/ Forestry / Food**	**Cultural Heritage**	**SSH**	**Mathem.**	**Life Sci**	**Physics**	**Chemistry**	**Geoscience Marine Research**
EU	X	X			X	X	X	X	X	X	X		X					
AT	X	X			X		X		X									
BE																		
Federal										X								X
Flemish	X	X			X													
Walloon	X			X	X				X	X	X							
Brussels	X	X			X													
BG	X	X			X		X				X	X						
CY	X	X			X	X	X						X					
CZ	X	X		X	X	X	X	X					X		X			
DK	X	X			X	X	X											
EE		X			X	X	X				X	X						
FI	X	X	X		X	X	X				X							
FR	X	X		X	X	X	X	X	X	X	X		X	X		X	X	X
DE	X	X			X	X	X	X		X								
GR	X	X		X	X	X	X	X	X	X	X	X	X					
HU	X	X			X	X	X								X			
IE	X	X			X						X			X	X	X	X	X
IT	X	X			X	X	X		X		X	X						
LV	X	X			X		X				X	X					X	
LI	X	X			X	X	X				X							

LU	X	X	X		X		X					X	X					
MT	X	X		X	X	X												
NL	X	X	X	X	X	X	X				X		X		X			
PL	X	X			X	X	X	X	X		X		X					
PT		X		X	X	X	X	X	X		X				X			X
RO	X	X	X		X	X	X	X		X	X		X					
SI		X			X	X	X	X										
SK	X			X	X		X								X			
ES	X	X		X	X		X		X						X			
SE	X	X			X	X							X					
UK	X	X	X	X	X	X	X	X	X									
U.S.					X	X		X		X	X				X			

Tab 5.2 Horizontal priorities in EU, EU MS and U.S.

	HR, Mobility	**Intern. Coop**	**PPP**	**Efficiency of public R&D system**	**Competitiveness**	**Basic research**	**Grand societal problem solving**	**Structural adaptations**	**Research Infras.**	**Evaluation QA, foresight**	**Science in Society**
AT	X	X	X			X	X				
BE											
Federal level					X						
Flanders	X	X			X						
Wallonia		X			X	X					
Brussels											
BG	X		X					X	X	X	
CY	X	X	X		X				X		
CZ	X	X	X	X			X	X		X	X
DK	X	X	X			X	X	X	X		
EE	X				X	X					
FI		X	X				X	X	X	X	
FR			X		X	X		X			

DE	X	X	X		X						
GR	X	X			X			X		X	
HU	X	X			X			X	X		X
IE	X				X			X			
IT	X				X			X			
LV											
LI											
LU											
MT											
NL											
PL											
PT											
RO											
SK	X	X		X			X	X	X	X	X
SI		X	X		X			X			
ES	X		X	X		X	X		X		X
SE		X	X			X	X	X			
UK	X	X		X		X					X
U.S.							X	X			

5.1 Comparison of thematic priorities

The first striking difference between the European and U.S. S&T systems is that the latter is strongly mission-oriented and lacks any central implementation body. Defense and public health remain the two major priority areas of U.S. research. Basic research is mainly supported through the Naitonal Science Foundation (NSF) and it does not involve any specific priority direction in its funding mechanisms.

On the other hand, in European Member States (EU MS) R&D policy is still to a large extent of generic nature, where a big part of R&D funds are spent without specific thematic focus. However, this does not mean that EU countries lack of thematic focus in their R&D policies. It is the areas of

- Energy, Environment and sustainable development
- ICT, Telecommunications and electronics
- Biotechnology and Health, and
- Nanoscience/-technology and material research

which are mentioned in all strategies of EU countries being of priority interest.
Further priority areas represented in some MS relate to Engineering and Technology, Security research, Transport and logistics, Space and agriculture/forestry/food.

What concerns priority basic research areas, it is reseach in cultural heritage and national identities as well as Socio-economic sciences which are of priority interest in many EU countries (see Annex 1).

Despite their importance for the national R&D system, in some countries (BG, CZ, GR, HU and EE) priorities are not or only partly reflected in the allocation of respective funds. In 19 out of the 27 EU MS the majority of funds is of generic nature. For the remaining eight (8) countries, thematic funding is higher than generic although thematic funding does not always reflect the priorities set in strategy papers.

In FP7, it is the Specific Programmes for Health, Food/Agriculture/Fisheries and Biotech, ICT and Nanoscience- and technology which receive the largest budget shares.

As can be seen from Annex 1, in the U.S. as well as in EU MS, applied research areas dominate thematic funding.

Interestingly, in Ireland, Sweden and the UK which have a highly developed applied research basis, with a close link to industry and a strong innovation capacity, the trend has reversed slightly: funding for the research basis has gained importance due to the consideration that a strong research base is important to feed into the applied and industry related research.

Priority setting is an exercise with the aim to increase research and innovation output by focusing of resources on specific themes. EU MS have widely undertaken the exercise and embarked on developing multiannual strategies (4-7 years) for their research systems. On the other side of the ocean, prioritisation in the U.S. S&T system is subject to annual cycles and political developments, making it a difficult and short-term process. Nevertheless, the U.S. leads investment (reflecting priorities) and output in the majority of (European) priority areas mentioned above:

- Investment in health related R&D in the United States is 0.22% of GDP, far above the levels for the EU (0.05% in 2006). In 2004 – 2006, the U.S. also accounted for almost half of patented inventions in medical technologies, which is twice as many as the EU.
- In biotechnology, the U.S. accounted for 43.5% of all biotechnology patent applications in 2006, Germany, as the only EU country, is on the third OECD place with 6.7%. Biotechnology research receives investment both from public and private sources, why the patent figures only partly reflect outputs from publicly funded research. However, this figure is quite rpresentative for the overall strong private R&D investmentin the U.S. (see Fig. 2.2).
- From 2004 -2006, 43% of the worldwide nanotechnology patents originated from the United States, 25% from EU27.
- Government budgets as a share of GDP are the largest in Spain, Portugal and the United States. In the U.S., defence accounts fro 57% of total government R&D spending in 2008, reflecting the srong mission-oriented approach in this research area. Spain, Portugal, Finland and Denmark have the largest government R&D budgets for civil programmes as a share of GDP in 2008

5.2 Comparison of horizontal policy areas

The **human capital** is the most crucial aspect in research. Without curious and dedicated researchers there is no research. All MS pay tribute to this issue by placing the support of human resources as their top priority. In all MS programmes for either mobility of researchers, the quality and quantity of research staff and engineers and support to young researchers and women are in place (to various extent). The Obama administration also puts emphasis on the education of the next generation with 21st century knowledge and skills while creating a world-class workforce.

The presence of foreign scholars is an indicator of the international attractiveness of the country´s universities and of opportunities for researchers. In absolute numbers, the United States hosted the largest foreign doctoral population, with more than 92.000 students in 2006 from abroad, followed by the UK (38.000) and France (28.000).

Mobility of researchers is one of the main objectives of the European Research Area and the MS are in the process of adapting their national regulations to facilitate mobility of researchers in accordance with their national R&D strategies. Therefore the situation in Europe at the moment varies from country to country!

Another important policy area is **international cooperation** - establishing strategic links with international research partners, tapping on knowledge generated elsewhere in the world, increasing the quality of own knowledge are for many EU MS drivers to engage in this priority area. What concerns FP7, it is completely open to the participation of third country research actors, dedicated calls support international cooperation in specific areas or with specific policy focus. The People programme also contains measures for international moblity of researchers. In terms of the EU Framework Programmes, millions of Euros have been spent on international cooperation in the course of the past years. Also, strategic efforts have been undertaken to exchange experiences, identify commonalities and work on joint approaches between EU MS (in the framework of CREST and by establishing the Strategic Forum for International Cooperation on EU level) In the U.S. there is no truely structured approach to international cooperation in place. Over the years international cooperation has been more acknowledged and Funding Agencies nowadays understand international cooperation as essential tool to support the future U.S. competitiveness. However, specific funding for international cooperation is hardly specified and for several agencies not possible.
Indicators which measure international cooperation like the number of co-authorship of publications and filed patents with international partners (co-patents) show that the degree of international collaboration varies. Small countries tend to look for more international collaboration and large countries tend to engage less. However, the traditionally strong commitment to international cooperation in the EU accounts for the fact that three of the large EU countries (France, Germany and the UK) conduct more collaborative work with international partners than the United States.

Given the function of research contributing to a country´s **competitiveness**, EU MS place great emphasis on raising their **innovation capacity**, **public-private cooperation** and in general,

providing favourable environment for companies and SMEs to conduct research and develop new market products and services.
A special example in this context is Germany´s High Tech strategy, which is the umbrella strategy for the country´s research and technology efforts in the next years. In the U.S., this notion has been ever since stronger pursuited than in the EU. The U.S. system is, as already mentioned, highly mission-driven, where new advances in research should serve the nation´s defensive ability and its health system.
The CIP (Competitiveness and Innovation Programme) is a specific EU FP7 programme dedicated to boost Europe´s innovation capacity. Also, the FP7 intends to boost SME research and innovation capacity across all thematic areas.
The difference in total R&D intensity between the EU27 and the U.S. is almost exclusively due to difference in levels of private sector funding (BERD), together with the strong output figures in priority areas such as health, nanotechnology and biotechnology, the U.S.´ focus on innovation and competitiveness is stronger than in Europe.

Recently a certain trend of directing research to find answers to societal and **global challenges** can be observed in some countries:
The U.S. strategy of "Innovation for Sustainable Growth and Quality Jobs" states that research and innovation shall "address the grand challenges of the 21st century" with focus on advances in health, transport technology and a clean energy revolution.
Since 2008, the ERA initiative on Joint Programming (JP) has been running. It has its origins in the ERA Green Paper of 2007, which recognised that there is a mismatch between major societal challenges which are European in scale and the research instruments to adress them, which are mainly (85%) at the level of EU MS. Joint Programming is intending to tackle this issue and the European Council of March 2008 called on the Commission and the MS to explore the potential of Joint Programming in research, asking for joint activities to be launched by 2010 as a contribution to solving major societal challenges. As a result, the High Level Group of JP (GPC) has identified 10 thematic areas of European and global concern, where MS will intend to set up JP initiatives (JPIs). These areas are:

- Alzheimer and neurodegenerative diseases
- Health, food and diet related diseases
- Cultural heritage and climate change
- Agriculture, food security and climate change
- Antimicrobial resistance
- Climate Knowledge
- Ageing
- Urbanisation
- Water challenges

- Healthy seas and oceans

The JP process has triggered huge interest and many EU countries participate in one and more JPIs. The process of selection of JPIs on national level was in most of the cases undertaken in a broad participatory manner on national level, through workshops, seminars, foresight activities and based on the research capacity or gaps in the countries. It has led to the consideration of societal challenges in research and mobilized stakeholders (public research organisations, researchers, societal actors, etc to quite some extent. It is too early to evaluate its impact on the European Research Area and in adressing the societal challenges, nevertheless, it is a first step of taking the importance of these topics into account.

This analysis takes a closer look on R&D priorities in the EU, EU MS and the U.S. by taking into account priority setting mechanisms, thematic and policy priorities. It analyses differences and commonalities of these aspects.

Some of the basic conclusions in this paper are:

- **Huge differences in R&D intensity:** the EU average investment in R&D as % of GDP is around 1.8%. Only Sweden and Finland are above the 3% target, seen as a level of investment in R&D necessary for Europe to remain competitive and contribute to the EU2020 strategy for a smarter, more sustainable and more inclusive growth for Europe.

- **Variety of priority setting approaches:** The U.S. system is strongly "mission oriented", where research in defense and health shall deliver results for the nation´s security and public health. These are the two areas with the biggest share in the budget. Traditionally less centralised priority setting, strong national agencies which define their budget allocations autonomously as well as yearly negotiations on the budget allow for flexibility and adaptability to new developments and to the orientation towards new areas in research.
  In Europe, the picture is overall rather different. On EU level (through the European R&D Framework Programme) as well on national level of single EU Member States (EU MS), one can see either top-down, centrally decided priorities, bottom-up, integrative approaches or a mixture of both mechanisms.

- **Thematic priorities: similar in the EU MS and the EU FP – some overlap with the U.S.** In almost all EU MS, following thematic areas are prioritized:
  - Energy, environment and sustainable development
  - ICT, Telecommunications and Electronics

- Biotechnology and Health, and
- Nanoscience/-technology and material research

In the U.S., public health and state security are of top priority, followed by space and energy research (with respect to budget share). The NSF receives another big share of the S&T budget, which is thematically not specified.

- **Increased attention to societal and global concerns:** Global and societal concerns have increasingly moved into the centre of attention for R&D policies. Climate change, ageing, health issues etc. stronger influence R&D priorities.both in the U.S. as well as in the EU. It is R&D and innovation which are expected to contribute to solving these major challenges, open new markets for innovative ideas and contribute to competitiveness.

- **Horizontal aspects**: The EU Framework Programmes and the EU MS have a variety of measures in place to tackle horizontal policy areas, such as mobility, strengthening of human resources in research, international cooperation, support to innovation in the private sector etc. Despite strong efforts in support for SMEs and private sector R&D, the EU/EU MS are lagging generally behind in this area. The mission-oriented, output focused U.S. system has triggered stronger private R&D investment. On the other hand, some Member States´ efforts in international cooperation have pushed them to the top three countries (DE, FR, UK) worldwide with highest share of cooperation in research with international partners.

6 Annex

Annex I Table of thematic priorities in EU, EU MS and U.S.

	APPLIED RESEARCH												BASIC SCIENCE FIELDS					
	Environment & Sustainable development	**ICT, telecommunications electronics**	**Service Sector**	**Engineering and Technology**	**Biotech & Health**	**Energy**	**Material Research Nanotechnologies**	**Security Research**	**Transport and Logistics**	**Space**	**Agriculture/Forestry/ Food**	**Cultural Heritage**	**Social Siences and Humanities**	**Mathematics**	**Lifesciences**	**Physics**	**Chemistry**	**Geoscience Marine Research**
EU	Environment (incl Climate Change)	IST			X	X	x	X	Transport and Aeronautics	X	X		x					
AT	Technologies for Sust. Dev., incl. Energy	X			Genomics		X		Transport systems and technologies									
BE																		
Federal										X								Polar research
Flemish	Strategic research centre in Environment	Strategic Research Centre in broadband technologies			Strategic Research Centre in Biotech													
Wallon Regio	Competitiveness pole in green technologies; Centre of excellence in sustainable			Competitiveness Pole in Mechanical Engineering	Competitiveness pole in life sciences and health				Competitiveness pole in Logistics	Competitiveness Centre	Competitiveness pole in Agro industry							

	development; research programmes in renewable energy, sustainable construction and smart technologies for the management of electronic networks																	
Brussels	Environment	X			X													
BG	Energy efficiency[a]	IT [a]			Biomed, biotech [a]		X [a]				X [a]	X [a]						
CY	Sustainable development	X			X	X	X						X,Socio economic sciences					
CZ	Sustainable development a	X, with specific thematic budget		Mechanical Engineering	Health: with specific thematic budget, administered by Ministry	Energy sources a	Material Research [a]	X [a]					Socio-economic sciences		Molecular biology			

					of Health													
DK	Sustainable Energy and Environment	X			Biotech; Food, Nutrition and Health	Sustainable energy production and use	X											
EE		X ICT CoE Electronics CoE			Biomed, Biotech Cancer Research CoE Food and Fermentation, CoE Healthy Dairy Products, CoE	Energy technology	X Nanotech CoE				Applied research and development in agriculture, plant breeding	Estonian language						
FI	Council: environment and energy sector Tekes: scarce resources	Council: X Tekes: knowledge society for all, interactive media, intelligent systems and environments	Council: X Tekes: service business and service innovation		Council: Biotech Council: Health and wellbeing Tekes: Wellbeing and health	Tekes: clean energy	Council: metal research, nano				Council: forest							
FR	Environmental science 2009 Strategy	2009 Strategy: X		Construction Engineering	2009 Strategy: biotech 2009	X (incl nuclear)	Nanotech	X	Transport, Mobility	X	Food, agriculture		Socio-economic sciences	X		X	X	X

	: Environment and ecotech				Strategy : health, well being, diet													
DE	Environment related technologies	X			biotech, health and medicine	Energy technologies	Nanotech	Security technologies		Aerospace techn.								
GR	SusDev and Environment	X		High-value added products and production technologies in traditional sectors	X	X	Nanotech, advanced materials, microelectronics	X	X	X	agriculture and food	Culture	Socio economic Sciences					
HU	environmental technologies	X			Biotech	renewable energy sources	material and nanotech								X			
IE	X	X			X						sustainable food and agriculture			X (as key disciplines)	X	X	X	Marine Research
IT	Sustainable growth	ICT and telecomm.			Quality of life, Biomed, Health, Pharmaceuticals	Energy, energy microgeneration	Ceramics		Motor design and manufacture, shipyard and aviation industry. Advance		Agrofood	Mediterranean cultures in globalised world						

									d logistics and transportation									
LV	Environment; sustainable use of local resources	X			Biomed Public health; medical science		Material science, innovative materials and technologies				Agro-biotechnology; forestry and wood science	National Identity; Letonica (Latvian language, culture, heritage)					Organic chemistry	
LI	Ecosystems, CC technologies	Research towards development to knowledge based society			Genomics and biotech for health	research related to nuclear safety, nuclear waste, termination of exploitation of a nuclear power plant	Nanotech, -sciences, Nanostructural materials				Genomics and biotech for agriculture							

LU	Sustainable resource management; Sustainable management of water resources	Security of information (high socio-econ potential area)	Innovation in services development and performance of financial systems (area of high socio-econ potential); high quality and efficient business services (area of high socio-econ potential)		Biomedical research regulation of chronic, degenerative and infectious diseases, e.g. ageing diseases (high socio-economic potential)		New functional and intelligent materials and surfaces (high socio-economic potential)					Identities (languages), diversity and integration;	Labour market, educational requirements and social protection					
MT	Environment: water desalination, waste	digital gaming industry, e-services of the governmen		Manufacturing and Services	Health-Biotech: genetic, bio-informatics,	Energy resources: solar, wind, bio energy												

	rehabilitation technologies, marine management	t, promote ICT in education				together with energy efficient technologies												
NL	Sustainable Earth	X (governmental priority); Knowledge base for ICT applications	Creative Industry (key area approach)	Chemical Industry (key area approach)	Genomics (governmental priority); Brain and Cognition; Life Sciences and Health (key area approach) New instruments for health care;	Basic energy research	Nanotech (Governmental priority); Use of nanoscience and nanotech. High Tech Systems and Materials (key area approach)				Food&Flowers (key area approach)		Conflict and Security; Cultural Dynamics; Dynamics of complex systems; Dynamics of Life Courses; R&I in smart creative contexts; Responsible Innovation Pensions and social security		Systems Biology			
PL	Environ	X			Health	X	New	X	X		Agricultu		State					

	ment						materials and technoligies				re and food		and society					
PT		IT, software engineering, robotics, digital contents, multimedia (research networks)		Manufacturing technologies (research network)	Health	X (research network)	International Iberian Nanotech Laboratory	Defence research, evaluation and prevention of risk	Transportation and logistics (research network)		Agriculture				Biosciences (res. Network)			Marine research
RO	Enviornment	X	Innovative processes and goods		Health	X	Innovative materials	X		X	X (without forestry)		Humanistic research Socio-economic sciences					
SI		X			Biotech, healthy lifestyles	X	New materials and nanotech	Internal and external State security										
SK	Environment			Technologies for sustainable economy; complex systems and innovative technolo	Health		Synthetic metals, non-metal materials and nanotech								X			

				gies														
ES	X	IST with electronics and communication, service oriented IST		Industrial design and production Construction Engineering	Biomed and biotech		Materials		Transport						X			
SE	Climate	IT: examples: new communication solutions in the intersection btw mobile broadband and IT			Medicine, examples: fight against major diseases that affect large sections of population (e.g. Alzheimer)	Climate, examples: new energy solutions for reduced CO2 emissions; greater energy efficiency and renewable energy sources							Humanities, social sciences					
UK	Living with environmental change	Digital economy, network security, electronics	High value services, Creative industry	Low impact buildings	Health; healthcare, Ageing and Life long health	X, generation and supply	Nanoscience through engineering to Application	Defense R&D	X									
U.S					Health	X		Defen		X	Agricultu				X			

.					care			se R&D			re							

7 List of Abbreviations

Abbreviation	Full-Term
AAAS	American Association for the Advancement of Science
APRE	Agency for the Promotion of European Research
BERD	Business sector R&D expenditure
BILAT	Bilateral Coordination for the Enhancement and Development of S&T partnerships
BILAT-USA	Bilateral Coordination for the Enhancement and Development of S&T Partnerships between the European Union and the United States of America
BRIC countries	Brazil, Russia, India, and China
DG	Directorate General
DHS	Department of Homeland Security
DOA	Department of Agriculture
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
EC	European Commission
ERA	European Research Area
ESFRI	European Strategy Forum on Research Infrastructure
EU	European Union
EURATOM	The European Atomic Energy Community
FFG	Austrian Research Promotion Agency (Österreichische Forschungsförderungsgesellschaft mbH)
FP6	Sixth Framework Programme for Research and Technological Development (2002-2006)
FP7	Seventh Framework Programme for Research and Technological Development (2007-2013)
GBAORD	Government budget appropriations of outlays for R&D
GDP	Gross Domestic Product
GERD	Gross Expenditure on RTD
GOVERD	Government R&D expenditure
HERD	Higher education sector R&D expenditure
HR	Human Resources
ICT	Information and Communication Technologies
INTRASOFT	INTRASOFT International S.A.
IST	Information Society Technologies
MS	Member State
NASA	National Aeronautics and Space Administration
NGO	Non Governmental Organisation
NIH	National Institute of Health

NSF	National Science Foundation
PPP	Public Private Partnerships
PRO	Public Research Organisation
R&D	Research & Development
RTD	Research and Technological Development
S&T	Science & Technology
SME	Small and Medium sized Enterprises
STA	Science & Technology Agreement
TETALAP	The Hungarian Science and Technology Foundation
U.S./USA	United States of America