Ad hoc analysis of the European Commission's draft concept for the seventh Framework Programme

(Snapshot, Status April 11, 2005)

Concept, perspectives and requirements

Study for

The Greens / European Free Alliance
in the European Parliament

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Important Notice:

- This study is a "snapshot", summarising the current status (as of April 11, 2005) of the European Commission's proposed concept for the 7th Framework Program (FP 7) and of the public debate of this proposal. It is based on public information available until April 8, 2005. Because of the short time scale information and sources were used on an 'as is' base without extensive additional verification.
- Currently the FP 7 concept is "work in progress". Further political and public debate, revisions and further detailing are expected between now and 2006, the planned launch date. During this process, significant changes of the objectives, structure, thematic priorities, instruments, etc. described in this document may occur.
- This analysis is based on publicly available information, except where stated differently in the text. Certain assumptions had to be made and inconsistencies between different sources may occur. We have done our best to identify and use all important sources of information in the time available. But we can not guarantee the quality of all used data. Therefore this report should not be used as the sole source for any political, strategic or operational decisions without further verification.
- In addition, this study focuses on those aspects of FP 7 which are of special relevance for policy discussion and for the political goals of The Greens /European Free alliance (EFA), who have commissioned the study. Therefore it is by no means intended to serve as a comprehensive description of FP 7 and all of its elements and framework conditions.

0. Executive summary

In its draft of the 7th Framework Programme the European Commission proposes to boost investment in research

April 6, 2005, the European Commission presented its proposal for the 7th Framework Programme of the European Community for research, technological development and demonstration activities (FP 7) with the following key elements:

- A substantial **increase of the European research budget** is proposed, raising the level of research funding from approx. 17 Billion Euro under the current sixth Framework Programme (FP 6) to 73,215 Billion Euro for the period 2007-2013[1].
- To enhance ***continuity*** of research, a duration of 7 years is proposed for FP 7 (with the option of a midterm review). The proposed FP 7 builds to a large extent on a continuous development of research themes and instruments already proven under its predecessor Framework Programmes in pursuit of the European Research Area (ERA) and develops them further. Collaborative projects, undertaken by consortia of European partners, will remain at the core of the programme. This will be accompanied by a portfolio of other measures to build the European research area of knowledge for growth. It is proposed to use funds to develop and increase those elements of previous programmes that worked well, e.g. Marie Curie, SME actions, collaborative projects, Networks of Excellence.
- The proposed programme structure regroups activities in **four specific programmes**[2]:

  1. **Cooperation** *(44,735 Billion. Euro = 61,1% of FP 7 budget)*
     Support will be provided for research activities carried out in transnational cooperation, from collaborative projects and networks to the coordination of national research programmes, to gain European leadership in key areas through cooperation of industry and research institutions. The Cooperation programme is organised into subprogrammes which will be operationally autonomous and at the same time demonstrate coherence and consistency, and allow for joint, cross-thematic approaches to research subjects of common interest.

     The restructured and extended portfolio of **thematic research areas** covers now nine research areas: Health, food, agriculture and biotechnology, information and communication technologies, nanosciences and nanotechnologies, materials and new production technologies, energy, environment (including climate change), transport (including aeronautics), socio-economic sciences and the humanities, security and space. In addition, two themes are covered by the Euratom Framework Programme: Fusion energy research and nuclear fission and radiation protection.
  2. **Ideas** *(11,942Billion Euro = 16,3% of FP 7 budget)*
     To strengthen the excellence of our science base by fostering competition at European level, an autonomous European Research Council shall be created. This ERC will support investigator-driven "frontier research" carried out by research teams, either individually or in partnership, competing at European level, in all scientific and technological fields, including natural sciences, engineering, socio-economic sciences and the humanities, etc..
  3. **People** *(7,178 Billion Euro = 9,8% of FP 7 budget)*
     To strengthen career prospects and mobility for researchers' activities, the support for individual researchers, referred to as "Marie Curie" actions, shall be reinforced with the aim of strengthening the human potential of European research through training, mobility and the development of European research careers.

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1 plus 3,103 Billion Euro for nuclear research under the Euratom FP7 (raised from 1,230 Billion Euro under Euratom FP 6)

2 plus non nuclear activities of the Joint Research Centre, accounting for 1,824 Billion Euro (2,5% of FP7 budget)

4. **Capacities** *(7,536 Billion. Euro = 10,3% of FP 7 budget)*
   With the objective that the European science community has the best possible capacities at its service, activities shall be supported to enhance research and innovation capacity throughout Europe. Support will be provided for research infrastructures, for regional research driven clusters, for the stimulation of the research potential in the EU's "convergence" regions, for clustering of regional actors in research to develop "regions of knowledge", for research for and by SMEs, for "science in society" issues and for horizontal activities of international cooperation.

- According to the Commission, FP 7 will have more focus than in the past on developing **research that responds to the needs of European industry** for example through the work of Technology Platforms and the new "Joint Technology Initiatives". These will be projects in fields of major **European public interest** on subjects identified through dialogue with industry, in particular in the European Technology Platforms. By **focussing more on themes and less on instruments**, the programme will be more flexible and adaptable to the needs of industry, as well as more straightforward for its participants.
- To implement FP 7, the Commission announces significant **simplifications of the administrative and financial rules and procedures** of FP 7 through a series of measures, including the rationalisation of funding schemes (new approach based on a simpler set of funding instruments), simpler, less bureaucratic languages (free of jargon and user friendly), reduction of the number and size of documents, reduction of the number of request to participants, instituting a light submission procedure, reduction of a priori controls (i.e. controls before the project is approved), increased autonomy of consortia, streamlining of the selection process and exploration of new modes of funding and simplifying the cost-based funding system.

The FP 7 proposal to boost European research investment is a step in the right direction

A recently published Five Year Assessment of the EU's Research Framework Programmes 1999-2003 points out that "…Europe is, increasingly, falling behind its main competitors. Europe's performance, in terms of growth, productivity and job creation is not sufficient to maintain prosperity in the future…". The same source concludes: "In order to reverse the trends, Europe – the EU and the Member States together – must take coordinated actions to meet four key challenges: To attract and reward the best talent, create a high-potential environment for business and industrial RTD, mobilise resources for innovation and sustainable growth, build trust in science and technology." In view of this challenge the European Commission has announced its proposal to boost research funding at the European Level through FP 7 in order to reach the targeted increase of the European research effort to 3% of the EU's GDP by 2010 (defined at the Barcelona European Council of March 2002). Two-thirds of this investment should come from private investment and one-third from the public sector.

Today, at a current investment of 1,96% of the European Union's GDP in research and development, the European research effort lags behind the efforts of the United States (2.59%), Japan (3,12%) and Korea (2,9%). The gap between US and EU is currently about € 130 billion a year, 80% of which can be attributed to the difference in private sector spending in research and development. With the proposed FP 7 budget, public sector funding will move towards its 1% goal and it is hoped that this will stimulate the necessary significant additional private sector R&D investment.

Will FP 7 meet the expectations?

Several recent reports indicate that Europe has not made the desired progress towards the Lisbon targets. The 'Kok Report' confirms the disappointing delivery of the strategy and concludes that while all three pillars of the Lisbon strategy – economic, social and environmental – remain valid, the priority for Europe now is to boost its economic growth rate and to increase employment. Other reports point out that European innovation performance is overall

stagnating and that the private sector investment in research and development is far from reaching the '2% target'.

Despite this disappointing situation, President Barroso has confirmed recently the dedication to reach the Lisbon objectives through rigorous focussing on economic growth and employment and a commitment to invest in Europe's research base and innovation capability.

FP 7 is at the heart of this effort and its success is a 'must'. However this raises questions:

- Will the increased public sector research investment under FP 7 realize its target to stimulate the necessary sustainable private sector research investment? The current FP 7 proposal is based on this implicit assumption, drawing on typical 'crowding in' effects, documented in literature, etc. But as a location for industrial research, Europe competes today increasingly with other regions with equal competencies and partially lower cost structures. Therefore in its further detailing FP 7 should become more explicit about how leveraging of public sector investment through private sector R&D spending will be achieved. Closing the research investment gap is crucial for the success of FP 7 and of the Lisbon strategy.
- Does FP 7 focus on those research areas where the highest leverage can be achieved? Some of the proposed research areas address obvious 'hot spots', but others still need to prove their potential to contribute to the Lisbon objectives and other EU policy targets, for example because they are still too young and their concept is not sufficiently elaborated (as is the case for example for security research), or because their expected 'payback' will only be realised significantly later than 2010, the date of the 'Lisbon objectives' (as is the case for example for Nuclear Fusion).
- FP 7 focuses on research areas which are perceived as the most demanding in terms of their dynamics, technology intensity and innovation requirements. However other sectors with equal importance for European GDP and employment (for example manufacturing industries with less 'high tech' character or the service sector) also rely on continuous innovation from research, even if innovation takes place in a more 'quiet' way.
- Will the described focussing have an effect on the richness and diversity of the European research landscape and/or create an imbalance between the three pillars of the Lisbon strategy – economic, social and environmental? Does Europe have to sacrifice social or environmental research objectives? Can we afford to pursue them all?
- Existing imbalances in research intensity and potential across the EC are further sharpened through the extension to 25 members. If the defined criterion of 'excellence' would be applied consequently, FP 7 would have to ignore these aspects, thus maybe contributing to a 'research divide', where the strong will be further strengthened and the weak can not receive the necessary help to catch up. To deal with this, FP 7 contains some elements with a cohesion policy character. However it is feared that these efforts will not have a critical mass to induce lasting change while preventing at the same time a clear interface with cohesion and regional policy measures whose primary responsibility this is.

Size and structure of the FP 7 budget: More transparency necessary

Even if the need to boost investment in European research through FP 7 is undoubted, it is not fully transparent from the outside how the FP 7 budget and its allocation to priorities in the Commission's proposal have been reached. Apparently the overall budget brings public sector research investment significantly closer to the '1% objective'. But major shifts in priorities are not visible: All research areas already existing in FP 6 grow at approximately the same rate.

Therefore a qualified evaluation of the proposed overall budget size and allocation to programmes will only be possible as more details will be known in the course of the further detailing of the FP 7 concept and of the ongoing policy debate.

FP 7 is addressing the right issues – but must be consequent in setting priorities

Based on available information, a first ad hoc analysis of the elements of FP 7 shows:

- Allocation of >60% of FP 7 budget to ***cooperative research*** addresses the priority objective of gaining leadership in key scientific and technology areas through a range of research activities performed in transnational cooperation between universities, industry, research centres and public authorities across the European Union as well as with the rest of the world. This form of collaborative research has proven to be efficient and should remain the main pillar of European research.
- The allocation of approx. 16% of the FP 7 budget to investigation driven research, funded by the ERC, is newly introduced to the Framework Programme concept under the **Ideas** programme. Its efficiency and effects are difficult to evaluate in advance, because the ERC concept is still under discussion. There are valid arguments for establishing an instrument to stimulate investigation-driven, independent research on a European level. But several conditions should be observed:
  - It should clearly focus on research themes where the European dimension adds significant value. In particular, ERC funding should not compete with national programmes in the same area.
  - The ERC should establish transparent and efficient instruments to secure (1) the 'excellence' criterion in funding decisions for projects, (2) the efficient management of projects funded and of the ERC's portfolio of projects, and (3) a consequent documentation, evaluation and dissemination of results achieved.
  - Detailed proposals for governance of the ERC, project selection criteria, etc. will only be available later this year. These should be discussed with all stakeholders in European research to ensure that investigation driven research does not take place in an 'ivory tower'[3].
  - Based on the available information it is also impossible to make a credible statement whether the proposed amount of funds for the Ideas programme (11.942 Mio. Euro) is appropriate. Are there currently unmet funding needs of the scientific community in this order? Are there enough potential projects fulfilling the 'excellence' and other relevant criteria? Can undesired structural effects happen (e.g. diversion of excellent research capacities, redundancies with national priorities and programmes)?
- Continuous development and further enhancement of the Marie Curie actions under FP 6 in the new **People** programme of FP 7 apparently addresses one of the key levers for securing the future science base in Europe and should therefore receive a high priority.
- For the **Capacities** programme, a differentiated view is necessary[4]:
  - The further development of and access to ***research infrastructures*** on a European scale is an apparent priority for the further realisation of the ERA.
  - The term 'infrastructure' should be extended beyond physical infrastructure. ICT-enabled virtual collaboration in networks and a secured and affordable access to scientific and technical information and literature merit growing attention and should be addressed by FP 7.
  - ***Research for the benefit of SMEs*** can be a powerful instrument to create leverage from FP 7 for SMEs which play a key role for European competitiveness, innovation performance and employment. But this requires a specific approach to meet their particular needs, time horizon and limited resource base to perform own research.

[3] For example through research programme review involving different stakeholders from the public and private sector, a partially problem oriented structure of the ERC funding, calls for proposals addressing actual challenges, etc.

[4] The question of 'excellence' vs 'cohesion' criteria for the ***Research Potential*** and ***Regions of Knowledge*** priorities has already been discussed and is it not repeated here.

- Beyond the creation of a favourable societal climate, ***Science in society*** should stimulate a 'two way communication' which enhances the understanding and acceptance of scientific work and its results in European Societies. Issues, where research and its results may be conflicting with what society desires and is willing to accept, should be identified and a consensus oriented dialogue should be initiated[5].
- As an important gateway between Europe and its partners the activities of ***international cooperation*** should be further pursued in the described way.

- In close coordination with other policy measures the future FP 7 structure must ensure a sane ***balance*** between a dedicated investment in the further development of the ERA and the creation of the necessary momentum in priority research fields. The objective must be to enable and stimulate ***seamless innovation processes*** in a world class European 'research landscape' and to create European leadership through breakthrough innovations as a basis for future economic growth and performance and for achieving the Lisbon objectives.
- The **socio-economic dimension** in main FP 7 research themes should be expanded beyond its current limited exploitation to a full integration of socio-economic research components in the work programmes and 'calls for proposals'. Aspects of science and society interactions and perspectives (introduced as a separate component in FP 6) should become a 'horizontal issue' applicable across all FP 7 RTD programmes, and hence become embedded in EU project coverage in a similar way to those parts addressing gender and ethical issues.
- There should be room for **interdisciplinary approaches** involving more than one of the defined research areas. The driving force behind such approaches should be a 'problem solving', mission oriented approach, complementing the technology and application oriented structure of the Framework programme.
- The current focus on young research fields with high innovation dynamics and technology intensity should not prevent appropriate **support for research for the benefit of more mature sectors** to maintain European competitiveness and employment in these sectors. Despite slower overall growth rates, in such sectors often 'silent revolutions' with high innovation content take place which enable improved product features, cost efficiency. etc. Sustainable competitiveness in these sectors as a basis to maintain their economic and employment contribution, merits appropriate attention also from the research side.
- During FP 7 the dynamics of global research and economy may lead to shifting priorities or to the evolution of new priority research areas. The FP 7 design should provide for the necessary **flexibility** to react to such changes.

In detail: Ad hoc observations and recommendations for the nine FP 7 research areas[6]

1. **Health** *(Budget = 8.373 Mio Euro; 18,7% of collaborative research; 11,4% of total FP 7)*

- The shift of emphasis from a mostly (bio-)technological focus towards more integrated approaches to major challenges of the health sector has the potential to create increased leverage for the creation of innovative treatment of diseases, for the development of sustainable and efficient healthcare systems in Europe and for strengthening the innovation performance and competitiveness of health related research and companies in Europe. For this purpose, research under FP 7 should combine advance in priority Life Science research themes and technologies with interdisciplinary approaches to new solutions for

[5] Examples like stem cell research, nuclear energy, etc. demonstrate how otherwise in some countries research and policy get stalled by the polarisation created and unresolved conflicts.

[6] Due to the short time between the publication of the Commission's proposal (April 6) and the publication of this study (April 11), selected priority areas have been analysed in-depth. Therefore several research areas are discussed in more depth than others in this section.

integrated health concepts, involving all relevant disciplines, including translational research, clinical research, development and validation of new therapies, methods for health promotion and prevention, diagnostic tools/technologies, etc.

- From a purely scientific and technological perspective, the FP 7 approach forms a good basis for shaping the EU's future research strategy in the health area. In order to contribute to the development of new therapeutic approaches, especially in areas where today no efficient pharmaceutical therapies exist, FP 7 should focus in particular on the bottlenecks of current drug development.
- But the resolution of ethical questions and the necessary acceptance in European societies are a 'must' for moving forward – especially in the field of biotechnology! The controversial debate about deployment of genetically modified material, stem cell research, etc. in some Member States should be taken serious and lead in a way which ensures a reasonable degree of consensus in European societies on the fields where European leadership is sought in this area and on the ethical standards in which this takes place.
- Already under FP 6, a part of the research effort in Life Sciences was devoted to actions going beyond purely economic motivation[7]. These objectives should be pursued and intensified under FP 7, for example by research on therapies for poverty related and/or rare diseases.

2. Food, Agriculture and Biotechnology *(Budget = 2.472 Mio Euro; 5,5% of collaborative research; 3,4% of total FP 7)*

- The extension of the FP 6 priority 'Food quality and safety' to a broader approach under FP 7 to build 'a European *Knowledge Based Bio-Economy"* provides significantly more potential for meeting the growing challenges in these areas. Research on a European level can make important contributions to addressing social and economic challenges like the growing demand for safer, healthier and higher quality food and for sustainable use and production of renewable bioresources, the increasing risk of epizootic and zoonotic diseases and food related disorders; threats to the sustainability and security of agricultural and fisheries production resulting in particular from climate change, taking into account animal welfare and rural contexts.
- Research in this area should integrate all necessary disciplines, reconciling for example unexploited potentials of organic farming and natural resource management with new approaches enabled by the 'omics' technologies and with necessary complementary contributions from social and behavioural sciences.
- Research in this area should focus on innovations and advancement of knowledge in the sustainable management, production and use of biological resources as basis for sustainable, eco-efficient and competitive products from agriculture, fisheries, food, health, forest based and related industries.

3. Information and Communication Technologies *(Budget = 12.756 Mio Euro; 28,5% of collaborative research;17,4% of total FP 7)*

- Information and Communication Technologies (ICT) play a double role: On one side they represent an important industrial sector with significant importance for European economy and employment. At the same time– in a cross cutting technology role - ICT is also an enabler for innovation in other sectors using ICT for their products and/or as a source of efficiency improvements, for example in manufacturing, supply chain, etc.
- For both reasons, investment in ICT research, as proposed by the FP 7 concept, is important for Europe.

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[7] For example the FP 6 'Research strategy to poverty-related diseases: HIV, Malaria and Tuberculosis' or the 'European & developing countries clinical trials partnership – EDCTP'

- The structure of research under FP 7 should account for this described duality and provide stimulation of research in areas where (1) European market and technology leadership is realistically achievable and (2) where ICT plays a decisive role as enabling technology for other sectors with high importance for European economy.

4. Nanosciences, Nanotechnologies, Materials and new Production Technologies *(Budget = 4.865 Mio. Euro;10,9% of collaborative research; 6,6% of total FP 7)*

Nanosciences, Nanotechnologies, Materials

- As one of the most important cross cutting technology areas with a high potential impact on many industrial and technology sectors, nanotechnology and materials should receive a high priority in FP 7. This initiative should balance nanotechnology and 'conventional' new materials research and ensure integration in the global nanotechnology/materials research community.
- This requires an integrated research strategy, involving basic research, developers/producers of advanced materials and users. Research strategy must balance two major objectives: (1) strengthen the European research base for the further development of knowledge and the exploration of new effects, materials, etc.; (2) accelerate the transformation of knowledge and results generated in research into successful technologies and products, especially in sectors where advance in materials research enables innovation in research and application fields using innovative materials. A sound balance between a materials orientation (focussing on scientific breakthroughs in materials/nano research) and an application orientation (translating the potential of nanosciences and materials into added value for sectors applying new materials, etc.) should therefore be sought.
- These technologically oriented research strategies should be complemented by research on possible health and environmental effects to address existing concerns and by technology foresight work, addressing the high complexity and unpredictability of technologies, global markets and applications of nanoscience sector.

New production technologies

- Innovative production technologies have a growing importance as a cross-cutting enabling technology for maintaining competitiveness in sectors of the manufacturing industries and of SMEs with a high importance for European economy. In the light of growing global competition and of the current trend towards relocation of manufacturing to low cost countries, the EC should take the initiative to develop a leading role in driving the necessary industrial transformation. Dedicated research in new production technologies can make an important contribution to avoid further loss of economic growth and employment potential in the manufacturing sectors.
- To account for this importance, new production technologies should not be positioned as an 'additional item' in the materials/nanoscience research area, but a positioning as an own research programme with a dedicated structure and budget should be considered.
- Research into innovative manufacturing solutions with the potential to reduce pollution, hazards, waste and resource consumption could also make contributions to progress on the other pillars of the Lisbon strategy, especially environmental.

5. Energy *(Budget = 2.951 Mio Euro; 6,6% of collaborative research; 4,0% of total FP 7[8])*

- To meet the challenges of alarming trends in global energy demand, of emissions with devastating consequences for climate change and of the damaging volatility of oil prices, the necessary transformation of the current fossil-fuel based energy system into a more sustainable one, research on a diverse portfolio of energy sources and carriers, combined with enhanced energy efficiency, should be supported by FP 7 with high priority.

[8] for FP 7; plus budget Euratom FP 7 for nuclear research

- The current FP 7/Euratom FP 7 proposals suggest to fund both nuclear research and non nuclear energy research. Both approaches have different potential and time horizons:
  - Many of the technologies in the *renewable energies* and *sustainable energy systems* sector are at the border of large scale commercialization with rapidly growing markets and global competition and reduced dependency on subsidies. New industries with significant economic and employment potential are evolving and the race for global technology and market leadership has begun. At the same time the resulting critical mass of innovation potential will also accelerate the availability of competitive new technologies for reducing greenhouse emissions, dependency on fossil fuels and the use of natural resources.
  - *Nuclear fusion* is a much longer term option which still needs to demonstrate its technical and economic feasibility through further large scale research for several decades. But even if all these uncertainties were resolved, expectations are that it will not be available as a reliable energy supply in the next decades, presumably not before the second half of the century. Therefore it will not have a short to medium term impact on energy supply, economic growth and fulfilment of ecological/emission targets.
  - As the current generation of nuclear power plants will reach the end of its lifetime, the Commission proposes in the field of *nuclear fission* (1) research into new, safer nuclear fission concepts for a next generation of power plants and (2) continued research to find solutions for current issues like final disposal of radioactive waste, etc.
- Research strategies
  - European leadership in *renewable energies* and *sustainable energy systems* requires investment (1) in research on fundamental elements to enhance understanding of and progress in the foundations of state-of-the-art technologies, (2) in accelerated technology and process development (including for example necessary knowledge for the development of competitive manufacturing processes) and (3) the creation of critical masses on a European scale in key research areas. Further research needs and priorities are manifold, depending on the type of technology. But their individual resource needs are mostly in a sizeable range and have the potential to create benefits for European societies already in the next years.
  - *Nuclear fusion development* will continue to require a highly concentrated, long term, multi Billion Euro "heavy weight" research program, working towards an expected technological breakthrough in an international cooperation. To get leverage from this investment, the commitment of a significant budget over an extended period and the readiness to accept the related technological and economic risks will be required, far beyond the currently planned FP 7 research investment.
  - Research in *nuclear fission* has two different aspects:
    - Current issues concerning existing nuclear power plants, etc. require short term solutions for final disposal of radioactive waste, nuclear safety, etc. The decommissioning of nuclear power plants after having reached the end of their lifetime is becoming an issue of growing importance. Experience so far shows that there is a high need to invest further in the development of technologies for certain tasks in this area and for an efficient diffusion of know how generated.
    - Research investment in the future ability of European industry to build new generations of nuclear power plants is only useful if the EC's and the member states' energy and environmental policies support the construction and use of new nuclear power plants[9].
- In view of the economic, employment and ecological potential of renewable energies and sustainable energy systems, the European position in this dynamic technological and

[9] Decisions in this area involve a complex set of aspects of energy policy, nuclear safety, etc., going beyond the research policy scope of this study.

market environment should be further strengthened. European leadership in this area needs a dedicated research effort.

For this purpose research efforts at European level should be increased to create a critical mass of research capability and initiatives in key areas. Such key areas should be chosen as a function of their technological, economical and ecological potential in all relevant steps, including generation, transformation, storage, consumption, etc.

- To realise this, a dedicated own programme element with a significant budget, addressing the specific research needs of the renewables sector and integrating all necessary skills where necessary (ranging from materials, e.g. for Photovoltaics via manufacturing technologies to systems integration and supporting socio-economic research) should be established under FP 7.

6. **Environment (including Climate Change)** *(Budget = 2.552 Mio Euro; 5,7% of collaborative research; 3,5% of total FP 7)*

- Europe has a favourable position in environmental research, technologies and markets. Strengthening this position is essential for the implementation of its environmental objectives, for fulfilling its international commitments and for realising their economic and employment potential. In addition, Europe is facing important environmental challenges.
- Therefore sustainable management of the environment and of its resources and the development of technologies and integrated approaches for this purpose should be supported through the proposed FP 7 programme. The focus should be on advancing knowledge on the interactions between the biosphere, ecosystems and human activities, and on developing new technologies, tools and services, in order to address in an integrated way global environmental issues.

7. **Transport (including Aeronautics)** *(Budget = 5.981 Mio Euro; 13,4% of collaborative research; 8,2% of total FP 7)*

- The transport sector is both an important contributor to European GDP and employment and a major source of emissions, responsible for 25% of all CO_2 emissions. Therefore innovative transport approaches and technologies with the potential to ensure safe and reliable transport in a converging Europe are of high importance.
- Research in this area should focus on technological advances for integrated, "greener" and "smarter" pan-European transport systems for the benefit of the citizen and society, respecting the environment and natural resources; and securing and further developing the leading role attained by the European industries in the global market.
- Research in this area should go beyond technological development and include also interdisciplinary approaches to integrated transportation systems, use of modern ICT-based communication, telematics, etc. and also address questions of growing importance for society (e.g. safety). On the technology side, a balance between research on potential breaktrough innovation (e.g. hydrogen based concepts) with potentially high, but longer term reach and pragmatic progress with more immediate impact, based on current concepts and technologies (e.g. hybrid vehicles) should be sought.

8. **Socio-economic Sciences and the Humanities** *(Budget = 798 Mio Euro; 1,8% of collaborative research; 1,1% of total FP 7)*

- An in-depth, shared understanding of the complex and interrelated socioeconomic challenges Europe is confronted with is a necessary prerequisite for efficient policy making. The positioning of Socio-economic Sciences and the Humanities as an own research priority with a dedicated budget is an important step in this direction.
- Beyond this, research in this area can also contribute to research in other areas of FP 7, working on some of Europe's major challenges. Research areas like health, energy, etc.

move towards a more system driven problem solving approach, which requires in-depth understanding of underlying socio-economic and other issues. Therefore the research potential in Socio-economic Sciences and the Humanities should be exploited in interdisciplinary projects and teams with a maximum of integration in such research areas addressing important challenges facing European societies[10].

9. Security and Space *(Budget = 3.987 Mio Euro; 8,9% of collaborative research; 5,4% of total FP 7)*

- It is surprising to see both research areas united in one programme as there are very limited communalities and synergies between them.

Space research

- The European Space Policy and the framework agreement with ESA create an important binding commitment of the EC to Space research. Therefore space applications research will continue to be funded under the Framework Programme.
- FP 7 funding should be focussed on research fields which are not covered by other programmes (e.g. ESA) and on fields of high application relevance. As an alternative, these could be funded via the respective application areas where appropriate.
- Beyond these general considerations it is not possible to make specific recommendations here, because publication of a detailed structure of future space research under FP 7 is still due. A comprehensive European Space Policy will only be endorsed in the course of 2005. Discussion should be taken up again after publication of more tangible proposals for this research area.

Security

- In view of current threats and recent events, making the potential of modern technology available for European security needs is an attractive approach. But the dividing line between defence and civil research, the absence of specific frameworks for security research at the EU level, the limited cooperation between Member States and the lack of coordination among national and European efforts hinder the development.
- Current considerations are mostly based on a technology driven use of the term 'security research', highlighting technologies for security of persons, infrastructure, etc. against terrorism and other threats. In a wider definition, 'security' might also include for example efficient measures against pandemic diseases or natural disasters like the recent surge catastrophe in Asia, etc. Experience with typical recent threats and events shows also that efficient security strategies often require complex, integrated approaches, combining the potential of advanced technologies for example with socio-economic approaches, political sciences, etc. Therefore the programme should emphasise interdisciplinary approaches.
- As a detailed security research strategy will only be available later this year, it is difficult to evaluate the proposed overall budget and strategy and its value at this point in time. But several questions need to be answered:
  - Will the research priority be on using technology as a 'force enabler' for a secure Europe, emphasizing Europe's security needs – or should priority be given to the Lisbon objectives, emphasizing the competitiveness of the European security and defence industry and its potential to create economic growth and employment in the world markets for security technologies?
  - How is the overall size of the budget for this research area justified and how will it be allocated to research priorities?

[10] If such a contribution is not possible on the basis of funds currently planned for this element, an extension should be considered. As an alternative, funding of socio-economic/humanities research in such areas could also be provided by the respective thematic programme elements.

- Is the proposed security research approach compatible with European values and ethical standards (for example in view of the close relationship between civilian and military technologies). Will it find the necessary public acceptance?

Instruments and implementation

Overall the European Commission's proposal for implementation of FP 7 seems to address most of the identified weaknesses and suggestions for necessary improvement at this stage. In particular the proposed significant simplification of the programme operation, focussing more on themes and less on instruments and on research that responds to the needs of European industry and new approaches to managing parts of the programme in partnership with the member countries are apparent steps towards improved efficiency.

For the success of FP 7 it will be vital that these guidelines are now implemented consequently.

Particular attention should be paid to the following issues:

1. **Instruments applied**

   To realize the proposed priority of research themes over instruments, four priorities should be fulfilled:

   - A further simplification and streamlining of the overall portfolio of instruments should make the programme more transparent. Together with the proposed simplification of implementation and funding schemes, reduced complexity should contribute to more efficient administrative processes as well as to increased attractiveness and accessibility for potential participants.
   - Flexibility in the application of instruments should make sure that excellent proposals for attractive research can be formulated on the basis of what support the specific project needs, irrespective of potentially to narrow formal framework conditions.
   - Financial instruments used in FP 7 must be coherent and compatible with relevant other programmes (e.g. TEN, EAFRD, and the Education and Training programmes) and should be applied in a mutually supportive and not in a competing way.
   - For specific target groups with particular needs, the instruments, type of projects funded, etc. must be adapted to enhance attractiveness and leverage for them. In particular SMEs will only be able to obtain maximum benefit from FP 7 if the support offered meets their different needs, research potential, time frame and resources.

2. **Operative implementation**

   The measures proposed for streamlining administrative processes and for partial externalisation of programme management should be implemented consequently. The proposed intensification of reviews will play a key role in the effort to ensure efficiency and therefore should be given high priority. Particular focus should be on rapid assessment of status and results achieved, identification of gaps and improvement potentials and rapid initiation of necessary amendments.

3. **Accessibility**

   Special attention should also be paid to easy and efficient access of potential participants. In the past potential participants often have refrained from participation because of (perceived) level of effort in the application phase and/or lack of knowledge about available funding. This will require a particular effort to make the new FP 7 offering as transparent as possible, to simplify proposal procedures and to 'market' it actively to potential participants.

1. Objectives of the study and approach

The communication "Science and technology, the key to Europe's future - Guidelines for future European Union policy to support research" was published by the European Commission June 16, 2004, to outline its concept for the future of research in Europe, especially under the umbrella of the 7. Framework Programme (FP 7). In pursuit of the implementation of the Lisbon process and of the European Research Area (ERA), the overall objective is to increase the European investment and performance in research and development massively[11]. From this, objectives and approaches of central importance are derived, e.g. for the further development of the ERA[12] and the achievement of the '3% target[13]'. Based on these guidelines objectives, thematic priorities, instruments and other relevant elements have been proposed for FP 7.

Since this initial concept has been published, it has been the subject of intensive public discussion. National governments, participants in the research process from the public and private sector and other stakeholders have expressed their viewpoints and recommendations. In parallel, the political and economic context in which FP 7 will operate has evolved further. And a multitude of preparatory activities have come up with proposals for detailed approaches to thematic priorities, instruments, etc.

Based on the results of these consultations, the Commission has published April 6, 2005 its refined and detailed proposal for FP 7. This official proposal will serve now as basis for further consultations, involving the European Commission, Council and Parliament, national governments and other stakeholders. As a result of this process, FP 7 will be launched in its final and agreed form by the end of its predecessor FP 6 in 2006.

This study, commissioned by the Greens/European Free Alliance (EFA) in the European Parliament and by the corresponding group in the German parliament serves as a rapid ad hoc assessment of this new FP 7 proposal in order to help accelerate the political process of defining and implementing European research and innovation policy, in particular the design of FP 7.

For this purpose, the study summarises the Commission's proposal and provides necessary background information, identifies and analyses objectives, structure, target areas and policy measures of FP 7 (as proposed by the Commission) and provides a first ad hoc evaluation of the proposed Framework Programme and its potential to achieve the objectives set out by the European Union's institutions. A special emphasis has been put on aspects with particular importance for the achievement of the objectives of The Greens / European Free Alliance.

11 See (EC 2004a), (EC2003a) and (EC2004b) for details
12 See (EC 2002a)
13 See (EC 2002b): The objective is to raise the European investment in research to a total of 3% of GDP. With the current level of approx. 2%, Europe is lagging significantly behind the US (2,8%) and Japan (>3%)).

2. Overall FP 7 Framework and context

2.1 The European Commission's proposal for FP 7

April 6, 2005, the European Commission has presented its proposal for the seventh Framework Programme of the European Community for research, technological development and demonstration activities (EC 2005a) with the following key elements:

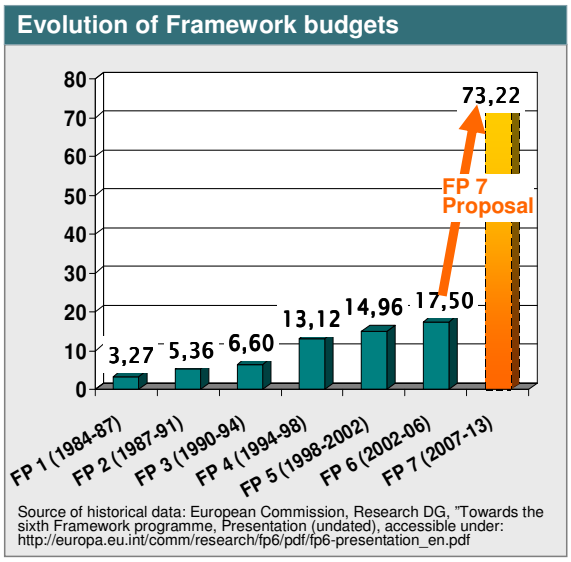


Figure 1: Budget evolution of Framework Programmes (in Billion Euros)

- A substantial **increase of the European research budget** is proposed, raising the level of research funding from approx. 17 Billion Euro under the current sixth Framework Programme (FP 6) to >73 Billion Euro for the period 2007-2013 (see figure 1).
- Continuity of research shall be strengthened through a programme that lasts **7 years** (with the possibility of a midterm review).
- FP 7 will be built on **continuity** with the past Framework Programmes in pursuit of the European Research Area (ERA). Projects undertaken by consortia of European partners will remain at the core of the programme, and the themes for these projects will be continuously developed from current focus research areas. It is proposed to use funds to develop and increase those elements of previous programmes that worked well: Marie Curie, SME actions, collaborative projects, Networks of Excellence.
- The Programme structure builds on the structure of the predecessor programmes and develops them further, regrouping activities in **four specific programmes**[14]:

  1. **Cooperation**
     Objective: To gain European leadership in key areas through cooperation of industry and research institutions. Support will be given to research activities carried out in transnational cooperation, from collaborative projects and networks to the coordination of national research programmes. The Cooperation programme is organised into sub-programmes which will be operationally autonomous and at the same time demonstrate coherence and consistency and allow for joint, cross-thematic approaches to research subjects of common interest. Nine themes have been identified (see next paragraph).
  2. **Ideas**
     Objective: To strengthen the excellence of our science base by fostering competition at European level. An autonomous European Research Council will be created to support "frontier research" carried out by research teams, either individually or in partnership, competing at European level, in all scientific and technological fields, including engineering, socio-economic sciences and the humanities.
  3. **People**
     Objective: To reinforce career prospects and mobility for researchers' activities. Supporting individual researchers, referred to as "Marie Curie" actions, will be reinforced with the aim of strengthening the human potential of European research through support to training, mobility and the development of European research careers.

[14] Source:EC2005b; programme details to be set out in specific legislative proposals later in the year.

4. **Capacities**
   Objective: To develop research capacities, so that the European science community has the best possible capacities at its service. Activities will be supported to enhance research and innovation capacity throughout Europe: research infrastructures; regional research driven clusters; stimulating the research potential in the EU's "convergence" regions; clustering regional actors in research to develop "regions of knowledge"; research for and by SMEs; "science in society" issues; "horizontal" activities of international cooperation.

- The portfolio of thematic research areas covered under **Cooperation** is restructured and extended:
  - Continuous development of research areas already covered under FP 6; and
  - Inclusion of two new research areas, space and security.

  In the Cooperation Programme, nine thematic areas are defined: Health, food, agriculture and biotechnology, Information and communication technologies, nanosciences and nanotechnologies, materials and new production technologies, energy, environment (including climate change), transport (including aeronautics), socio-economic sciences and the humanities, security and space. In addition, two themes are covered by the Euratom Framework Programme: Fusion energy research, nuclear fission and radiation protection.
- As a new element, support for ***investigator-driven research*** through a European Research Council (ERC) is introduced under the **Ideas** programme.
- According to the Commission, the programme will have more focus than in the past on developing research that **responds to the needs of European industry** through the work of Technology Platforms and the new "Joint Technology Initiatives". These will be projects in fields of major European public interest on subjects identified through dialogue with industry, in particular in the European Technology Platforms. By **focussing more on themes and less on instruments**, the programme will be more flexible and adaptable to the needs of industry, as well as more straightforward for its participants.
- To implement FP 7, the Commission announces significant **simplifications of the administrative and financial rules and procedures** of FP 7 through a series of measures, including the rationalisation of the funding schemes (new approach based on a simpler set of funding instruments), simpler, less bureaucratic languages (free of jargon and user friendly), reduction of the number and size of documents, reduction of the number of request to participants and instituting a light submission procedure, reduction of a priori controls (i.e. controls before the project is approved), increased autonomy of consortia, streamlining of the selection process and exploration of new modes of funding and simplifying the cost-based funding system.

The inter-institutional debate for consensus on important issues and further detailing of the FP 7 proposal will continue in 2005. In parallel, the negotiations on the EU's financial perspectives for the next seven years, 2007 – 2013 will be pursued, building on the guidelines agreed by the European Council in December 2004 with the aim of reaching political agreement by June 2005 and final adoption of the detailed legislation by the end of the year.

According to the timeline of the European Commission, a European Security Research Programme will be proposed during 2006 and final administrative stages in the co-decision process for adoption of FP 7 will be concluded, so that FP 7 is to be launched at the end of 2006.

2.2 Rationale for FP 7

Scientific research, technological development and innovation are key factors to achieve sustainable growth, competitiveness and employment. Therefore the Lisbon European Council of March 2000 has defined the objective to make Europe by 2010 "the most competitive and dynamic knowledge-based economy in the world". To achieve this, the European Commission has made the strengthening of European research a major objective. Major elements

of this effort were the launch of the European Research Area (ERA) project as a reference framework for research in Europe at the Lisbon European Council and the objective to increase the European research effort to 3% of the European Union's GDP by 2010 (defined at the Barcelona European Council of March 2002). Two-thirds of this investment should come from private investment and one-third from the public sector.

At a current investment of 1,96% of the European Union's GDP in research and development, the European research effort lags behind the efforts of the United States (2.59%), Japan (3,12%) and Korea (2,9%). The gap between US and EU is currently about € 130 Billion a year, 80% of which can be attributed to the difference in private sector spending in research and development (Source of data: EC 2005c).

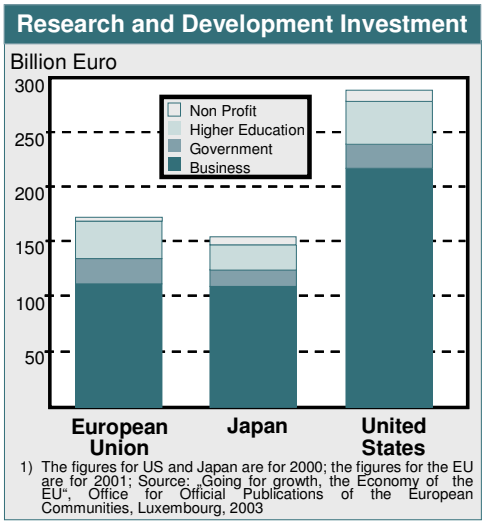


Figure 2: Comparison of international R&D investment

In view of this gap the European Commission has proposed a significant budget increase already during the preparation of the current FP 7 concept. According to its proposal, the budget should be doubled taking all activities together (see EC 2004a, EC 2004b).

This proposed significant budget increase has been supported by the European Parliament, which in November 2003 unanimously adopted a report calling for the FP 7 budget to be raised to 30 Billion Euro for the period 2006-2010 (EP 2003a).

In its Communication "Science and technology, the key to Europe's future - Guidelines for future European Union policy to support research" (EC 2004a) the Commission outlines that increasing research efforts at the overall European level are indispensable to attain the Lisbon objectives. It proposes a major initiative to strengthening the European research effort with six core objectives[15] (see Figure 3).

Figure 4 summarises the operative framework which FP 7 will use to attain these objectives.

The Commission proposes furthermore to continuously develop the research areas which have evolved under the previous Framework programmes and to add two new research areas: Security and space.

To support the implementation of this ambitious

Objective 1: Creating European centres of excellence through collaboration between laboratories.

- Implementation of Programmes to support trans-national collaboration between research centres, universities and companies, using the FP6-type instruments, such as the Networks of Excellence and Integrated Projects.

Objective 2: Launching European technological initiatives

- Establishment of Technology Platforms to bring together different stakeholders to define a common research agenda and to mobilise a critical mass of public and private resources[1].

Objective 3: Stimulating the creativity of basic research through competition between teams at European level

- Boost the dynamism, creativity and excellence of European research through open competition between individual research teams and support for investigator-driven research at European level, whilst increasing its visibility.
- The Commission suggests the creation of a support mechanism (e.g. a European Research Council) for such research projects conducted by individual teams which are in competition with each other at European level.

Objective 4: Making Europe more attractive to the best researchers

- Promote the development of European scientific careers while, at the same time, helping to make sure that researchers stay in Europe and attracting the best researchers to Europe[2].

Objective 5: Developing research infrastructure of European interest

- With the creation of the ESFRI forum, an important step has been taken in the field of research infrastructures in Europe. It is proposed to strengthen this action through the introduction of support for the construction and operation of new research infrastructures of European interest.

Objective 6: Improving the coordination of national research programmes

- Improve the coordination of national research programmes, especially through a strengthening of the efforts launched in the context of FP 6.
- This involves increasing the resources allocated to ERA-NET activities for the networking of national programmes, extending the financial support they offer to research activities, and an increased effort towards the mutual opening-up of programmes.

[1] For areas where this approach has been adopted see chapter 4. In certain cases it will be possible to implement the research agenda by means of Integrated Projects or to launch a 'pan-European' approach, involving the implementation of large-scale 'joint technology initiatives', for example under structures based on Article 171 of the Treaty
[2] See chapter 4 for details of the 'Marie Curie' actions undertaken for this purpose.

Figure 3: FP 7 Objectives defined by the initial draft concept

[15] Source: (EC 2004a)

- **Increase research efforts at the European level to attain Lisbon objectives**
  - Increase investment in European R&D, from 1.9 % in 2000, to 3 % of GDP by 2010
  - Increase level of business funding to two-thirds of total R&D investment
- **Create "European value"** through combined effects
  - Establish a "critical mass" of resources, particularly in key areas for growth such as microelectronics, telecommunications, biotechnologies and aeronautics
  - Strengthen excellence through competition at European level and trans-national collaboration
  - Exercise a "catalytic" effect on national initiatives and improving the coordination of the activities of the Member States in areas of interest to certain countries (such as natural hazards), or of interest to all (such as climate change)
  - Encourage private sector companies to invest more in Europe
  - Emergence of "European centres of excellence" to strengthen Europe's role on the world technology scene and in research initiatives on global issues by boosting excellence through support for collaboration and competition at European level
- **Encourage increased private sector investment in RTD**
  - Establishment of a framework for major technological projects to bring enterprises and universities together at European level, and which can only be conceived at this level
  - Increase human resources: e.g. increase number of researchers to/above US level
  - Create "centres of excellence" capable of attracting private investment
- **Excellence and innovation as keys to European industrial competitiveness**
  - Realise "European centres of excellence"
  - Solve the „European paradox": Improve capacity to transform scientific excellence and knowledge into products, services and economic success
  - Regroup activities to support research in SMEs and for their benefit & related activities for the support of specific target groups to form a coherent whole with a critical mass
- **Adapt Framework concept**
  - High response to FP 6, but unsatisfactory rate of support for excellent proposals
  - Limited number of instruments to meet different needs
  - Further improvement of implementation
- **Take full advantage of complementarity with the Structural Funds**
  - Strengthen complementarity between the use of research budget and Structural Funds, in particular in the framework of the future "Strategic Union guidelines for cohesion"
  - Increase combined use[1]
- **Focus the European Union's efforts on KEY TOPICS**
  - Identifying topics of major European interest
  - Supporting the Union's political objectives
  - Two new areas for the Union: space and security
- **"Doing better to do more"**
  - Using the most effective means of implementation
  - Improving the operation of the Framework Programme

[1] for example by granting complementary funding from the Structural Funds where a research project co-financed by the Framework Programme is carried out in a "Convergence" Objective region

Source: "Science and technology, the key to Europe's future - Guidelines for future European Union policy to support research" (EC 2004a)

Figure 4: Key elements of future research funding policy under FP 7

agenda, the instruments used under the predecessors of FP 7 will be further developed and complemented, (for example through European Technology Platforms which bring together companies, research institutions, the financial world and regulatory authorities at European level to define a common research agenda which should mobilise a critical mass of - national and European – public and private resources in high potential research and innovation areas).

The need for improvement of implementation efficiency is also addressed. The Communication describing the proposed FP 7 framework (EC 2004a) states for example that

> *"… the Framework Programme has been the victim of its own success. Out of the thousands of proposals received, only 1 in 5 has been able to be supported due to the lack of funding. In particular, just under 50% of projects considered to be of a very high standard were able to be financed…."*

With the aim to increase the transparency of the evaluation process, to reduce delays, and to minimise the cost of preparing projects, the financial and administrative provisions must be revised and simplified compared with current practice. In addition, the Commission proposes to use appropriate measures to decouple the increases in the Commission's budget and staffing while strengthening the link with national structures.

2.3 Observations and recommendations regarding the defined six objectives

The six objectives of the draft FP 7 concept are supported by this study. The following paragraphs highlight and comment their central elements:

First objective: "Creating European centres of excellence through collaboration between laboratories"

- Transnational cooperation on thematic priority areas should continue to be the central element of the Framework Programme. These research efforts should focus on future-oriented topics with high leverage.
- The research areas listed in chapter 2.1 should be the core thematic areas, but sufficient flexibility should be provided to account for evolving new research areas.

Second objective: "Launching European Technological Initiatives"

- European technology platforms (ETPs) can be an efficient instrument to strengthen the European innovation performance in key, pace-setting technologies.
- Implementation of ETPs is still under discussion. There is a trade-off between a stepwise approach for their development, starting with one or few pilot platforms to test the instrument and a broad roll out of all or most ETPs in parallel. As they provide a powerful platform for cooperation of main actors in thematic priority areas with an obvious need to act, the second approach has a higher potential to lead to rapid improvements in the targeted technology areas.
- Different challenges, approaches and types of actors in different technology areas will require different ways how the ETPs organize themselves to unite important actors in a joint initiative. For this reason different funding instruments may be appropriate (e.g. Integrated Projects, but in a few exceptional cases also measures pursuant to Article 171 can be considered). Room for flexibility should be given while maintaining a clear mission orientation and transparency regarding the ETPs' activities and achievements.
- Since ETPs will involve a high degree of sophistication and long term commitment, they will not be equally suited to reach all types of actors (e.g. SMEs). Therefore appropriate means to ensure involvement of SMEs should be sought where appropriate.

Third objective: "Stimulating the creativity of basic research through competition between teams at the European level"

- In increasingly global and competitive research structures, a dedicated initiative to enhance the quality of European basic research in the described form has considerable merits, if it fulfils the following criteria:
  - Consequent application of the 'excellence' criterion also in this area, ensured through efficient project selection criteria and processes, transparent decisions and efficient review of projects;
  - Full coordination with programmes on national and/or sectoral level to ensure appropriate overall allocation of resources/funds to research areas, avoid duplication of funding initiatives, etc.;
  - Encouraging of enhanced cooperation between national programmes/actors and of opening of national programmes.

Fourth Objective: "Making Europe more attractive to the best researchers"

- Skilled and motivated researchers are the key element of an innovation system. Therefore attracting young people to a scientific career and providing incentives for the best researchers to work in Europe should be a high priority for FP 7.

- To create the ERA, mobility should be further increased through continued use of the Marie Curie grant approach.
- As an additional element, increased mobility between public research institutions and private industry research would help to improve the transfer of research results into industrial innovation.

Fifth Objective: "Developing research infrastructures of European interest"

- The EU should continue and even increase its support for creating the ERA also in the area of transnational access to and cooperation of research infrastructures:
  - Because of the high costs of building and operating large-scale research infrastructures, European cooperation in this field is of particular importance.
  - Beyond large-scale equipment, improved transnational access to medium-sized research infrastructures may gain growing importance, for example to secure the competitiveness of SMEs. Those have a particular need for highly specialized, state of the art scientific and technological knowledge and research support and an efficient technology transfer to ensure their innovation performance.
- Another area where increased efforts on a European level should be considered, is open access to knowledge in the sciences and humanities. The commercialisation of scientific information has lead to growing concerns about the open access to knowledge in the sciences and humanities, expressed by the scientific community[16]. In view of these developments, the European Commission has launched in 2004 a study on the economic and technical evolution of the scientific publication markets in Europe. Its results will be available in 2005 ("An effective scientific publishing system for European research").

  A dedicated effort to identify and implement appropriate measures to ensure and improve access to scientific and technological information therefore would be an important contribution to sustainable European research performance in the ERA.
- The platform for cooperation created through the establishment of the European Strategy Forum on Research Infrastructures (ESFRI) should be further developed.

Sixth Objective: "Improving the coordination of national research programmes"

- Most of the support for research, development and innovation is provided by national programmes of the member states with different research systems. The "method of open coordination", based on the priority of the responsibility of member states, provides a platform for coordination in this area. This platform should be further strengthened, maintaining its voluntary basis.
- However, the globalisation of research, markets and competition creates a growing need for Europe to act in a coordinated way. Europe can no longer afford isolated 'islands'! Therefore appropriate initiatives should be taken to further enhance cooperation and coordination in this area.

[16] See for example the 'Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities' (Berlin 2003 and sources quoted therein). According to this document, the Internet has fundamentally changed the practical and economic realities of distributing scientific knowledge and cultural heritage. To offer a global and interactive representation of scientific and other human knowledge, the challenges of this emerging medium must be addressed appropriately. Content and software tools must be developed further while being openly accessible and compatible. This requires to encourage researchers to publish their work according to the principles of the open access paradigm, to encourage the holders of cultural heritage to support open access by providing their resources on the Internet, to develop means and ways to evaluate open access contributions and online-journals in order to maintain the standards of quality assurance and good scientific practice, to advocate that open access publication be recognized in promotion and tenure evaluation and to advocate the intrinsic merit of contributions to an open access infrastructure by software tool development, content provision, metadata creation or the publication of articles.

3. Achieving leverage from FP 7: A major challenge

3.1 Current Status and challenges (As of April 2005)

Since the Communication "Science and technology, the key to Europe's future - Guidelines for future European Union policy to support research" (EC 2004a) has been issued, a variety of new insights have emerged. Some of them provide indications for the necessity to allocate particular importance to the creation of leverage from FP 7 to achieve the Lisbon and Barcelona objectives:

1. Recent reports suggest that the Lisbon targets are in danger

A recent review of the status of the Lisbon targets ("Kok Report", see Kok 2004) confirms the disappointing delivery of the strategy. 'It concludes that while all three pillars of the Lisbon strategy – economic, social and environmental – remain valid, the priority for Europe now is to boost its economic growth rate and to increase employment.

In view of this critical mid term review, President Barroso has announced a "new start for the Lisbon strategy", building on three central concepts: An even stronger focus of Europe's actions, mobilisation of support for change and simplification and streamlining of Lisbon (EC 2005d).

To place "knowledge and innovation at the heart of European growth" (EC 2004a), the Kok report emphasizes the need to raise private and public R&D spending as "the centrepiece of a concerted effort to increase the creation and diffusion of scientific, technological and intellectual capital". As one of five key policy areas with a high need for determined action, the Knowledge Society is addressed with these recommendations:

- Increasing Europe's attractiveness for researchers and scientists,
- making R&D a top priority, and
- promoting the use of ICT.

The Second Implementation Report on the 2003-2005 Broad Economic Policy Guidelines (BEPGs), issued January 27, 2005, is more specific about the situation in research: "Only gradual progress towards the knowledge based economy… with Lisbon target on R&D at risk" (EC 2005e). This report states in particular:

… Despite different measures taken to enhance the transition towards a knowledge based economy, the progress is only gradual. The EU continues to substantially lag behind the US in research and innovation …

… R&D-expenditures have increased only marginally to 2 percent of GDP in 2002, making the target for R&D-investments of 3 per cent of GDP by 2010 (of which two-thirds to be financed by the private sector) virtually unattainable, without major initiatives. Some Member States (Sweden and Finland) have high R&D-ratios, whereas others have experienced declining ratios since 1999 (Greece, Ireland and the Netherlands)…

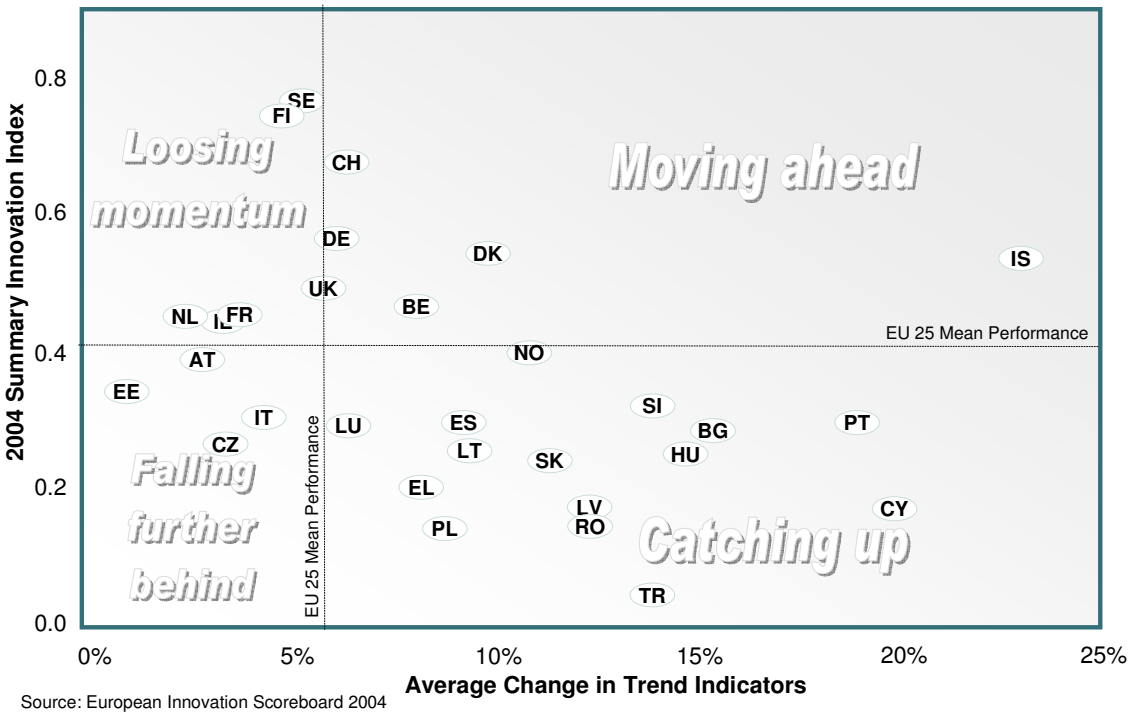
2. European research investment and innovation performance have not caught up since Lisbon

Until 2002 Research & Development intensity (i.e. R&D expenditure as a percentage of GDP) in the EU-25 has been rising from 1.82% in 1998 to 1.93%. European R&D expenditure rose by 4.0% on average per year (between 1999 and 2002), compared to +2.7% in the United States (between 1998 and 2003) and +2.2% in Japan (between 1998 and 2002). But the R&D intensity has remained significantly lower in the EU-25. At this pace European R&D expenditure will remain significantly below R&D expenditure in the US (2.76% of GDP in 2003) and in Japan (3.12% in 2002) for the foreseeable future[17].

[17] Source of data: (Eurostat 2005)

The 2004 innovation scoreboard (EC 2004c) provides further details on progress achieved and gaps remaining:

- The EU innovation performance, as measured by the European Innovation Scoreboard[18], has been relatively constant since 1996, whereas the innovation performance in the US and Japan has further improved, thus widening the gap.
- Significant differences in innovation performance and innovation style are observed between ERA countries and industry sectors. Even if most new Member States and some older Member States are catching up, coming from relatively low levels, large differences will remain dominant for the next years.



Source: European Innovation Scoreboard 2004

Figure 5: Large spread of innovation performance of ERA countries[19]

3. Private sector research and development investment is far from reaching "2%" target

The business sector financed 55% of the total EU-25 R&D expenditure in 2001, while the shares of the business sector in the United States and Japan were 67% (in 2001) and 74% (in 2002) respectively (Eurostat 2005). Significant growth could also not be achieved here: The target rate of 67% private sector share in overall R&D funding will also not be achievable in 2010 at the current pace.

The 2004 EU industrial R&D investment scoreboard, published in December 2004 (EC 2004d) provides some insight why no significant progress has been made on this objective (See figure 6).

[18] Measured on the basis of 12 common indicators, see (EC 2004c). The gap between the US and the EU can be largely explained by 3 indicators: Patents (50% of the gap), working population with tertiary education (26%) and R&D expenditures (11%; mainly business R&D).

[19] Relative national innovation performance measured as a composite indicator (Summary Innovation Index) based on up to 20 indicators. For details see http://trendchart.cordis.lu/scoreboards/scoreboard2004/ executive_summary.cfm

- **Further decline in EU private sector R&D investments**
  - EU-500 R&D investments dropped by 2 % last year compared to a rise of 3.9 % for non-EU-500
  - Twelve of the top 25 EU companies reduced their R&D over the last year, four of them by double figure percentages (US: Only four of the top 25 US companies reduced R&D last year, just one by a double figure percentage)
  - Over the past four years, EU-500 R&D investments have grown by 1.2 % per year on average - significantly lower than the non-EU-500 rate of 3.7 %
- **Concentration of EU R&D in large companies…..**
  - A small group of firms is responsible for a high proportion of aggregate R&D investment
    - Non-EU500: Top 20 account for 37 % of the total R&D
    - EU-500: Top 20 account for 55 % of the total R&D
- **.... in a few R&D-intensive sectors...**
  - Four largest sectors in terms of aggregate R&D investment (automobiles & parts, pharmaceuticals & biotechnology, IT hardware, and electronics & electrical equipment) account for 64 % (EU) and 68 % (non-EU) of total R&D.
- **.... and in a few key countries**
  - Companies with registered head offices located in three EU countries – Germany, France, and the UK – together account for 74 % of EU-500 R&D investment

Source: Monitoring industrial research - The 2004 EU industrial R&D investment scoreboard

Figure 6: Selected statements from the 2004 Industrial R&D Investment Scoreboard

3.2 Observations and recommendations

2. Closing the research investment gap

To meet the Lisbon targets and to overcome the 'European Paradox' it is indispensable to stimulate the private sector's research investment. The "Five-year assessment of the European Union research framework programmes 1999-2003" (EC 2004e) states

> *"…The industrial orientation and participation in the Framework Programme must be enhanced. This requires restoring industrial relevance and leadership in programmes aimed at innovation and competitiveness. In particular, high-tech SMEs should be able to find direct participation more attractive…"*

Therefore the FP 7 concept should be more explicit about how it will stimulate private sector investment in research beyond the implicit assumption of the current concept that increased public research spending will 'automatically' stimulate private sector investment in research.

The European Competitiveness Report 2004 (EC 2004f) states

> *… that both direct funding of business R&D and tax incentives for R&D have a significant and positive impact on business R&D spending in OECD and EU countries. However, the majority of the increase in the average R&D intensity cannot be explained by tax credits or direct funding. Other factors such as the shift to R&D intensive industries seem to be more important than direct support for R&D in explaining the change in the R&D intensity in the business sector across EU countries…*

Therefore specific and measurable targets should be defined for the important building blocks of FP 7 which permit (1) to define the expected specific outputs and results of programmes and policy measures (e.g. targeted improvement of innovation performance, economic growth, etc.), (2) to measure progress achieved during FP 7 against targets (e.g. Have the projects lead to additional industrial research investment, sustainable growth, etc.?) and (3) to take immediate action if important targets are missed.

According to the European Competitiveness Report 2004 (EC 2004f) the largest impact is achieved when collaboration among firms and public funding are present simultaneously. The relevance of collaboration in fostering innovative performance reflects the importance of the interconnections between public and private agents in driving innovation. It is precisely in this area that the EU tends to score low relative to the US where public and higher education research institutions have developed a far more effective system of linkages with the world of innovation.

For this purpose measures and instruments employed under FP 7 should specifically address possibilities to foster collaboration between the private sector and public research.

An example for this is the growing need for a permanent flux of new knowledge from basic research to private sector research and development. Under a high economic pressure most commercial companies have significantly reduced their investment in basic research and concentrated on short term oriented product development activities. This creates a growing need for an efficient generation and transfer of knowledge in academic research.

3. Focussing – on what?

In his speech on "A new start for the Lisbon Strategy", February 2, 2005, (EC 2005d), President Barroso has confirmed the intention to focus even more with a "rigorous prioritisation": The Commission proposes to focus on economic growth and employment. For the ERA and especially for FP 7 this can lead to an intensive debate about possible implications of such an approach and about the equality of the three pillars of the Lisbon agenda (economic growth and competitiveness, social inclusion and environmental concerns). An effort to focus FP 7's portfolio of research areas or instruments will inevitably lead to trade-off decisions, for example:

- Should research areas with a high potential to create short to medium economic and employment effects be given priority over research areas with a purely long term perspective (e.g. ITER)?
- Should research areas with a high potential to create short to medium economic and employment effects be given priority over research areas which create more benefits in other areas (e.g. achievement of sustainability/ecological improvements)?

Focussing of research funded by FP 7 on a limited number of priority areas may have the short term potential to achieve the desired leverage on economic growth and employment. But it has also its dangers: In the long run such a "strengthen the strong" approach does not support other research areas and can reduce the overall wealth of skills available in the ERA. It may also contribute to further concentration among the actors in European research ("weaken the weak").

Therefore FP 7 should maintain a clear focus on actions with a high potential to contribute to the achievement of the Lisbon targets and to enhance innovation performance and competitiveness of European economies. But at the same time it should account for research with a longer time horizon, for curiosity driven research and for research with a focus on achieving other objectives by allocating defined shares of program budgets for them, (e.g. "..% of the Life Science area budget for projects targeting poverty related diseases, etc…").

Another aspect to be considered under this perspective is the focus on research in "high tech" sectors, as illustrated by two examples:

- In the manufacturing industries a significant portion of economic value added and employment is in sectors which are considered as mature in their markets and technologies. Therefore at first sight such sectors seem to be less attractive targets for significant research investments (see figure 7). However competitiveness in such sectors often depends on major continuous innovation efforts – even though less spectacular and focussing on continuous improvement instead of breakthrough innovations. Without an appropriate innovation effort these sectors will not be able to make the necessary contributions to achieving the Lisbon targets.

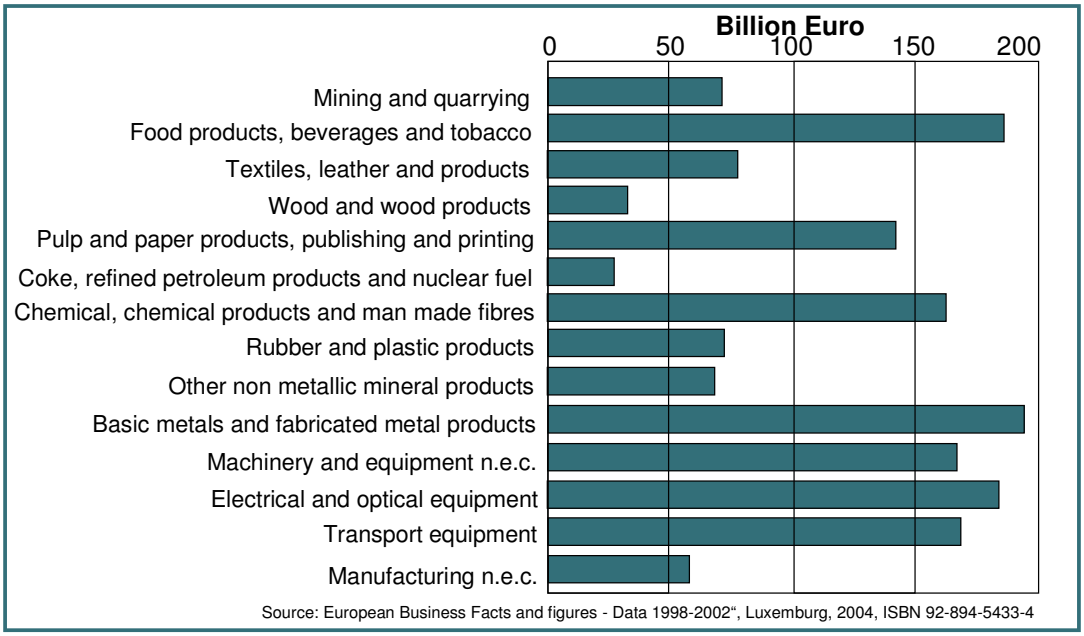


Figure 7: Breakdown of value added in mining and manufacturing sectors of the EU, 2001

- With almost 69.2% of all persons employed in 2003, the service sector is the main employer in the EU. Industry accounted for 25.5% and agriculture for 5.2%. Services accounted for 71% of total gross value added generated in the EU. The industry and agriculture sectors contributed 27% and 2% respectively (Eurostat 2004). As innovation also becomes increasingly important for competitiveness in service sectors and as many innovative services depend on the use of innovative technology, the needs of the service sectors should be considered in addition to the needs of manufacturing sectors.

4. Excellence versus cohesion

In its April 7, 2005 announcement of the FP 7 proposal, the Commission emphasises:

> *Focus will be on excellence throughout the programme, a requirement if it is to play its role in developing Europe's global competitiveness.*

To ensure this 'excellence' criterion, EU RTD policy would have to "ignore" under FP 7 consequently location aspects of RTD activities (in a positive and open way) and to put everybody in competition for excellence. In contrast with FP 7, Regional Policy/Cohesion Policy works in partnership with the Member States and the regions to fight development disparities across the Union and to promote the Union's priorities on the ground. Therefore a careful coordination between FP 7 and innovation/research support under structural programmes is indispensable.

For FP 7, the challenge is to maintain the 'excellence' criterion and at the same time avoid the occurrence of a potential 'excellence divide', coming from the large spread of research intensity and other structural differences between the ERA countries (see figure 8). It is unlikely that a "one fits all" approach of FP 7 will meet the needs of less advanced countries or scientific communities and/or give them the opportunity to compete for funds on an equal basis. An open competition without complementary structural footing tends to enhance the stronger performers rather than to help improve the position and integration of the weaker. Therefore pleads have been raised for additional targeted measures to support the process of socio-economic stabilisation and growth in the region, to meet the current demands of their scientific community and to address the innovative potential in the countries concerned.

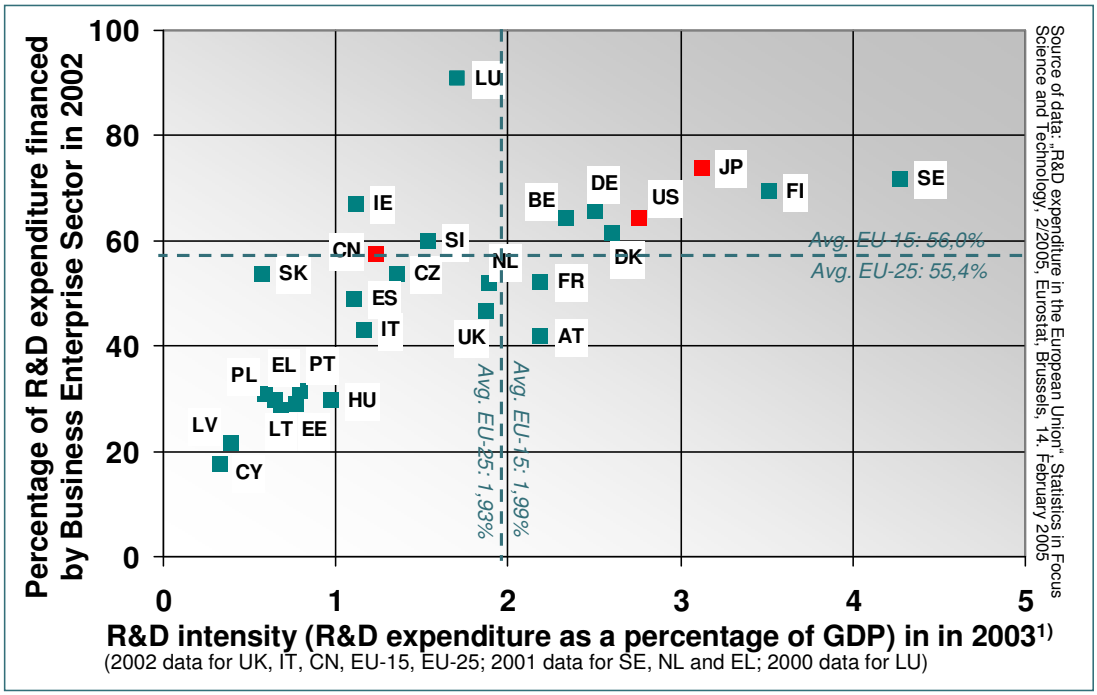


Figure 8: R&D Intensity and business sector share of total R&D in EU and Triade countries

Already FP 6 contained important actions with direct regional relevance (e.g. the ERA-NET scheme), and measures to strengthen the ERA foundations and with indirect regional relevance (e.g. measures targeting SMES and Human Potential, Support for Research Infrastructure of European interest). FP 7 continues this approach, especially through the elements Regions of Knowledge and Research Potential. These objectives should be carefully separated and a clear interface with cohesion policy measures should be established to avoid a 'dilution' of FP 7 excellence!

Under the legislative proposals by the European Commission for the reform of cohesion policy[20] (2007–13 period) territorial development is linked among other to the knowledge society, innovation and research. For example under the "Convergence" objective, the European Regional Development Fund (ERDF) shall support sustainable integrated regional and local economic development, mobilise and strengthen endogenous capacity among other measures through fostering research and technological development (RTD), innovation and entrepreneurship. This includes strengthening of regional research and technological development capacities, aid to RTD in SMEs and to technology transfer, improvement of links between SMEs and universities, and research and technology centres, development of business networks and clusters, support for the provision of busi-

[20] On 14 July 2004, the European Commission adopted its legislative proposals on cohesion policy reform. With a total allocation of EUR 336.1 Billion, or approximately one third of the Community budget, this reform aims to make structural actions:
- more targeted on the EU's strategic priorities (Lisbon and Gothenburg agendas for a sustainable and competitive knowledge economy', European employment strategy);
- more concentrated on the least favoured regions while anticipating change in the rest of the Union;
- more decentralised with a simpler, more transparent and more efficient implementation.

The proposals include:
- a general regulation laying down a common set of rules for the three sources of financing for structural actions during the 2007–13 period;
- a regulation for each of these components, namely: the European Regional Development Fund (ERDF), the European Social Fund (ESF), the Cohesion Fund; and
- a proposal for a completely new regulation allowing the creation of a cross-border cooperation structure.

For details see the proposals for the new structural funds regulations for the period 2007-2013, available from http://europa.eu.int/comm/regional_policy/sources/docoffic/official/regulation/newregl0713_en.htm

ness and technology services to groups of SMEs, fostering of entrepreneurship and innovation funding for SMEs through new financing instruments (EC 2004g).

4. Optimisation of interfaces with other funding activities

The desired progress on achieving the Lisbon objectives can only be reached if all instruments and resources available to realise the 'knowledge triangle' of research, education and innovation join forces in a coordinated way.

The Commission's draft communication "Building the ERA of knowledge for growth" (EC 2005c) lists the following important elements which complement FP 7 in this respect:

- **The Structural and Cohesion Funds,** to strengthen the knowledge capacities throughout the European Union by extending research and development capacities in the less advanced regions and by ensuring, through innovation, education and a modern infrastructure, that the fruits of research spread to all regions. Research and development, innovation and the transition to a knowledge economy rank among the top priorities within the three new objectives of EU regional policies (Convergence, Regional Competitiveness, and European Territorial Cooperation);
- **The Competitiveness and Innovation Framework Programme,** to enhance European innovation capacity, through support to innovating SME's, innovation networks, the dissemination of results, technology transfer and the funding of technology innovation through risk capital (for details see EC2004h);
- **The new generation of Education and Training Programmes,** to raise the capacity to produce, master and exploit knowledge in Europe, through an integrated action on life-long education and training covering in particular university education and the training of researchers.
- **Trans European Networks,** to deploy on a pan-European scale advanced infrastructures and systems derived from and supporting further R&D and innovation (such as Galileo).
- **The new European Agricultural Fund for Rural Development**, having as priorities the increased competitiveness of the agricultural and forestry sector, sustainable land management, the diversification of the rural economy and quality of life in rural areas.

In addition, FP 7 must be coordinated with other funding activities on the European level, for example COST (intergovernmental framework for European cooperation in the field of Scientific and Technical Research, allowing the coordination of nationally funded research on a European level; see (COST 2005) for details) and EUREKA (Network for market-oriented, industrial R&D through its support to businesses, research centres and universities who carry out pan-European projects to develop innovative products, processes and services, including elements like EUREKA Clusters, Eureka Umbrellas and BUSANET, a European network of Business Angels; see EUREKA 2005 for details).

4. Structure and resource allocation of FP 7

4.1 Commission's proposal for size and structure of FP 7

In its "Impact Assessment and ex ante evaluation" of FP 7 (EC2005f), the Commission has analysed three scenarios:

- The "Do nothing" option (Discontinuation of funding under the Framework Programmes) is ruled out, because it would stop the process of building an integrated European Research Area. Europe would return to the complete fragmentation of the pre-ERA period, with 25 Member States and numerous regions defining their research priorities independently from each other and from the EU. Without an appropriate level of European collaborative research some important fields of S&T would advance more slowly, Europe's competitiveness and capability to generate economic welfare and employment and its capability to meet other important policy objectives would suffer significantly.
- The "business as usual" option (Continuing with FP 7 as it is currently under FP 6, with no significant change to its budget, structure or thematic content) would provide continuity. But it would not represent an adequate response to the new challenges facing Europe and its capability to catch up with other world regions in terms of economic and productivity growth and employment creation. While FP 6 was devised as an instrument to implement the ERA and has made a positive contribution, to continue with the same FP structure and level of funding would not allow Europe to make sufficiently rapid progress towards the Lisbon goals. Therefore the Commission considers the "business as usual" option as not sufficient to enhance Europe's production and exploitation of knowledge at the centre of Europe's strategy to compete in higher value products and services, rather than on the basis of cheap labour.
- Therefore the European Commission argues (EC2005f):

  The final policy choice therefore consists of a substantially larger and excellence-based Framework Programme, which is organised around People, Ideas, Cooperation and Capacities, as outlined above. This choice has been made because all evidence shows that through this option the largest impacts would be achieved in terms of contributing to the achievement of economic, social, environmental and European Research Area objectives. This evidence has been drawn from a wide range of sources: inputs from stakeholders; technical and evaluation studies by European Commission services and the Commission statistical agency, EU-25 Member States and international organisations (OECD, IMF, UN organisations, etc.); inputs provided by recognised European experts in the fields of evaluation and impact assessment.

  According to this evaluation a significantly enlarged FP 7 budget is the only possible response to meet the economic, social and environmental challenges the EU is facing, to overcome the weaknesses of the European research system and to account for the enlargement of the EU to 25 members.

Based on these considerations, the budget structure described in figure 9 is proposed by the Commission for FP 7 in connection with an extension of its duration to the period 2006-2013.

The Commission proposes to organise FP 7 in four specific programmes:

- ***Cooperation***: Support will be given to research activities carried out in transnational cooperation, from collaborative projects and networks to the coordination of national research programmes.
- ***Ideas***: An autonomous European Research Council will be created to support "frontier (basic) research" carried out by individual teams competing at European level, in all scientific and technological fields, including engineering, socio-economic sciences and the humanities.
- ***People***: Activities supporting individual researchers, referred to as "Marie Curie" actions, will be reinforced with the aim of strengthening the human potential of European research through support to training, mobility and the development of European research careers.

- ***Capacities***: Activities will be supported to enhance research and innovation capacity throughout Europe: research infrastructures; regional research driven clusters; stimulating the research potential in the EU's "convergence" regions; research for and by SMEs; "science in society" issues; international cooperation.

Activity	Budget (Mio Euro)	
	Total	Breakdown
1. Cooperation	44735	
1.1 Health		*8373*
1.2 Food, Agriculture and Biotechnology		*2472*
1.3 Information and Communication Technologies		*12756*
1.4 Nanosciences, Nanotechnologies, Materials and new Production Technologies		*4865*
1.5 Energy		*2951*
1.6 Environment (including Climate Change)		*2552*
1.7 Transport (including Aeronautics)		*5981*
1.8 Socio-economic Sciences and the Humanities		*798*
1.9 Security and Space		*3987*
2. Ideas	*11942*	
3. People	*7178*	
4. Capacities	*7536*	
4.1 Research Infrastructures		*3987*
4.2 Research for the benefit of SMEs		*1914*
4.3 Regions of Knowledge		*160*
4.4 Research Potential		*558*
4.5 Science in Society		*558*
4.6 Activities of International co-operation		*359*
5. Joint Research Centre (Non nuclear actions)	*1824*	
EC 7th Framework Programme in Total	**73215**	
Euratom 7th Framework Programme	**3103**	
1. Fusion energy research		*2167*
2. Nuclear fission and radiation protection		*395*
3. Nuclear Activities of the Joint Research Centre		*541*
EURATOM 7th Framework Programme	**3103**	
Grand Total (EC FP7 + EURATOM FP7)	**76318**	

Figure 9: Proposed structure of FP 7 and allocation of financial resources

At a first glance, the FP 7 budget rise from 17,5 Billion Euro to approx. 73 Billion Euro is impressive. However to compare both budgets, these absolute numbers must be corrected for the different duration of both Framework programmes (see Figure 10).

Programme		Duration	Budget Mio. Euro)	Calculated average annual budget growth FP 6→FP 7
Research FP	6th Framework Programme	2002-2006	16270	**+189%**
	7th Framework Programme	2007-2013	73215	
Euratom Res. FP	6th Framework Programme	2002-2006	1230	**+127%**
	7th Framework Programme	2007-2011	3103	

Figure 10: Comparison of FP 6 and FP 7 budgets on the basis of a theoretical average annual budget[21]

[21] Average Annual Growth Rate FP 6→FP7 calculated on the basis of theoretical annual Framework Programme budgets, assuming durations of 7 years for FP7 (2006-2013) and 4,5 years for FP 6 (2002-2006, 0,5 years overlap with FP5), For comparison see the FP 6 Budget breakdown in Figure 11)

Activity	Budget (Mio Euro) Total	Breakdown
1. Focusing and integrating Community research	13345	
1.1 Thematic priorities:		*11285*
1.1.1 Life sciences, genomics and biotechnology for health		*2255*
1.1.1.1 Advanced genomics and its applications for health		*1100*
1.1.1.2 Combating major diseases		*1155*
1.1.2 Information society technologies		*3625*
1.1.3 Nanotechnologies and nanosciences, knowledge-based multifunctional materials & new production processes & devices		*1300*
1.1.4 Aeronautics and space		*1075*
1.1.5 Food quality and safety		*685*
1.1.6 Sustainable development, global change and ecosystems		*2120*
1.1.6.1 Sustainable energy systems		*810*
1.1.6.2 Sustainable surface transport		*610*
1.1.6.3 Global change and ecosystems		*700*
1.1.7 Citizens and governance in a knowledge-based society		*225*
1.2 Specific activities covering a wider field of research		*1300*
1.2.1 Policy support and anticipating scientific and technological needs		*555*
1.2.2 Horizontal research activities involving SMEs		*430*
1.2.3 Specific measures in support of international co-operation		*315*
1.3 Non-nuclear activities of the Joint Research Centre		*760*
2. Structuring the European Research Area	2605	
2.1 Research and innovation		*290*
2.2 Human resources and mobility		*1580*
2.3 Research infrastructures		*655*
2.4 Science and society		*80*
3. Strengthening the foundations of the European Research Area	320	
3.1 Support for the co-ordination of activities		*270*
3.2 Support for the coherent development of policies		*50*
EC 6th Framework Programme in Total	**16270**	
Euratom 6th Framework Programme	1 230	
1. Fusion energy research		*750*
2. Management of radioactive waste		*90*
3. Radiation protection		*50*
4. Other activities in the fields of nuclear technologies and safety		*50*
5. Activities of the Joint Research Centre (Direct actions)		*290*
EURATOM 6th Framework Programme	**1230**	
Grand Total (EC FP6 + EURATOM FP6)	**17500**	

Figure 11: Financial structure of FP 6[22]

Based on the same calculation, the Cooperation Programme has been growing below the average growth of the Framework Programme at a rate of +155% (Budget for Thematic Priorities under FP 6: 11.285 Mio. Euro ➔ Cooperation under FP 7: 44.735 Mio. Euro). The second largest of the programmes continuing from FP 6, the "People" Programme (continuing the Marie Curie actions under FP 6) grows by 192%. Most of this difference between the growth of the overall budget and the growth of its continued part can be explained by the introduction of the "Ideas" programme, which has no predecessor under FP 6 and now takes a share of 15,4% of the total FP budget.

A detailed analysis of the development of the research areas under the "Cooperation" programme reveals also, that apparently no important shift of priorities between the research areas has taken place[23]. All research area budgets have grown at almost the same rate in the order of 128-141%. All research areas continuously developed from FP 6 to FP 7 are growing below average, the difference to the average growth of the "Cooperation" pro-

[22] Source of data: (EC 2002c), (EC 2002d)
[23] to the extent that they are comparable

gramme being mostly due to the introduction of the new "Security and space" research area (taking now 8,9% of the budget for "Cooperation").

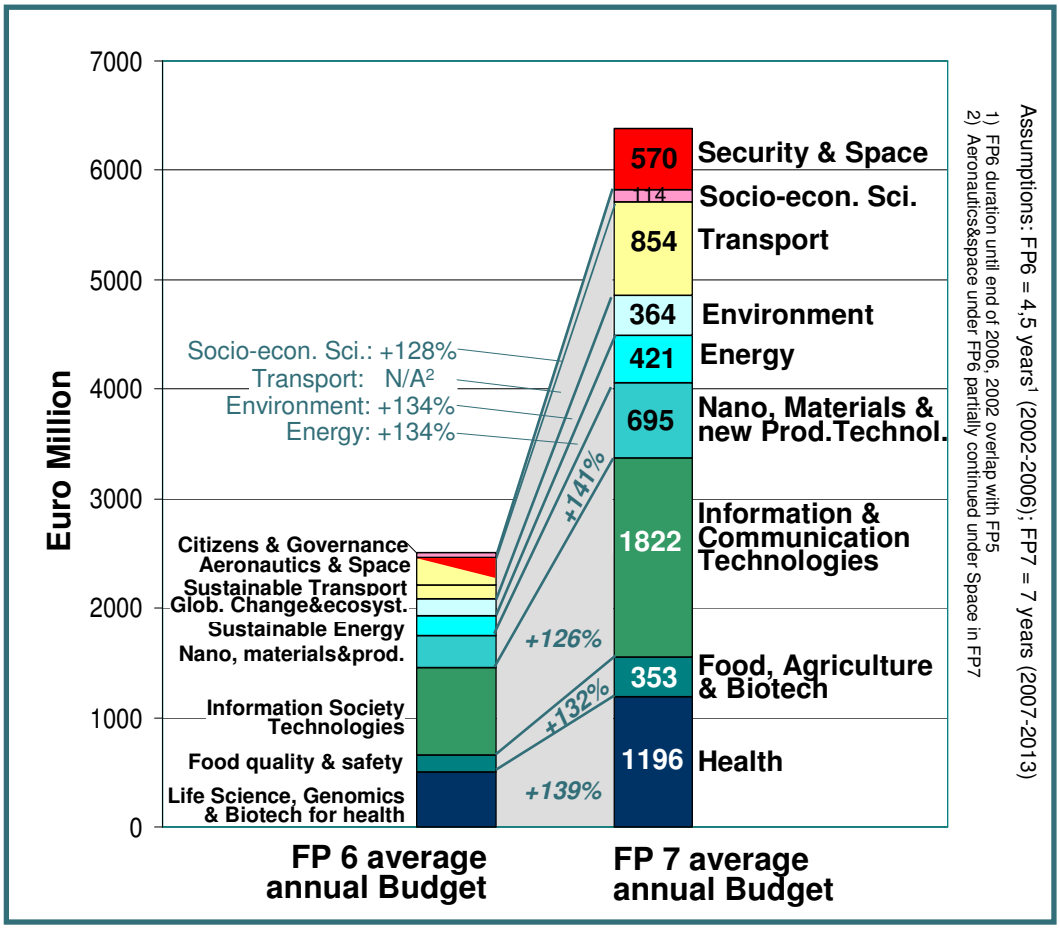


Figure 12: Comparison of theoretical average annual Framework Programme budgets

4.2 Building blocks of FP 7

FP 7 consists of four important building blocks:

1. Cooperation

61% of the total FP 7 budget is devoted to a range of research activities performed in transnational cooperation with the aim of gaining leadership in key scientific and technology areas by supporting cooperation between universities, industry, research centres and public authorities across the European Union as well as with the rest of the world. For this purpose nine thematic priority areas have been defined in which flexible use will be made of available actions and funding schemes. In addition a catalytic effect of Community funding on other public research spending is sought through scaled up ERANET actions that will boost research in given areas through joined up national programmes (see following section for details).

This part of FP 7 provides support for transnational cooperation in a number of thematic areas corresponding to major fields of the progress of knowledge and technology, where research must be supported and strengthened to address European social, economic, environmental and industrial challenges. The primary objective is to contribute to sustainable development and the achievement of the Lisbon objectives.

According to the Commission's proposal, these themes are broadly defined at relatively high level, such that they can adapt to evolving needs and opportunities that may arise during the lifetime of FP 7. For each of them, activities have been identified which indi-

cate the broad lines envisaged for Community support. Applicable criteria include their contribution to EU objectives, including the transition to a knowledge society, the relevant European research potential and the added value of EU level intervention for these subjects. Beside these activities, the possibility will be ensured to address also *emerging needs* (through specific support for spontaneous research proposals aiming at identifying or further exploring new scientific and technological opportunities, in particular linked with a potential for significant breakthroughs) and *unforeseen policy needs* (to respond in a flexible way to new policy needs that arise during the course of the Framework Programme, such as unforeseen developments or events requiring a quick reaction like, the new epidemics, emerging concerns in food safety or natural disaster response). Actions to support innovation will be taken under the Competitiveness and Innovation Programme.

Across all these themes, support to transnational cooperation will be implemented through the following four approaches:

- **Collaborative research** will constitute the bulk and the core of EU research funding, using a range of funding schemes, including Collaborative projects, Networks of Excellence and coordination/support actions. The objective is to establish, in the major fields of advancement of knowledge, excellent research projects and networks.
- **Joint Technology Initiatives** aim at setting up long term public private partnerships in a limited number of cases, where the scope of a RTD objective and the scale of the resources involved justifies combined private sector investment and national and European public funding. Joint Technology Initiatives may be decided on the basis of Article 171 of the Treaty or on the basis of the Specific Programme Decisions in accordance with Article 166 of the Treaty. Potential Joint Technology Initiatives will be identified on the basis of a series of criteria including added value of European-level intervention, degree and clarity of definition of the objective to be pursued, strength of the financial and resource commitment from industry, scale of the impact on industrial competitiveness and growth, importance of the contribution to broader policy objectives, capacity to attract additional national support and leverage current or future industry funding and inability of existing instruments to achieve the objective.
- **Coordination of non-Community research programmes** will make use of two main tools: the ERA-NET scheme and the participation of the Community in jointly implemented national research programmes (Treaty Article 169). The action may cover subjects not directly linked to the nine themes in as far as they have a sufficient EU added value. The action will also be used to enhance the complementary and synergy between the Framework Programme and activities carried out in the framework of intergovernmental structures such as EUREKA and COST.
- **International cooperation** actions support the opening of all activities carried out in the thematic areas to researchers and research institutions from third countries, and specific cooperation in each thematic area dedicated to third countries in the case of mutual interest.

  Such actions are, in particular: actions aiming at reinforcing the research capacities of candidate countries as well as neighbourhood countries; cooperative activities targeted at developing and emerging countries, focusing on their particular needs in fields such as health, agriculture, fisheries and environment, and implemented in financial conditions adapted to their capacities.

2. Ideas

Approximately 16% of the total FP 7 budget is allocated to the stimulation of the creativity and excellence of European research through the funding of "frontier research" carried out by individual teams competing at European level. For this purpose it is proposed to enhance the dynamism, creativity and excellence of European research at the frontier of knowledge through support for "investigator driven" research projects carried out across

all fields by individual teams in competition at the European level. Projects will be funded on the basis of proposals presented by researchers on subjects of their choice and evaluated on the sole criterion of excellence as judged by peer review.

Complementing existing national initiatives in the same area, this action shall respond to the most promising and productive areas of research and the best opportunities for scientific and technological progress, within and across disciplines, including engineering and social sciences and the humanities.

The Commission proposes to implement it independently of the thematic orientations of the other parts of the Framework Programme by a European Research Council (ERC), consisting of a scientific council, supported by a dedicated implementation structure. The scientific council will consist of representatives of the European scientific community at the highest level, acting in their personal capacity, independently of political or other interests. The scientific council will, inter alia, oversee decisions on the type of research to be funded and act as guarantor of the quality of the activity from the scientific perspective. Its tasks will cover, in particular, the development of the annual work programme, the establishment of the peer review process, as well as the monitoring and quality control of the programme's implementation from the scientific perspective.

The dedicated implementation structure will be responsible for all aspects of implementation and programme execution, as provided for in the annual work programme. It will, in particular, implement the peer review and selection process according to the principles established by the scientific council and will ensure the financial and scientific management of the grants.

The implementation and management of the activity will be reviewed and evaluated at appropriate intervals to assess its achievements and to adjust and improve procedures on the basis of experience.

The European Commission will act as the guarantor of the ERC's full autonomy and integrity.

3. People

Approximately 10% of the total FP 7 budget is allocated to the reinforcement of the existing "Marie Curie" actions of support to researchers, better focusing on key aspects of skills and career development, increasing mobility between university and industry, and strengthening links with national systems. The objective is to develop and strengthen the human potential of European research through support to training, mobility and the development of European research careers.

For this purpose the following activities will be supported[24]:

- **Initial training of researchers** to improve their career perspectives, in both public and private sectors, including through the broadening of their scientific and generic skills, and attracting more young researchers to scientific careers. This will be implemented through Marie Curie Networks with the main objective to overcome fragmentation of and to strengthen at European level the initial training and career development of researchers.
- **Life-long training and career development** to support the career development of experienced researchers by complementing or acquiring new skills and competencies and enhancing inter-/multidisciplinarity and/or inter-sectoral mobility. This action line will be implemented through both individual fellowships awarded directly at Community level and through the co-financing of regional, national or international programmes.

[24] Source: EC2005a

- **Industry-academia pathways and partnerships**: Support to longer term cooperation programmes between organisations from academia and industry, in particular SMEs, aims at increasing knowledge sharing through joint research partnerships, supported by the recruitment of experienced researchers to the partnership, by staff secondments between both sectors, and by the organisation of events.
- **The international dimension**, to increase the quality of European research by attracting research talent from outside Europe and fostering mutually beneficial research collaboration with researchers from outside Europe. This will be addressed through international outgoing fellowships (with an in-built mandatory return phase); international incoming fellowships; partnerships to support the exchange of researchers. Common initiatives between European organisations and organisations from countries neighbouring the EU and countries with which the EU has a Science and Technology agreement will also be supported.
- **Specific actions to support the creation of a genuine European labour market for researchers**, by removing obstacles to mobility and enhancing the career perspectives of researchers in Europe. Furthermore, awards to improve the public awareness of Marie Curie actions and their objectives will be provided.

4. Capacities

Approximately 10% of the total FP 7 budget is allocated to the enhancement of research and innovation capacity throughout Europe. The focus of actions will be on ensuring optimal use and development of research infrastructures; supporting regional research-driven clusters; unleashing the full research potential existing in the EU's convergence regions and outermost regions; supporting research for the benefit of SMEs; bringing science and society closer together; and developing and coordinating an international science and technology cooperation policy. Through their combined impact, these programmes are expected to allow for the emergence and reinforcement of European poles of excellence in various fields.

This programme will have the following elements:

- **Research infrastructures**: To make the best research infrastructures of pan-European interest needed by the European scientific community available, this part of the programme will provide *Support to existing research infrastructures* through transnational access to the best research infrastructures for European researchers, better integration and structuring of activities on a European scale, promoting their coherent use and development and support for the development of research e-infrastructure (e.g. high capacity and high-performance communication and grid infrastructures and high-end computing capabilities, fostering the adoption by user communities, etc.). In addition it will also provide *Support to new research infrastructures* through support for the construction of new infrastructures and major updates of existing ones and design studies, to promote the creation of new research infrastructures by funding exploratory awards and feasibility studies for new infrastructures.
- **Research for the benefit of SMEs**: To strengthen the innovation capacity of European SMEs and their contribution to the development of new technology based products and markets this part of the programme will help them to outsource research, increase their research efforts, extend their networks, better exploit research results and acquire technological know how on two levels (*Research for SMEs* will support small groups of innovative SMEs to solve common or complementary technological problems; *Research for SME associations* will support SME associations and SME groupings to develop technical solutions to problems common to large numbers of SMEs in specific industrial sectors or segments of the value chain).
- **Regions of Knowledge** is a new programme element, aiming at strengthening the research potential of European regions, in particular by encouraging and supporting the development, across Europe, of regional "research-driven clusters" associating

universities, research centres, enterprises and regional authorities. For this purpose the initiative will involve and bring together regional actors involved in research for joint analysis of research agendas of regional clusters and the elaboration of a set of instruments to address them in specific research activities[25].

- **Research potential** to stimulate the realisation of the full research potential of the enlarged Union by unlocking and developing the research potential in the EU's convergence regions and outermost regions and helping to strengthen the capacities of their researchers to successfully participate in research activities at EU level. For this purpose the action in this domain will comprise support for transnational two-way secondments of research staff between selected organisations, the acquisition and development of research equipment and the development of a material environment, the organisation of workshops and conferences to facilitate knowledge transfer; promotion activities as well as initiatives aiming at disseminating and transferring research results in other countries and on international markets and "evaluation facilities" through which any research centre in the convergence regions can obtain an international independent expert evaluation of the level of their overall research quality and infrastructures[26].
- **Science in Society** aims to stimulate the integration of scientific and technological endeavour and associated research policies in the European social web through research projects, studies, networking and exchanges, public events and initiatives, prizes, surveys and data collection. Examples include reflection and debate on science and technology and their place in society, gender research, the creation of an environment which triggers curiosity for science in young people, and improved communication between the scientific world and the wider audience of policymakers, the media and the general public.
- **Activities of international cooperation** provides horizontal support actions and measures with a focus other than a specific thematic or interdisciplinary area, in particular to improve the coherence of national activities by supporting the coordination of national programmes on international scientific cooperation. The overall coordination of the international cooperation actions under the different programmes of the Framework Programme will be ensured.

5. Non nuclear activities of the Joint Research Centre

The JRC's priorities are on providing scientific and technical support to the EU policy making process, ensuring support to the implementation and monitoring of existing policies and responding to new policy demands. Focus will be on areas of key concern for the Union, including Prosperity in a knowledge-intensive society, solidarity and responsible management of resources, Security and freedom and Europe as world partner.

Based in the Euratom Treaty, a complementary proposal for research under the **Euratom Framework Programme** covers the period 2007-2011[27]separately. This proposed Euratom Framework Programme is organised in two specific programmes:

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[25] According to the Commission's proposal, these activities will be implemented in close relationship with EU regional policy and the Competitiveness and Innovation Programme and the Education and Training Programmes. Synergies will be sought with the EU's regional policy, in particular with regard to convergence and outermost regions.

[26] According to the Commission's proposal Strong synergies will be sought with the EU's regional policy. Actions supported under this heading will identify needs and opportunities for reinforcing the research capacities of emerging and existing centres of excellence in convergence regions which may be met by Structural and Cohesion funds.

[27] The Commission proposes that, unless extenuating circumstances arise, this framework programme can be renewed for the period 2012-2013, in accordance with the foreseen legislative procedure.

6. **'Indirect' actions on fusion energy research and nuclear fission and radiation protection**

   This proposed programme consists of two actions:

   - **Fusion energy research**

     70% of the Euratom Framework Programme budget are allocated to the development of the knowledge base for, and realising ITER in the effort to create Prototype reactors for power stations.

     Activities in this area include measures for the joint realisation of ITER (as an international research infrastructure), R&D in preparation of ITER operation, technology activities in preparation of DEMO, R&D activities for the longer term and support for human resources, education, training and infrastructures.

   - **Nuclear fission and radiation protection**

     13% of the Euratom Framework Programme budget will be used for the scientific and technical basis and the acceleration of practical developments for the safer management of long-lived radioactive waste, promoting safer, more resource-efficient and competitive exploitation of nuclear energy and ensuring a robust and socially acceptable system of protection against the effects of ionising radiation.

     The focus will be on Management of radioactive waste, reactor systems, radiation protection, infrastructures, human resources and training.

7. **'Direct' nuclear research activities of the Joint Research Centre**

   The objective is to provide scientific and technical support to the policy making process in the nuclear field, while ensuring stability of support to the implementation of existing policies and adapting to changing policy demands.

   The JRC activities will focus on nuclear *waste management and environmental impact* (aiming to understand the nuclear fuel processes from production of energy to waste storage and to develop effective solutions), *nuclear safety* (research on existing and new fuel cycles and on reactor safety of both Western and Russian reactor types as well as on new reactor design) and *nuclear security* (control of the fuel cycle facilities emphasising the back-end of the fuel cycle, the monitoring of the radioactivity in the environment, or the implementation of the additional protocol and the integrated safeguards, and the prevention of the diversion of nuclear and radioactive material associated with illicit trafficking of such material).

4.3 Thematic areas of the Collaborative Research programme

The commission proposes a portfolio of nine research areas, based on continuous development and restructuring of themes already pursued under FP 6, resulting in eight new research areas for FP 7 and two new research topics, resulting in the Security and Space area (see figure 12). These are briefly described in the following sections.

1. **Health** *(Budget = 8.373 Mio Euro; 18,7% of collaborative research; 11,4% of total FP 7)*

   Objective

   Improving the health of European citizens and increasing the competitiveness of European health-related industries and businesses, while addressing global health issues including emerging epidemics. Emphasis will be put on translational research (translation of basic discoveries in clinical applications), the development and validation of new therapies, methods for health promotion and prevention, diagnostic tools and technologies, as well as sustainable and efficient healthcare systems.

   Approach

   ☛ *See chapter 5.1 for detailed discussion*

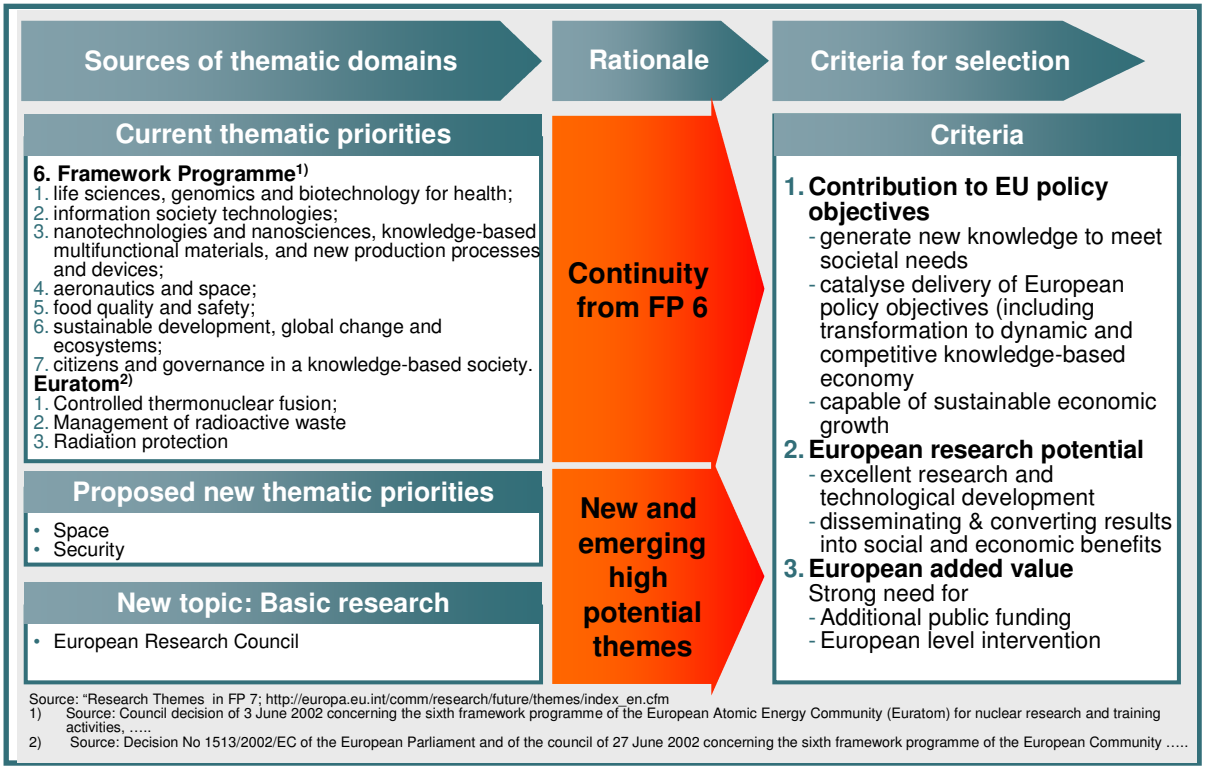

Figure 12: Development of thematic priorities for FP 7

2. Food, Agriculture and Biotechnology *(Budget = 2.472 Mio Euro; 5,5% of collaborative research; 3,4% of total FP 7)*

Objective

Building a European *Knowledge Based Bio-Economy* by bringing together science, industry and other stakeholders, to exploit new and emerging research opportunities that address social and economic challenges: The growing demand for safer, healthier and higher quality food and for sustainable use and production of renewable bioresources; the increasing risk of epizootic and zoonotic diseases and food related disorders; threats to the sustainability and security of agricultural and fisheries production resulting in particular from climate change; and the increasing demand for high quality food, taking into account animal welfare and rural contexts.

Approach

Research in this area shall provide innovations and advancement of knowledge in the sustainable management, production and use of biological resources as basis for sustainable, eco-efficient and competitive products from agriculture, fisheries, food, health, forest based and related industries. In line with the European strategy on life sciences and biotechnology, this is intended to help increase the competitiveness of European biotechnology and food companies, while improving social welfare and well-being. Research shall further help to fight food related disorders and infectious diseases. For this purpose three research topics are proposed:

- Sustainable production and management of biological resources from land, forest, and aquatic environments;
- "Fork to farm": Food, health and well being (Consumer, societal, industrial and health aspects of food and feed);
- Life sciences and biotechnology for sustainable non-food products and processes.

3. **Information and Communication Technologies** *(Budget = 12.756 Mio Euro; 28,5% of collaborative research; 17,4% of total FP 7)*

Objective

To enable Europe to master and shape the future developments of Information and Communication Technologies (ICT) so that the demands of its society and economy are met. Activities will strengthen Europe's scientific and technology base in ICT, help drive and stimulate innovation through ICT use and ensure that ICT progress is rapidly transformed into benefits for Europe's citizens, businesses, industry and governments.

Approach

Innovative ICT Technologies are critical to Europe's future because half of the productivity gains in modern economies are explained by the impact of ICT on products, services and business processes. As a cross-cutting technology ICT is catalytic in the advance of other fields of science and technology. ICT research is involved in a global race to achieve further miniaturisation, to master the convergence of computing, communications, media technologies and with other relevant disciplines.

The Commission proposes to perform collaborative research in this area in coordination with relevant European Technology Platforms and industrial initiatives in areas such as nano-electronics, embedded systems, mobile communications, electronic media, robotics and software, services and Grids, focussing on the following areas:

- ICT Technology Pillars (Nano-electronics, photonics and integrated micro/nano-systems; ubiquitous and unlimited capacity communication networks; embedded systems, computing and control; software, grids, security and dependability; knowledge, cognitive and learning systems; simulation, visualisation, interaction and mixed realities);
- Integration of Technologies (Personal environments; home environments; robotic systems; intelligent infrastructures);
- Applications Research (ICT meeting societal challenges, e.g. in health, mobility, environment; ICT for content, creativity and personal development, e.g. new media, technology-enhanced learning, ICT supporting businesses and industry, ICT for trust and confidence);
- Future and Emerging Technologies (Support research at the frontier of knowledge in core ICTs and in their combination with other relevant areas and disciplines; to nurture novel ideas and radically new uses and to explore new options in ICT research roadmaps).

4. **Nanosciences, Nanotechnologies, Materials and new Production Technologies** *(Budget = 4.865 Mio. Euro; 10,9% of collaborative research; 6,6% of total FP 7)*

Objective

Improve the competitiveness of European industry and ensure its transformation from a resource-intensive to a knowledge-intensive industry, by generating breakthrough knowledge for new applications at the crossroads between different technologies and disciplines.

Approach

☛ *See chapter 5.2 for detailed discussion*

5. **Energy** *(Budget = 2.951 Mio Euro; 6,6% of collaborative research; 4,0% of total FP 7)*

   Objective

   Transforming the current fossil-fuel based energy system into a more sustainable one based on a diverse portfolio of energy sources and carriers combined with enhanced energy efficiency, to address the pressing challenges of security of supply and climate change, whilst increasing the competitiveness of Europe's energy industries.

   Approach

   ☛ *See chapter 5.3 for detailed discussion*

6. **Environment (including Climate Change)** *(Budget = 2.552 Mio Euro; 5,7% of collaborative research; 3,5% of total FP 7)*

   Objective

   Sustainable management of the environment and its resources through advancing our knowledge on the interactions between the biosphere, ecosystems and human activities, and developing new technologies, tools and services, in order to address in an integrated way global environmental issues. Emphasis will be put on prediction of climate, ecological, earth and ocean systems changes; on tools and technologies for monitoring, prevention and mitigation of environmental pressures and risks including on health, as well as for the conservation of the natural and man-made environment.

   Approach

   Strengthening the EU's technological and market position in environmental technologies is essential for the implementation of its environmental objectives, for fulfilling its international commitments[28] and for realising their economic and employment potential. For this purpose the Commission proposes the following research areas:

   - Climate change, pollution and risks (Pressures on environment and climate; environment and health; Natural hazards);
   - Sustainable Management of Resources (Conservation and sustainable management of natural and man-made resources; evolution of marine environments)
   - Environmental Technologies (Environmental technologies for observation, prevention, mitigation, adaptation, remediation and restoration of the natural and man-made environment; technology assessment, verification and testing);
   - Earth observation and assessment tools (Earth observation; forecasting methods and assessment tools).

7. **Transport (including Aeronautics)** *(Budget = 5.981 Mio Euro; 13,4% of collaborative research; 8,2% of total FP 7)*

   Objective

   Based on technological advances, develop integrated, "greener" and "smarter" pan-European transport systems for the benefit of the citizen and society, respecting the environment and natural resources; and securing and further developing the leading role attained by the European industries in the global market.

[28] such as the Kyoto protocol, the UN Convention on Biological Diversity, the objectives of the World Summit on Sustainable Development 2002, including the EU Water Initiative, and contributions to the Intergovernmental Panel on Climate Change and the Earth Observation initiative. In addition there are significant research needs arising from existing and emerging EU level policies, the implementation of the 6th Environmental Action Plan and associated thematic strategies, the action plans on Environmental Technologies and Environment and Health, and Directives such as the Water Framework.

Approach

The transport sector is an important contributor to GDP and employment in Europe and an important prerequisite for trade, manufacturing, etc. But at the same time it also produces 25% of all CO_2 emissions. Therefore the Commission allocates a high priority to research in this area as an enabler for 'greener', integrated transportation systems, based on innovative, efficient and environmentally friendly transportation technologies.

The Commission proposes the following research areas to meet these needs:

- Aeronautics and air transport
  - 'Greening' of air transport (reduction of emissions and noise, engines and alternative fuels, structures and aircraft designs, airport operations, traffic management);
  - Increased time and cost efficiency (including operating schedules, air traffic management systems, manufacturing cost reduction, zero maintenance aircraft);
  - Ensuring customer satisfaction and safety, efficient passenger handling;
  - Protection of aircraft and passengers;
  - Pioneering the air transport of the future (radical, environmentally efficient and innovative air transport technologies).
- Surface transport (rail, road and waterborne)
  - 'Greening' of surface transport (emissions and noise reduction, clean and efficient engines, hybrid technology, alternative fuels, end of life strategies);
  - Encouraging modal shift and decongesting transport corridors (innovative regional and national transport networks, infrastructures and systems);
  - Sustainable urban mobility (Clean and safe vehicles, non-polluting transport means, new public transportation modes, integrated town planning and transport);
  - Improving safety and security (as inherent to the transport system);
  - Strengthening competitiveness (design processes, advanced power-train and vehicle technologies; innovative production systems and infrastructure construction; integrative architectures);
- Support to the European global satellite navigation system (Galileo).

8. Socio-Economic Sciences and the Humanities *(Budget = 798 Mio Euro; 1,8% of collaborative research; 1,1% of total FP 7)*

Objective

Generating an in-depth, shared understanding of complex and interrelated socioeconomic challenges Europe is confronted with, such as growth, employment and competitiveness, social cohesion and sustainability, quality of life and global interdependence, in particular with the view of providing an improved knowledge base for policies in the fields concerned.

Approach

☛ *See chapter 5.5 for detailed discussion*

9. Security and Space *(Budget = 3.987 Mio Euro; 8,9% of collaborative research; 5,4% of total FP 7)*

Objective

To develop the technologies and knowledge for building capabilities needed to ensure the security of citizens from threats such as terrorism, and crime, while respecting fundamental human rights; to ensure optimal and concerted use of available technologies to

the benefit of European security, and to stimulate the cooperation of providers and users for security solutions.

Supporting a European Space Programme focusing on applications such as GMES with benefits for citizens and for the competitiveness of the European space industry. According to the Commission this will contribute to the development of a European Space Policy, complementing efforts by Member States and by other key players, including the European Space Agency.

Approach

☛ *See chapter 5.4 for detailed discussion*

4.4 Observations and recommendations

1. FP 7 overall budget

Even if the need to boost European investment in research under FP 7 is generally recognized and not questioned by this report, the current proposal of raising the FP 7 budget to over 73 Billion Euro raises several questions:

- The proposed overall budget is based on the implicit assumption that Europe's failure to meet the Lisbon targets is caused by underspending on public research and can therefore be cured by raising its budget close to the target level of 1% of GDP for Public Sector Research investment in the EU. In its own FP 7 impact assessment and ex-ante evaluation (EU2005f) the Commission argues that increased public research investment as proposed under FP 7 will generate significant additional Private Sector R&D investment[29] and calculates that it will generate at least 0.69 and up to 1.66 percent of extra GDP over and above the business-as-usual scenario of moderate growth in FP funding.

  These assumptions are based on literature and econometric considerations. But FP 7's capability to achieve this leverage will only become visible once the proposals for the individual programmes will be more concrete. In formulating them, the Commission should pay special attention to measures used to achieve this transformation of public sector research investment into sustainable private sector commitment, economic welfare and employment.

- The proposed FP 7 budget increase will create a significant additional influx of 'fresh money' into existing research structures. For example the 'Ideas' programme alone will provide additional funds for basic research in the order of over 1 Billion Euro per year for an existing research base which is currently financed by national authorities. This change in the flow of funds will have structural implications and it should be carefully avoided that for example research of national importance is 'diluted' in an undesirable way because the best national researchers turn towards EC funded projects, or that within this huge additional financial volume the quality of projects under the 'Ideas' programme can not be assured at the level defined by the 'excellence' criteria.

- In its communication "Building our common Future - Policy challenges and Budgetary means of the Enlarged Union 2007-2013" (EC 2004b) the Commission describes the overall financial framework in which FP 7 is competing for scarce financial resources available[30] (see figure 13). Even if research as a whole and FP 7 in particular account only for a minor portion of the Community's overall funding, the provision of the necessary funds for boosting the Framework budget requires the Commission to either reallocate funds from other programmes or to contribute to exceeding the ceiling of 1% of Gross National Income of ERA countries if necessary.

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[29] based on an assumed "crowding-in" effect of of public R&D funding allocated to business generates between €0.7 and € 0.93 of Private Sector R&D spending per 1€ of Public Sector spending.

[30] For an overview over current status of EC budget issues, see also EC2005g

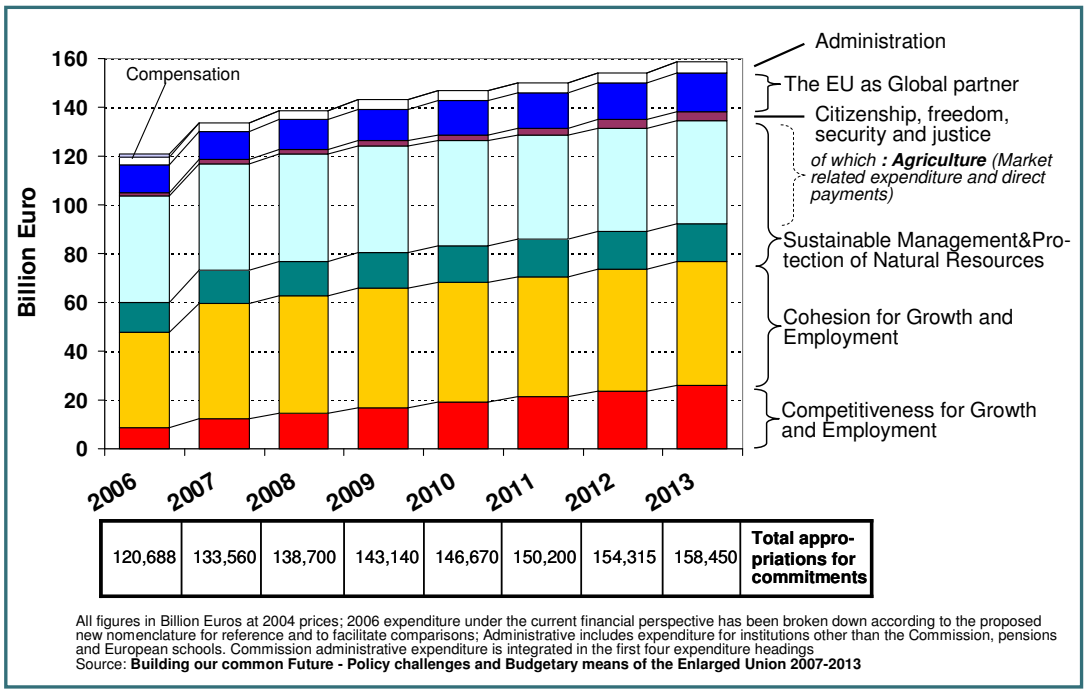

Figure13: Overview of the new financial framework 2007-2013

In their joint letter to the President of the Commission dated 15. December 2003, the Prime Ministers of the United Kingdom, the Netherlands and Sweden, the President of France and the Chancellors of Germany and Austria have expressed their concerns (Blair 2003):

> *"…We see in this context no room for a EU budget near the current ceiling for own resources. Average expenditure during the next financial perspective should in our view be stabilised around current expenditure levels, and should not exceed 1.0% of GNI, including agriculture spending within the ceiling set by the European Council in October 2002. This would still allow for annual increases in the EU budget well above growth rates of national budgets in most Member States, and permit a sufficient margin for policy implementation in the enlarged Union…"*

Under these aspects the proposed budget raise should be critically reviewed and not accepted per se. Without additional details the general budgets for the individual programmes and research areas are not sufficiently transparent to be able to lead a more profound discussion. In addition an effort should also be made to estimate the productivity gains in the programme execution though the proposed improvements in its implementation.

In the definition of priorities and of the research portfolio of FP 7, the Commission itself has a key role to play. It must ensure a sane balance between top-down actions to stimulate a coordinated approach to planning and funding research in priority areas and bottom-up approaches, driven by the needs of the stakeholders in European research.

The budget requests generated by stakeholders in the current bottom-up process are likely to exceed again the proposed FP 7 budget, despite its significant increase compared with FP 6. For this reason and to account for the general budget restrictions which the EU is facing, the portfolio of FP 7 research themes should be carefully managed, using a thorough selection of research areas and projects to give priority to high potential projects.

If the proposed overall budget in the order of over 70 Billion Euros is not accepted for whatever reason, the inclusion of the proposed new research areas should not dilute research efforts and lead to 'undercritical masses' in existing priority areas. Under such

conditions especially the launch of new research themes should be carefully reconsidered if for example limited available funds under FP 7 require further focussing.

2. Programme elements

Overall the proposed structure of FP 7 and its elements represent current research fields with high innovation dynamics and important leverage potential (in view of the Lisbon objectives and the other EU policy targets). The following items provide brief comments and suggestions for further improvement where appropriate[31]:

Possible approaches for further improving this structure are listed in the following paragraphs:

- Under the term "***Cooperation***" the Commission summarises two different types of research areas. Cross cutting technologies like nanosciences/nanotechnologies/materials have a different role and requirements than research fields directly aiming at breakthrough innovation in specific sectors. Therefore they should maintain momentum to enhance knowledge in their areas and push the frontiers of research further. But – given the overall FP 7 priority on reaching the Lisbon targets and other policy objectives, their main orientation should be to create maximum value in their important fields of application. For example, innovative materials are key to innovation in sectors like ICT, transport and energy.
- The importance of ***Manufacturing Technologies*** as an enabler for further improvement of the competitiveness of various sectors of the manufacturing industry has already been mentioned in chapter 3.2. Maintaining the attractiveness of Europe as an attractive manufacturing location requires dedicated, interdisciplinary research, drawing also on state-of-the-art knowledge from ICT, operations management and other relevant research areas. As a cross-cutting enabling technology with a decisive influence on the further efficiency improvement in manufacturing they merit high attention and should not be positioned as an 'annex' to Nanoscience and materials research.
- For a more profound and reliable evaluation of the proposed research areas, more ***in-depth information*** about detailed research strategies, allocation of funds to individual themes, roadmaps, etc. needs to be available. In particular a better understanding of the research strategies in the proposed new research themes Space and Security is necessary to evaluate their rationale and approach. Efforts to evaluate them on the basis of current information can only be preliminary.
- The importance of ***Socio-economic Sciences and Humanities*** is now emphasized by making them an own research priority under FP 7. However this should not result in an isolated programme. The in-depth discussion of individual research fields in chapter 5 provides evidence that Socio-economic Sciences and Humanities can make important contributions to solving many of the challenges our society is facing, as for example research in health moves from a (bio)technology focus towards integrated approaches to disease management and a focus on health and societal challenges (e.g. ageing society). Therefore these scientific disciplines should be integrated as far as possible in interdisciplinary approaches to meet the key challenges of European societies and economies.
- Efficiency and effects of the ***Ideas*** programme are difficult to evaluate in advance, as the ERC concept is still under discussion. There are valid arguments for establishing an instrument to stimulate investigation-driven research on a European level. But several conditions should be observed:

[31] For detailed comments and recommendations in the research areas investigated in-depth see chapter 5.

- It should clearly focus on research themes where the European dimension adds significant value (i.e. it should not compete with national programmes in the same area!).
- The ERC should establish transparent and efficient instruments to secure (1) the 'excellence' criterion in funding decisions for projects, (2) the efficient management of projects funded and of the ERC's portfolio of projects, and (3) a consequent documentation, evaluation and dissemination of results achieved.
- Detailed proposals for governance of the ERC, project selection criteria, etc. will only be available later this year. These should also ensure that investigation driven research does not take place in an 'ivory tower'[32].
- Based on the available information it is impossible to make a credible statement whether the amount of funds for the Ideas programme (11.942 Mio. Euro) is appropriate in terms of funding needs of the scientific community not met today, potential projects fulfilling the 'excellence' and other relevant criteria and avoidance of undesired structural effects (see previous section).

- Continuous development and further enhancement of the Marie Curie actions under FP 6 in the new ***People*** programme of FP 7 apparently addresses one of the key levers for securing the future science base in Europe and should therefore receive a high priority.
- For the ***Capacities*** programme a differentiated view is necessary:
  - The further development of and access to ***Research infrastructures*** on a European scale is an apparent priority for the further realisation of the ERA.
  - The term 'infrastructure' should be ***extended beyond physical infrastructure***. ICT-enabled virtual collaboration in networks and a secured and affordable access to scientific and technical information and literature merit growing attention and should be addressed by FP 7.
  - ***Research for the Benefit of SMEs*** can be a powerful instrument to create leverage from FP 7 for SMEs. SMEs play a key role for European competitiveness, innovation performance and sustainable employment, especially. But due to their specific needs, time horizon and role in the innovation process and their limited resource base to perform own research a special effort is necessary to enhance their access to and use of European research and innovation collaborations[33]
    - The terms and conditions for participation by SMEs in thematic priority projects must be made far more attractive. In particular, funding of smaller projects with few partners and a flexible use of funding instruments which meet the needs of SMEs (e.g. SME-led IPs, STREPS) must be possible.
    - In addition, specific measures for SMEs must be improved or created to encourage SMEs doing research and those not doing research to launch innovations (e.g. strengthening of CRAFT and Collective Research, better orientation of other measures to support innovations to the needs of SMEs, etc.)
  - At a first glance the ***Research Potential*** and ***Regions of Knowledge*** priorities are in contradiction with the overriding 'excellence' focus of FP 7 promoted by the Commission itself. Depending on the detailed design of these programmes, there is a danger that they interfere again with structural and cohesion oriented measures, which should be carried out under those budgets and not under FP 7. Therefore under FP 7 these activities should be limited to measures with a direct

[32] For example through research programme review involving different stakeholders from the public and private sector, calls for proposals addressing actual problems, etc.

[33] adapted from the Position paper by the German Federal Government (BMBF 2004)

relevance for FP 7 as a whole, for example measures which enable researchers and research groups from new accession countries to compete for and participate successfully in FP 7 projects.

- The weight of ***Science in Society*** is confirmed by the high importance, which participants in the FP 7 online consultation (EC 2004q) allocated to the importance of taking into account interactions between science and society in the design of future European research programmes and initiatives (see figure 14). Comments highlight for example the need to focus on young people and science education, the importance of ethical aspects of research and the need for genuine debate and the idea that 'societal' considerations should not take precedence over scientific criteria.

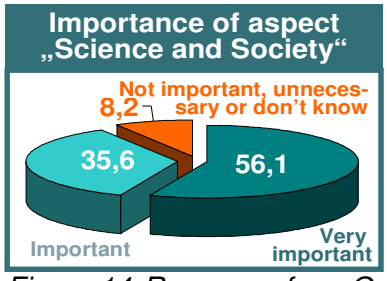

Figure 14: Response from Online Consultation

Beyond the creation of a favourable climate for science in society (including for example interesting bright young people in a scientific career) ***Science in Society*** should stimulate a 'two way communication' which enhances the understanding and acceptance of scientific work and its results in European Societies. Issues, where research and its results may be conflicting with what society desires and is willing to accept, should be identified and a consensus oriented dialogue should be initiated. Examples like stem cell research, nuclear energy, etc. demonstrate how otherwise in some countries research and policy get stalled by the polarisation created and unresolved conflicts. Therefore this programme element should also stimulate approaches to identify issues, where research and its results may be in conflicting with what society desires and is willing to accept and initiate a consensus oriented dialogue. As a necessary precondition for this, a sufficient level of public knowledge about and understanding for modern science and its themes must be ensured.

- As an important gateway between Europe and its partners the ***Activities of international Cooperation*** should be further pursued in the described way.

3. Integrated approaches and seamless innovation chains

The future FP 7 structure must fulfil two major requirements in a balanced way:

- Through a dedicated investment in the further development of the ERA and the decisive enablers of a world class European research landscape, FP 7 must create the base for sustainable research performance.
- At the same time FP 7 must also create the necessary momentum to build European leadership through breakthrough innovations in key sectors as a basis for future growth and economic performance and for achieving the Lisbon objectives[34].

The Five Year Assessment of the European Union Research Framework Programmes 1999-2003 (EC 2005e) confirms the importance of the Framework programmes for achieving the first objective:

> *The Panel concludes that the EU Research Framework Programmes have played an important role in developing the European knowledge base over the period of the review (1999-2003). The Framework Programmes have corrected some of the deficiencies in the European RTD landscape and have contributed significantly to bridging the gap between RTD and innovation.*

But the same source also points to major improvement potentials in the achievement of the second objective:

[34] In close interaction with the other instruments for this purpose already mentioned (e.g. CIP).

Despite notable successes, however, the achievement of the Framework Programmes has been more modest in terms of direct contribution to innovations with the potential to deliver dominance in global markets.

Together with the provided explanations, the proposed FP 7 structure accounts for this challenge. For example the extension of the FP 6 priority "Genomics and biotechnology for health" to a broader research approach to health related research for the health of European citizens and to ensure the competitiveness and performance of European health systems and industries and the extension of the FP 6 priority "Food quality and safety" to a broader research approach to Food and agriculture related research[35] is an important improvement. Both sectors are of very high technological and economic importance for Europe and depend on a dedicated effort to maintain their competitiveness. In the case of health, the stronger emphasis on industry needs and on seamless innovation chains, as represented for example by the focus on clinical studies, epidemiology and disease treatment concepts shows an integrated approach, going beyond the technology focus of previous programmes, which should further be strengthened.

The efficient interaction of private sector and public sector research is key to achieving the desired increased commitment to and investment in research by the private sector. Therefore a dedicated effort should be undertaken to improve this interface and to correct known deficits[36].

4. Strengthen the "Socio-Economic Dimension" in main FP 7 research themes

The European Research Advisory Board has emphasized the importance of integrating socio-economic research components in research programmes with the following recommendations (EURAB 2004):

"…The "Socio-Economic Dimension" of FP RTD main science and technology programmes should be expanded beyond the present emphasis on ex-post analysis of "social and economic impacts of science and technology" and "foresight" assessments to the full integration of socio-economic research components in the work programmes and "calls for proposals"…

… The European Commission should undertake an analysis of the number and range of SSH disciplinary experts involved in successful proposals to the first "calls for proposals" of FP 6 Thematic Priorities 1 to 6 where "socio-economic dimensions" were emphasized. The purpose of the analysis would be to measure the extent of actual as opposed to simply rhetorical reference to the importance of the "socio-economic dimension" of the research projects…

… The European Commission should increase SSH expert participation in both the design stage (Advisory Groups) of the work programmes and in the evaluation process of FP 6 Thematic Priorities 1 to 6 as well as in future FPs...

… All aspects of "Science and Society" interactions and perspectives (introduced as a separate component in FP 6) should become a "horizontal issue" applicable across all FP RTD programmes, and hence become embedded in EU project coverage in a similar way to those parts addressing gender and ethical issues…"

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35 Agricultural and food related research is already an element of the EC's "Quality of Life and Living Resources" programme which run from 1998-2002. For example Key Action 5, covering sustainable agriculture, forestry, fisheries and rural development, has a budget of around €520 million to fund a range of research projects covering plant systems; animal systems; fisheries and aquaculture; non-food development; forestry management; forest products; common agricultural and fisheries policies; and rural development. Key Action 1 is covering Food, Nutrition and Health. Apparently actions under FP 7 must build on these existing activities and be in alignment with them.

36 Even if national governments have the primary responsibility for this task the European Commission can support this through support for innovative approaches, coordination of national policies, proliferation of best practices, etc.

For this purpose the integration of activities already launched under FP 6 and of existing competencies (e.g. the European Parliamentary Technology Assessment (EPTA), The European Commission's Institute for Prospective Technological Studies (IPTS), the European Science Foundation's "Forward Looks" instrument, ForSociety ERA-NET and similar initiatives at the national level) should be enhanced.

5. Portfolio considerations

The research areas defined by the Commission represent dynamic innovation fields requiring dedicated research initiatives. However a flexible handling of this portfolio is necessary:

- There should be room for interdisciplinary approaches involving more than one of the defined research areas. The driving force behind such approaches should be a 'problem solving', mission oriented approach, complementing the technology oriented structure of the Framework programme.
- The current focus on young research fields with high innovation dynamics should not prevent appropriate support for more mature sectors to maintain European competitiveness and local employment in sectors like the chemical industry, textiles, etc. Despite slower overall growth rates, in such sectors often 'silent revolutions' with high innovation content take place which enable improved product features, cost efficiency, etc.
- During FP 7 the dynamics of global research and economy may lead to shifting priorities or to the evolution of new priority research areas. The FP 7 design should provide for the necessary flexibility to react to such changes.

To account for these proposed amendments, Figure 15 proposes a slightly different perception of the FP 7 structure It is based on the differentiation between

- Areas of research where ***collaborative research*** is the instrument of choice for bringing together European researchers in excellent projects to create European leadership in priority research areas. The objective here is to create critical masses on a European level and realize additional value from the European dimension to build momentum for innovation and leadership in target sectors. This approach applied to the *Collaborative Research* programme as well as to the *Ideas* programme.
- A complementary set of ***enablers*** for integrated world class research in the ERA creates the necessary structural and resource conditions for leading edge research in Europe. This is the focus of the *People* and *Capacities* programmes.

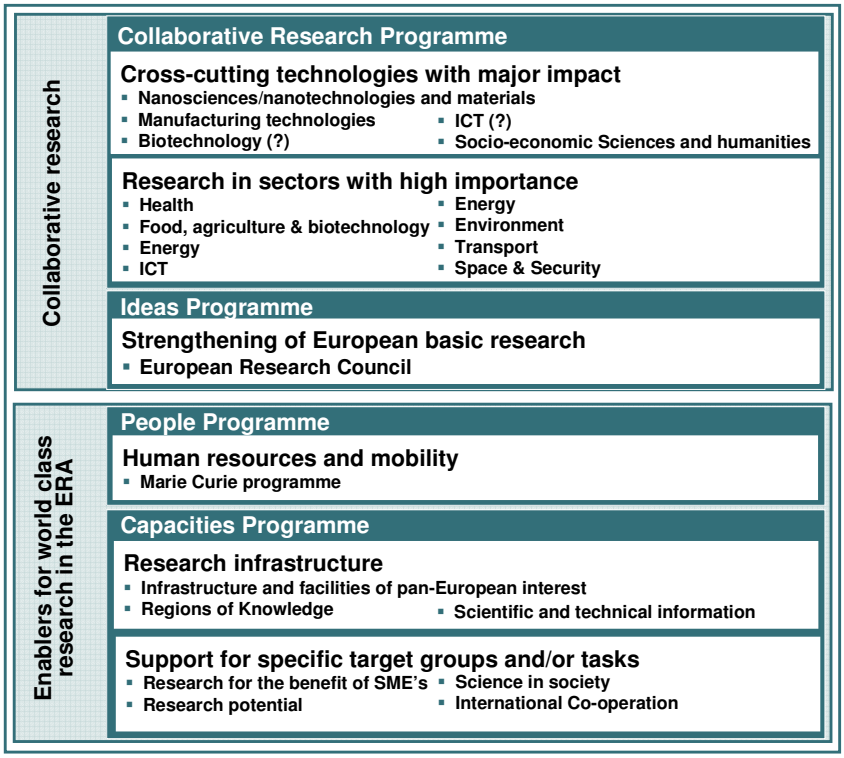

Figure15: Proposed modified dimensions of FP 7 programme structure

5. In-depth analysis of selected thematic priorities

Introductory remark:

In view of the short time available between the publication of the Commission's FP 7 proposal (April 6) and the publication of this report (April 11), five research areas were preselected for in-depth analysis because of the particular need for additional information of the constituent of this study, The Greens/EFA.

5.1 Health

Proposal by the Commission

Past research has been focussing on the sequencing of the human genome and recent advances in post-genomics, which have revolutionised research into human health and diseases and created vast amounts of data. In its FP 7 proposal, the Commission emphasises translational research (translation of basic discoveries in clinical applications), the development and validation of new therapies, methods for health promotion and prevention, diagnostic tools and technologies, as well as sustainable and efficient healthcare systems. The objective is to improve the health of European citizens and to increase the competitiveness of European health-related industries and businesses, while addressing global health issues including emerging epidemics.

Understanding the underlying biological processes requires bringing together critical masses of various expertises and resources that are not available at a national level. Clinical research on many diseases (e.g. cancer, cardiovascular diseases, mental and neurological diseases, in particular those linked with ageing, such as Alzheimer and Parkinson diseases) relies on international multi-centre trials to achieve the required number of patients in a short time-frame. Epidemiological research requires a large diversity of populations and international networks to achieve significant conclusions. Developing new diagnostics and treatments for rare disorders also requires multi-country approaches to increase the number of patients for each study. And performing health policy-driven research at the European level enables comparisons of the models, systems, data, and patient material held in national databases and biobanks.

A strong EU-based biomedical research will help strengthen the competitiveness of the European healthcare biotechnology, medical technology and pharmaceutical industries. The EU also has to play an active role in creating an environment conducive to innovation in the pharmaceutical sector, in particular to maximise the success of clinical research.

Two strategic issues, child health and the health of the ageing population, will be addressed across activities.

The activities that will be addressed, which include research essential to policy requirements, are set out below:

- Biotechnology, generic tools and technologies for human health (High-throughput research to catalyse experimental progress in biomedical research by enhancing data generation, standardisation, acquisition and analysis; detection, diagnosis and monitoring, with emphasis on non-invasive or minimally invasive approaches, predicting suitability, safety and efficacy of therapies to develop and validate biological markers, innovative therapeutic approaches and intervention to consolidate and ensure further developments in advanced therapies and technologies with potential application in many diseases and disorders.
- Translating research for human health (Integrating biological data and processes: large-scale data gathering, systems biology to generate and analyse the vast amount of data needed to understand better the complex regulatory networks of thousands of genes and

gene-products controlling important biological processes; research on the brain and related diseases, human development and ageing; translational research in infectious diseases to address anti-microbial drug resistance and the global threats of HIV/AIDS, malaria and tuberculosis as well as emerging epidemics (e.g. SARS and highly pathogenic influenza), translational research in major diseases: cancer, cardiovascular disease, etc. to develop patient-oriented strategies from prevention to diagnosis and treatment including clinical research.

- Optimising the delivery of health care to European citizens (Translating clinical outcome into clinical practice to understand clinical decision-making and how to translate outcomes of clinical research into clinical practice; Quality, efficiency and solidarity of health systems including transitional health systems to translate effective interventions into management decisions; enhanced disease prevention and better use of medicines; appropriate use of new health therapies and technologies)

Status and options

Modern life sciences have led to huge expectations concerning their potential to improve health, agriculture and the environment and to open up new avenues for key industrial sectors, including energy production, chemical engineering and the development of materials. Yet these advances have not always gained acceptance by society.

Research under FP 6 is based on the action plan laid out in the Commission's Communication "Life Sciences and Biotechnology: A Strategy for Europe' (EC 2002e). This paper describes the policy challenge as follows:

…A revolution is taking place in the knowledge base of life sciences and biotechnology, opening up new applications in healthcare, agriculture and food production, and environmental protection, as well as new scientific discoveries. This is happening globally. The common knowledge base relating to living organisms and ecosystems is producing new scientific disciplines such as genomics and bioinformatics and novel applications, such as gene testing and regeneration of human organs or tissues. These in turn offer the prospect of applications with profound impacts throughout our societies and economies, far beyond uses such as genetically modified plant crops.

The expansion of the knowledge base is accompanied by an unprecedented speed in transformation of frontier scientific inventions into practical use and products and thus also represents a potential for new wealth creation: old industries are being regenerated and new enterprises are emerging, offering the kind of skill-based jobs that sustain knowledge-based economies. As probably the most promising of the frontier technologies, life sciences and biotechnology can provide a major contribution to achieving the European Community's Lisbon Summit's objective of becoming a leading knowledge-based economy. The European Council in Stockholm in March 2001 confirmed this and invited the Commission, together with the Council, to:

'examine measures required to utilise the full potential of biotechnology and strengthen the European biotechnology sector's competitiveness in order to match leading competitors while ensuring that those developments occur in a manner which is healthy and safe for consumers and the environment, and consistent with common fundamental values and ethical principles.'

Europe's current performance in life sciences and biotechnology is not facilitating the achievement of that objective.

In Europe and elsewhere, intensive public debate has emerged. While the public debate has contributed to awareness and concrete improvements on important issues, it has also focused narrowly on genetically modified organisms (GMOs) and specific ethical questions, on which public opinion has become polarised. In the Community, like in other regions and countries, the scientific and technological progress in these areas raises difficult policy issues and complex regulatory challenges.

Uncertainty about societal acceptance has contributed to detracting attention in Europe from the factors that determine our capacity for innovation and technology development and uptake. This has stifled our competitive position, weakened our research capability and could limit our policy options in the longer term.

Europe is currently at a crossroads: we need to actively develop responsible policies in a forward-looking and global perspective, or we will be confronted by policies shaped by others, in Europe and globally. The technology and its applications are developing rapidly — the Commission believes that Europe's policy choice is, therefore, not whether but how to deal with the challenges posed by the new knowledge and its applications…

The strategy derived from this assessment identifies the main benefits of Life Sciences and proposes four priorities (see EC 2002e for details):

1. **Harvesting the potential** (Actions 1-12)

   Develop skills, support European research, provide a strong European intellectual property system, facilitate access to capital, network various European biotech stakeholders & increase proactive role of public authorities

2. **A key element for responsible policy: governing life sciences and biotechnology** (Actions 13-23)

   Dialogue among stakeholders, ethical and social implications, consumers' right to choose and legislative framework

3. **Europe in the world – responding to global challenges** (Actions 24-28)

   Highlight Europe's role in developing international guidelines and indicate the areas where Europe can support the developing world in its efforts

4. **Implementation and coherence across policies, sectors and stakeholders** (Actions 29 and 30)

   Defines the role of the Commission in evaluating and further developing Europe's biotechnology policy in the coming years

The current status of Life Science research under FP 6 is described by the Commissions April 2004 Communication "Life sciences and biotechnology — A strategy for Europe; Second Progress Report and future Orientations" (EC 2004i):

- ***Progress has been made in the implementation of the Strategy ……..***

  The 6th Framework Programme for Research (FP 6) has made a successful effort to bring science and society closer together and to develop an understanding of and an information exchange on life sciences and biotechnology. Progress has been achieved in the regulatory and legal framework (e.g. pharmaceutical legislation, regulatory framework on Genetically Modified Organisms). Member States pursue different strategies to support biotechnology development, to respond to the challenge of education and to make the European Research Area (ERA) more attractive for scientists in and outside the Union.

- ***…however, there is obviously still much to be done to improve the situation for European biotechnology.***

  Public and private investments in research urgently need to be increased. As the industry matures (Visible for example in the shrinking number of pharmaceutical compounds in clinical trials, a common measure of research activity), demands on the European system for financing and performing innovation rise. The Commission reminds that member States have made commitments to implement measures on intellectual property, especially for implementation of Directive 98/44/EC, on the legal protection of biotechnological inventions.

This last issue is a representative example for conflicts arising at the interface between policy objectives, regulatory framework, scientific progress, research strategies and ethical concerns[37].

The European Commission states (EC 2004i):

> *The delays incurred in the implementation of Directive 98/44/EC, on the legal protection of biotechnological inventions leaves companies engaged in innovative biotechnology research uncertain as to whether they are fully entitled to the commercial fruits of their work. This is severely hampering the industry's development, discouraging not only innovators themselves but also the potential investors whose finance is so desperately needed. The slow progress in adopting a Community patent has also led many companies to adopt a strategy of primarily securing patents in the US and a few European states. Resolving these two issues will be important for the growth of the biotechnology industry.*

Despite this argument several national governments have been reluctant to implement the directive[38]. The reasons for this reluctance, driven by ethical concerns, are expressed for example in an opinion of the ´Comité Consultatif National d'Ethique pour les sciences de la vie et de la santé´ on a preliminary draft law for transposition of Directive 98/44/CE into the French Code of intellectual property[39]:

> *"… Three ethical principles are at stake*
>
> – *the principle of not making commercial use of the human body.*
> – *free access to knowledge of the gene.*
> – *sharing this knowledge.*
>
> *The first guarantee at stake is the principle of not making commercial use of the human body. This is one of the cornerstones of the laws on "bioethics". It is consecrated by the Code Civil, in articles 16-1 and 16-5. "The human body, its elements, and its products cannot be the object of any rights of patrimony" and "conventions with a view to confer rights of patrimony to the human body, its elements, or its products, are null and void". The Conseil Constitutionnel confirmed this principle. Individuals are prohibited from engaging in the trade of their own bodies or of its elements, and this rule is of considerable importance as regards the gift of organs and tissues. This is one of the main instruments to combat the risk of the human body being made into an instrument…"*

For the further development of Life Science research beyond FP 6, the European Group of Life Sciences (EGLS), established in 2000 to advise the Commission on current and future life science technologies, has identified 15 scientific challenges that it believes can contribute to tackling current societal problems, and which could be used to shape the European research agenda in the coming years (EGLS 2004a, EGLS 2004b). According to EGLS, these priority areas are diverse, and include food supply and natural resources, microbial lifestyles and the microbial metagenome, stem cells, infectious diseases, regulations, systems biology, synthetic biology and education. Some of these must be priorities in Europe in order to ensure human survival, while others promise a better quality of life. Knowledge in all of these fields is also likely to boost economic competitiveness, particularly in those that are only beginning to emerge now. The EGLS' also warns that education could become the major bottleneck for the future of life sciences research in Europe and urges action in order to capture young talent.

Yet the European Group of Life Sciences confirms that advances in Life Sciences have not always gained acceptance by society (EGLS 2004a):

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37 Similar issues arise for example in the information Technology sector (Software patent!).

38 Germany for example has transposed the directive with four years of delay only after having been convicted by the Court of Justice of the European Communities in December 2004.

39 Quoted from http://www.greenpeace.org/deutschland/?page=/deutschland/fakten/gentechnik/patente/stellungnahmen-zur-biopatent-richtlinie

"… The one lesson to emerge after a decade of controversies (GM food, stem cells, reproductive technologies...) is that research, development and innovation can hardly prosper in the face of social opposition to science. Citizens' demands for greater control over their taxes and explanations of how they are spent sometimes come as an unwelcome surprise to scientists traditionally educated in the culture of pure, curiosity-driven research. We are convinced that the way forward is not to avoid or to disguise the debate over modern life science research, but to promote a structured and informed discussion among all stakeholders of any given challenge – those already existing and those still to come…"

Observations and recommendations

1. Resolution of ethical questions as a basis for moving forward

Trying to provide answers for the ethical questions associated with current biotechnology research goes beyond the scope of this study. However it is obvious that

- a continued disagreement on the ethics of biotechnological research and its regulatory/legal framework is likely to prevent increased acceptance of biotechnological research and products. The controversial debate about deployment of genetically modified material, stem cell research, etc. in some Member States should be taken serious and lead in a way which ensures a reasonable degree of consensus in European societies on the fields where European leadership is sought in this area and on the ethical standards in which this takes place.
- If this is not achieved, the full deployment of the European potential for achieving the progress which Life Science innovation can deliver, will be further hampered. In this case, Europe is likely to fall further behind the pace of the global evolution of Life Science research and industry, even in areas where consensus exists, thus putting medical and societal progress and the realisation of economic and employment potentials in these sectors at stake.

There is no obvious solution to all existing conflicting views of stakeholders involved, but a high need to solve and reconcile them - at least to the possible extent. Therefore the European Commission should allocate high attention to working towards a consensus.

Only through this, a broad acceptance of biotechnological research and its legal and regulatory framework can be ensured, also as an obvious prerequisite for the private sector's readiness to invest in Life Science research and industry.

2. Research strategy

The economic and employment importance of the health sector and the growing challenges in this area, (coming from socio-demographic changes, illnesses where no efficient treatment exists today, etc.) suggest that a high commitment to Life Science research is a ´must´ to exploit the sector's innovation and growth potential. From a purely scientific and technological perspective the EGLS recommendations form a good basis for shaping the EC's future research strategy under FP 7.

In order to contribute to the development of new therapeutic approaches, especially in areas where today no efficient pharmaceutical therapies exist, FP 7 should focus in particular on the bottlenecks of current drug development. Seamless innovation chains must be created, leading from basic research on the causes of diseases and drug discovery via preclinical and clinical development, epidemiology, etc. to efficient pharmaceutical treatments and integrated 'disease management' concepts'. This calls for a balanced support of all steps of the Life Science innovation chain, including drug discovery, preclinical and clinical research, etc.

3. Balancing economic with other policy objectives

Already under FP 6 a part of the research effort in Life Sciences was devoted to actions going beyond purely economic motivation (For example the FP 6 ´Research strategy to poverty-related diseases: HIV, Malaria and Tuberculosis´ or the European & developing countries clinical trials partnership – EDCTP').

These objectives should be pursued also under FP 7 and continuity should be ensured in the light of the duration and cost of typical development of new treatments. Work in the area of poverty related diseases and 'neglected diseases should be continued and, if possible, extended[40].

4. Integrated, thematically driven approaches for major challenges in the Life Science area

So far Life Science research funded by FP 6 has mostly been focussed on pharmaceutical or biotechnological progress. This should be complemented by interdisciplinary approaches, targeting 'burning issues' in the health area (For example problem areas with high relevance for European societies, e.g. 'aging society'), which integrate all relevant scientific disciplines (including Social Sciences, palliative medicine, etc.) in integrated 'disease management' approaches.

An example: Over 650.000 people in Germany are suffering from Alzheimer's disease, for which currently no treatment exists. This is causing annual costs for society of over 28 Billion Euro. Only a minor portion of this cost is for medical treatment. The trend towards rising average lifetime indicates that these numbers will rise significantly over the next years. There are two possible approaches: (1) Investing in research to find effective new medical treatment to prevent or cure the disease and/or (2) development of integrated approaches to delay the occurrence and to improve the quality of life of patients. Both require significant further investment in innovative approaches.

5.2 Nanosciences, Nanotechnologies, Materials and new Production Technologies

Proposal by the Commission

The Commission identifies leadership in fields such as in nanotechnologies, materials and production technologies as a key to maintaining competitiveness of many sectors of its economy and of companies using such technologies, including SMEs. Therefore this programme part aims at fostering the transition from a resource-intensive to a knowledge-intensive industry, by generating breakthrough knowledge for new applications at the crossroads between different technologies and disciplines.

This shall be achieved through activities in the following fields:

- ***Nanosciences, Nanotechnologies***: Generate new knowledge on interface and size dependent phenomena; nano-scale control of material properties for new applications; integration of technologies at the nano-scale; self-assembling properties; nano-motors; nano-machines and nano-systems; methods and tools for characterisation and manipulation at nano dimensions; nano and high-precision technologies in chemistry; impact on human safety, health and the environment; metrology, nomenclature and standards; exploration of new concepts and approaches for sectoral applications, including the integration and convergence of emerging technologies.
- ***Materials***: Generate new knowledge on high-performance materials for new products and processes; knowledge-based materials with tailored properties; more reliable design and simulation; higher complexity; environmental compatibility; integration of nano-

[40] If possible, investigated 'neglected diseases' should be extended, for example to visceral leishmaniasis, human African trypanosomiasis, & Chagas disease, etc.

molecular macro levels in the chemical technology and materials processing industries; new nano-materials, bio-materials and hybrid materials, including design and control of their processing.

- ***New Production***: Create conditions and assets for knowledge-intensive production, including construction, development and validation of new paradigms responding to emerging industrial needs; development of generic production assets for adaptive, networked and knowledge-based production; development of new engineering concepts exploiting the convergence of technologies (eg, nano, bio, info, cognitive and their engineering requirements) for the next generation of high value-added products and services, and adaptation to the changing needs.
- ***Integration of technologies for industrial applications***: Integrate new knowledge and technologies on nano, materials and production in sectoral and cross sectoral applications such as: health, construction, transport, energy, chemistry, environment, textiles and clothing, pulp and paper, mechanical engineering.

Status and options

Partially driven by the dynamic evolution of nanosciences, research in industrial and materials technology and manufacturing has received again high attention in the sixth Framework Programme. With a total budget of 1.3 Billion Euros over the next four years, Priority 3 of FP 6 brings together nanotechnologies, materials science and manufacturing, as well as other technologies based on bio- or environmental sciences. Over 700 Mio Euro of this are devoted specifically to nanotechnology.

Nanotechnology

In the Communication 'Towards a European strategy for nanotechnology', which was endorsed by the Council of the European Union (EC 2004j, Council 2004a), the Commission proposes a major effort to boost European nanotechnology R&D. Its main considerations are the consolidation of public and private research efforts and improved technology transfer to turn research findings into commercially viable products. It also addresses the need to identify and respond to concerns about safety, health and environmental risks related to nanotechnologies. A public consultation confirmed strong stakeholder consensus that nanotechnology will have a significant impact on European industry and its citizens within ten years from now (Nanoforum 2004). An Action Plan on nanotechnology is under preparation and will be published here in spring 2005.

In its Communication, the Commission proposes to

- boost research investment and infrastructure;
- improve training for research staff;
- enhance technology transfer in Europe and to increase funding for this;
- increase international cooperation towards a responsible approach to nanotechnology R&D globally.

However the Commission has also already addressed in its strategy the aspect of a responsible approach to such a new technology with potential high future impact. In the case of nanomaterials concerns exist that manufactured nanoparticles and nanotubes which are not fixed or etched onto a larger object and therefore unable to stray into the environment, could be inhaled, ingested or enter the body via the skin, and then cause damage to cells[41].

Currently, there is only limited knowledge about the effects of absorbing nanoparticles or nanotubes, for example by inhaling them, absorbing them through the skin or via the food chain, and about how they affect plants and animals. For this reason a recent report by the Royal Society and the Royal Academy of Engineering Report calls for research into potential

[41] For example, Nanotubes are structurally similar to asbestos fibres, which can cause respiratory problems when inhaled in large amounts over long periods.

hazards to keep pace with new developments and provision of funds for a research to address safety concerns (Royal Society 2004).

Materials Science

Extending the scope to the whole field of materials research (including metals, ceramics, polymers, composites, etc.), a high level group, initiated by the Max-Planck-Society, laid out the following strategic directions for the future development of materials research in a 'European White Book on Fundamental Research in Materials Science' (MPG 2001):

- Materials science is of essential importance for the prosperity of European and global economies.
- There is a high need for a better theoretical understanding of materials and their behaviour, and the fundamental research needed to obtain this.
- Research must account for the highly interdisciplinary nature of materials science.
- Continued, long-term investment, particularly basic research, must be ensured by national governments, industry, and the European Commission.
- Excitement and personal rewards that a career in this field can bring must be emphasised to ensure that the best researchers are attracted.

According to this White Paper, priority research areas for European materials research should include materials discovery and design, interdisciplinary research strategies and special materials with high innovation potential. For this purpose, the availability and efficient use of European large-scale facilities and of modern techniques in materials analysis, networks and Centres of Excellence in key research areas, materials classes and application areas should be supported appropriately.

Complementing this basic research oriented approach, stakeholders in the innovation chain (e.g. the Materials Technology Section of the European Technology Platform ´Sustainable Chemistry´) are currently working on concrete roadmaps and development strategies for key technologies, application and product areas. Significant support is also necessary for this transformation of scientific progress into competitive advantage and economic growth in the materials industry as well as in various sectors using innovative materials.

New production technologies

A sustainable EU economy depends on a competitive European manufacturing sector. For the success of this sector continuous innovation in products and processes is indispensable. It is argued that an economy based on service industries alone will not survive in the longer term - industrial transformation is a must. Therefore the MANUFUTURE initiative, initiated by the Commission, recommends that in addition to increased commitment from the private sector, it is essential to combine European Commission efforts with those of Member States and accession countries to develop a common vision – starting at the industrial level but going much further in addressing technical, environmental and social issues (Manufuture 2004).

Particular recommendations include the following:

- In order to meet the competitive, environmental and social challenges, a European manufacturing strategy should drive industrial transformation from a resource intensive to a knowledge intensive, innovative sector capable of achieving and maintaining technological and production leadership in the global market place.
- Such a concerted effort to create a European manufacturing strategy must be based on research and innovation to promote industrial transformation, secure and create high added value employment and ensure the maximum possible share of world manufacturing output.
- The necessary competitive R & D system, facilitated by favourable framework conditions, must foster knowledge generation, innovation and the adaptation of education and train-

ing schemes, create easily accessible research, technological development and innovation (RTDI) infrastructures and find solutions for the burning technological questions in this area.

To identify priorities and possible approaches the Commission has promoted a three-month public consultation from December 2003 to February 2004[42].

Observations and recommendations

1. Nanotechnology and materials

- As one of the most important cross cutting technology areas with a high potential impact on many industrial and technology sectors, nanotechnology and materials should receive a high priority in FP 7. This initiative should balance nanotechnology and 'conventional' new materials research and ensure integration in the global nanotechnology/materials research community[43].
- This requires an integrated research strategy, involving all stakeholders from public research and from the private sector, with two major elements
  - Strengthening the European research base for the further development of knowledge and the exploration of new effects, principles, materials, etc. in the field of nanotechnology and new materials. Approaches to achieve this include European research networks, International collaboration, European infrastructure (e.g. large scale research facilities) and mobilization of the best researchers.
  - Acceleration of the transformation of knowledge and results generated in research into successful technologies and products, especially in sectors with a high need for nanotechnology and materials innovation, e.g. through support for relevant European Technology Initiatives and for the diffusion of nanotechnology/materials innovation into research in other application areas.

  A sound balance between a materials orientation (focussing on scientific breakthroughs in materials/nano research) and an application orientation (translating the potential of nanosciences and materials into added value for sectors applying new materials, etc.) should be sought.
- Integrated approaches to research in this area are essential …
  - along the innovation chain: Typically materials are developed on the basis of new knowledge coming from publicly funded research by the materials/chemical industry, technology oriented start-ups, etc. In the conversion of such materials to innovative products often SME's take an important role. Therefore it is essential to support not only research and development of such new materials but also at the same time the materials competency of companies using them to develop innovative new products.
  - with other scientific disciplines: (MPG 2001) identifies for example bio-, biomimetic and self-assembly materials, computer modelling (especially multi-scale modelling) and surface/interface science as some of the most promising areas for interdisciplinary research in materials science.
- These scientifically and technologically oriented research strategies should be complemented by two additional elements:

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42 Results were not available at the time of preparation of this report.

43 For example with the US National nanotechnology Initiative (NNI), which 'provides a multi-agency framework to ensure US leadership in nanotechnology that will be essential to improved human health, economic well being and national security. The NNI invests in fundamental research to further understanding of nanoscale phenomena and facilitates technology transfer.' (Source: http://www.nano.gov/

- In view of the concerns raised about possible health and environmental considerations of nanomaterials, these should be addressed by appropriate research activities.
- In view of the high complexity and unpredictability of technologies, global competition markets technology foresight and other appropriate instruments to asses the social and economic impacts of nanotechnology should be used[44].

2. New production technologies[45]

- Especially in the light of growing competition from low cost countries the EC should take the initiative to develop a leading role in driving the necessary industrial transformation through innovation to avoid further loss of economic growth and employment potential. MANUFUTURE states (Manufuture 2004):

  > *The traditional structure of manufacturing industries is constructed upon the three pillars of land, labour and capital. The challenge is to move towards a new structure, which can be described as 'innovating production', founded on knowledge and capital. The transition will depend on adoption of new attitudes towards the continued acquisition, deployment, protection and funding of new knowledge.*

- As a contribution to this strategy, FP 7 should provide the necessary support for research in this area, based on the recommendations of Manufuture and of the stakeholder consultation, which are expected soon.

5.3 Energy

Proposal by the Commission

Non nuclear research

To meet the challenges of alarming trends in global energy demand (predicted to rise by 60% in the next 30 years), emissions of greenhouse gases with devastating consequences of climate change and the damaging volatility of oil prices, the Commission aims at transforming the current fossil-fuel based energy system into a more sustainable one based on a diverse portfolio of energy sources and carriers combined with enhanced energy efficiency, to address the pressing challenges of security of supply and climate change, whilst disrupting the competitiveness of Europe's energy industries.

For this purpose Europe's leading position in a number of energy technologies, in particular in the modern renewable energy technologies shall be further developed. As radical transformation of the energy system requires new technologies with very high risks, public investment shall stimulate necessary research, development, demonstration and deployment.

A specific activity on knowledge for energy policy making is included which may also provide support to new policy needs that emerge, for example relating to the role of European energy policy in the developments of international climate change actions, and instabilities or disruptions in energy supply and price.

The activities to meet the objective are set out below:

- Hydrogen and fuel cells: Integrated action to provide a strong technological foundation for competitive EU fuel cell and hydrogen industries, for stationary, portable and transport applications. The Hydrogen and Fuel Cells European Technology Platform helps this activity by proposing an integrated research and deployment strategy.

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[44] In this context the future development of nanotechnology based technologies, products and markets should also be observed carefully to make sure that the current enthusiasm for this emerging technology field leads to tangible contributions to the fulfilment of the Lisbon objectives (Avoiding the experience with High Temperature Superconductivity, which has not yet generated significant commercial impact after almost two decades of research)

[45] As outlined in Chapter 3.1 it is proposed to make manufacturing technologies an own priority under FP 7. However as currently it is part of priority 3 of FP 6 it is treated here in chapter 3.2.2 together with naonosciences/nanotechnologies/materials

- Renewable electricity generation: Technologies to increase overall conversion efficiency, driving down the cost of electricity production from indigenous renewable energy sources, and the development and the demonstration of technologies suited to different regional conditions.
- Renewable fuel production: Integrated conversion technologies: to develop and drive down the unit cost of solid, liquid and gaseous (including hydrogen) fuels produced from renewable energy sources, aiming at the cost-effective production and use of carbon-neutral fuels, in particular liquid biofuels for transport.
- Renewables for heating and cooling: Technologies to increase efficiencies and drive down the costs of heating and cooling from renewable energy sources, ensuring their use in different regional conditions.
- CO_2 capture and storage technologies for zero emission power generation: To drastically reduce the environmental impact of fossil fuel use aiming at highly efficient power generation plants with near zero emissions, based on CO_2 capture and storage technologies.
- Clean coal technologies: To substantially improve plant efficiency, reliability and cost through development and demonstration of clean coal conversion technologies.
- Smart energy networks: To increase the efficiency, safety and reliability of the European electricity and gas systems and networks e.g. by transforming the current electricity grids into an interactive (customers/operators) service network and to remove obstacles to the large-scale deployment and effective integration of distributed and renewable energy sources.
- Energy efficiency and savings: New concepts and technologies to improve energy efficiency and savings for buildings, services and industry. This includes the integration of strategies and technologies for energy efficiency, the use of new and renewable energy technologies and energy demand management.
- Knowledge for energy policy making: Development of tools, methods and models to assess the main economic and social issues related to energy technologies and to provide quantifiable targets and scenarios for medium and long term horizons.

Nuclear research

The proposed Euratom FP 7 is organised in two parts corresponding to the 'indirect' actions on fusion energy research and nuclear fission and radiation protection, and the 'direct' research activities of the Joint Research Centre.

- The objective of ***Fusion Energy Research*** is to develop the knowledge base for, and realising ITER as the major step towards, the creation of prototype reactors for power stations which are safe, sustainable, environmentally responsible, and economically viable. According to the Commission Fusion has the potential to make a major contribution to overcome the serious shortcomings in Europe's energy supply in a few decades from now.

  Therefore the Commission's strategy entails, as its first priority, the construction of ITER (a major experimental facility which will demonstrate the scientific and technical feasibility of fusion power), followed by the construction of DEMO, a "demonstration" fusion power station. This will be accompanied by a programme of supporting R&D for ITER and for the developments in fusion materials, technologies and physics required for DEMO.

  For this purpose the following actions are proposed:

  - The realisation of ITER as an international research infrastructure: in particular site preparation, establishing the ITER Organisation and the European Joint Undertaking for ITER, management and staffing, general technical and administrative support, construction of equipment and installations, support to the project during construction.
  - R&D in preparation of ITER operation: Physics and technology programme, exploiting the facilities and resources in the fusion programme (including JET) to assess specific

key ITER technologies, consolidate ITER project choices, and prepare for ITER operation through experimental and theoretical activities.

- Technology activities in preparation of DEMO, entailing the development of fusion materials and key technologies for fusion, and the establishment of a dedicated project team to prepare for the construction of the International Fusion Materials Irradiation Facility (IFMIF) to qualify materials for DEMO.
- R&D activities for the longer term include further development of improved concepts for magnetic confinement schemes, theory and modelling aimed at a comprehensive understanding of the behaviour of fusion plasmas and coordination of Member States' civil research activities on inertial confinement.
- Human resources, education and training shall ensure that adequate human resources will be available in view of the immediate and medium term needs of ITER, and for the further development of fusion.
- Infrastructures will contribute to the construction of ITER as an element of the new research infrastructures with a strong European dimension.

- ***Nuclear fission and radiation protection research*** aims at establishing a sound scientific and technical basis in order to accelerate practical developments for the safer management of long-lived radioactive waste, promoting safer, more resource-efficient and competitive exploitation of nuclear energy and ensuring a robust and socially acceptable system of protection of man and the environment against the effects of ionising radiation. As nuclear power generates one third of all electricity consumed in the EU and the European nuclear sector is typified by cutting-edge technology and provides highly skilled employment, the Commission proposes to further invest in research for advanced nuclear technology.

  Other aspects are existing concerns affecting the continued use of this energy source, especially concerning reactor safety and management of long-lived waste and protection of man and environment in all uses of radiation. Research will also be needed to explore new scientific and technological opportunities and to respond in a flexible way to new policy needs that arise during the course of the Framework Programme.

  For this purpose the following activities are proposed:

  - Management of radioactive waste: Research and development activities on deep geological disposal of long-lived radioactive waste and, as appropriate, demonstration on the technologies and safety; research on partitioning and transmutation and/or other concepts aimed at reducing the amount and/or hazard of the waste for disposal;
  - Reactor systems: Research to underpin the continued safe operation of existing reactor systems (including fuel cycle facilities); development of new advanced safety assessment methodologies;
  - Radiation protection: Research, in particular on the risks from low doses, on medical uses and on the management of accidents; research to minimise the threat posed by nuclear and radiological terrorism and mitigate its impact;
  - Infrastructures to ensure the availability of research infrastructures such as material test reactors, underground research laboratories and radiobiology facilities;
  - Human resources and training to support the retention and further development of scientific competence and human capacity to guarantee the availability of suitably qualified researchers and employees in the nuclear sector over the longer term.

- ***Nuclear activities of the Joint Research Centre*** shall provide customer driven scientific and technical support to the EU policy making process in the nuclear field, ensuring support to the implementation and monitoring of existing policies while flexibly responding to new policy demands.

Status and options

Two recent reports from the Commission's Advisory Group on Energy provide the Commission's vision of future energy research in the ERA. The first of these reports, focussing on Key Tasks for future European Energy R&D (AGE 2005a), makes strategic recommendations for future research in energy technologies:

- The initially higher level of Commission-funded energy R&D expenditure, which has decreased dramatically over time[46] (in real terms by almost a factor of four over the past 25 years) must be restored to meet the crucial energy challenges we face, with potentially dire consequences if failure.
- Although other instruments (such as taxes, subsidies or regulations) may be helpful, the only route to a sustainable energy system is through new or improved energy technologies that will have to be found through research and development and through accelerating market diffusion of recently developed energy technologies.
- To address the energy-related challenges appropriately, it is necessary to develop a portfolio of energy technologies and options. There is no certain solution: No single technology that can provide 'the' answer, nor is energy conservation (although very commendable and to be strongly encouraged) sufficient on its own. Therefore targeted research should be performed in a range of energy technology areas, but on well-selected topics, tackling key tasks where a technical breakthrough would dramatically improve our chances of making our energy system sustainable.
- The possible roles of eight energy technology areas have been assessed and the type of research needed in each area has been identified (Biomass, Coal, Fuel Cells, Hydrogen, Fission, Fusion, PV and Wind)

The second AGE report focuses on ways towards the European Energy Research Area (AGE 2005b):

- Making full use of ERA related instruments to help energy RTD in Europe to adopt ambitious long-term goals for technology deployment is of high importance and relevance.
- This requires greater coordination and increased pooling of regional, national and European funding, including appropriate use of article 171, of coordinated networks (ERA-NETS) in energy, of joint technology initiatives and of EU structural funds.
- A set of 10 practical recommendations to make ERA a reality in energy research is described.

FP 6 contains two major elements in the field of energy research: From a total RTD budget of 17.500 Mio Euro for Priority 6 in the current Sixth Framework Programme, 810 Mio Euro have been allocated to Sustainable Energy Systems: 405 Mio Euro for medium and long-term research and 405 Mio Euro for medium and short-term demonstration (EC 2004k). Nuclear research is funded under the Euratom FP 6 with a total of 1230 Mio Euro (Fusion energy research: 750 Mio Euro, management of radioactive waste: 90 Mio Euro, radiation protection: 50 Mio Euro, other activities in the fields of nuclear technologies and safety: 50 Mio Euro, activities of the Joint Research Centre (Direct actions): 290 Mio Euro).

In view of FP 7 the current state of discussion is as follows:

- **Renewable energy / sustainable energy systems**

  According to the Communication from the Commission "The share of renewable energy in the EU" (EC 2004k), OECD data indicate that only 10% of government energy R&D budgets are related to renewable energy, in contrast with more than 50% for conventional (fossil fuel and nuclear) energy technologies. It further states

[46] Parallel declines have occurred in funding by EU Member States and by private industry, the latter accelerated during the last decade in the energy utilities by the liberalisation of the energy market.

"... in order to support the longer term expectations regarding the penetration of renewables, it is therefore necessary to strengthen support and accelerate the pace of public support for research, technological development and demonstration in renewables in Europe."

The Environmental Technologies Action Plan for the European Union (EC 2004l) underlines the importance of developing and making better use of environmental technologies to meet the Lisbon objective and modernise our economy by contributing to technological innovation, increasing European competitiveness, unlocking potential markets and thus creating new, skilled jobs.

Under FP 6 EU-sponsored renewable energy research focuses on bringing the next generation of more cost-effective renewable energy technologies to market, for example in the following areas:

- *Biomass:* Focus on the production of electricity from energy crops, waste derived fuels, optimization of the fuel supply chain and innovative technologies for power generation
- *Wind:* Focus on the development of innovative turbines, components, modelling of turbines and sites, research into new materials, aerodynamics, etc.
- *Photovoltaics: Focus on* innovative production concepts for high efficiency PV cells and modules, system integration, transfer of new generation PV technologies to industrial scale production and deployment and longer-term research into next generation technologies.
- *Electric Power Production from Other Renewable Sources.* Te EU supports for example solar thermal generation of electricity, geothermal energy technology, small scale hydropower and ocean energy technology research.

On this basis a research strategy and priorities for renewable energy have been proposed in March 2005 by the European Renewable Energy Centres Agency (EUREC 2005):

- Renewable energies create an attractive commercial market with the potential to generate significant new employment and to make major contributions to reduced emission and dependency on the import of fossil fuels. Further growth requires significant development efforts to make the technologies of the renewable energy sector still more cost efficient and competitive.
- Investments in research and innovation are crucial for keeping pace with the highly dynamic development of technologies, markets and stiff global competition to maintain competitiveness of European renewable energy research and industry.
- Technology-focused small- and medium-sized companies with an ability to assimilate and to commercialise new scientific knowledge are the driving force behind the renewable energy industry's double digit growth rates.
- The different sectors of renewable energy (in particular bio energy, geothermal energy, hydro energies, solar energies, wind energy and distributed generation) require dedicated research strategies for their specific needs.
- From this, EUREC derives the following recommendations:
  - Within FP 7 an average annual research budget of 250 Mio Euro should be allocated exclusively for renewable energy technologies.
  - To increase the take-up of research results by industry better tools and mechanisms should be employed.
  - In particular greater SME participation should be encouraged through appropriate instruments and changes in the implementation of the Framework Programme.

- **Nuclear fusion**

  Under the EURATOM Sixth Framework Programme, there are three major research activities:

  - *Fusion Physics and Technology* encompasses R&D in plasma engineering and fusion materials. In addition, the programme sponsors research needed for the decommissioning of the European Union's Joint European Torus (JET) experimental fusion reactor in Oxford, UK, Economic and policy research, and studies of the social acceptability of fusion energy, are also funded by the fusion physics programme.
  - *Operation and Use of the JET Facilities* to enable study of the conditions and dimensions needed in a power plant. It will be succeeded by the internationally-funded machine ITER, followed by a demonstration fusion power plant.
  - *Design of the International Thermonuclear Experimental Reactor* (ITER) to demonstrate the ability to control and maintain burning plasmas for extended periods of time. ITER would also provide experience in the integrated operation of all the components of this complex technology.

  According to the Commission's Advisory Group on Energy (AGE 2005a), ITER should be built as soon as possible, preferably in Europe as an international collaboration to share the costs, but with the EU playing an active leading role. However, success with ITER will still leave major technological and engineering hurdles along the path to a demonstration reactor and a full-scale, fusion power plant which need to be tackled in parallel. But although there are now clear road maps for future development, we are still several decades from a full-scale fusion power station.

- **Nuclear fission**

  Today nuclear fission is a major energy source in the EU. A goal of current EU-sponsored fission research under Euratom FP 6 is the full exploitation of the potential of the existing nuclear power base to achieve the policy goals of energy security, and climate change mitigation. Other key objectives include the solution of the issue of nuclear waste disposal and enhancing nuclear safety and radiation protection at existing plants across Europe.

  But these research objectives and policies must also be seen in the light of existing concerns against nuclear fission and the resulting low confidence in nuclear power and will to invest in building new capacities in many Western countries. Fission energy is seen as too unsafe to use, as creating waste for which no assured disposal method is available, and as encouraging the proliferation of nuclear weapons and nuclear terrorism[47].

  Fission energy research programmes sponsored currently by the EU focus on the following topics:

  - *Management of Radioactive Waste* with four main areas: Geological disposal, partitioning and transmutation, reducing waste production and cross-cutting research for radioactive waste management.
  - *Innovative, safer and more efficient power plants* evaluates the potential of new and innovative concepts for nuclear power production.
  - *Safety of Existing Nuclear Installations* strives to continually improve European nuclear safety standards and performance, and to develop a common scientific foundation for EU-wide safety standards.

[47] This section is written under a purely research oriented viewpoint. The scope of this study does not permit a general discussion of the concerns against nuclear power and of individual national policies to develop new nuclear power or to withdraw from it, etc. But it is obvious that the decision, whether to invest in the proposed fusion and fission energy research depends on such energy, safety and other policy considerations.

- *Plant Life Management* develops risk assessment methodologies and analyzes high fuel burn-up.
- *Severe Accident Phenomenology and Management* supports the development of advanced, common numerical simulation tools for major nuclear accidents.
- *Decommissioning Research* focuses on the coordination of scientific and technological activities across Europe, on the improvement and maintenance of the existing decommissioning databank, and on the organization of training activities.
- *Radiation Protection*. The primary focus of the EU's radiation research program is risk reduction associated with exposure to low and protracted doses of radiation as experienced by workers in the nuclear power industry. Research includes epidemiological studies of exposed populations and cellular and molecular biology research on the interactions of radiation with DNA, cells, organs, and the body as a whole.

The Advisory Group on Energy (AGE 2005a) recommends that

> *"… EU-wide involvement in fission energy development is essential, primarily to ensure that Member States evolve a common understanding on the safety requirements to be set for new plant designs and on waste disposal. Only then will the nuclear plant construction industry, currently trying to survive with almost no new orders, be able to justify the costs of developing and selling the new designs. However, in achieving commonality it will be important to ensure that the common standards finally agreed are based on good science. SWOG therefore believes that fission research needs EU-wide funding and coordinated attention, with resources focused on improving the technology for the future, not simply on ensuring the safety of existing plant…"*

The European Commission has initiated four fission working groups to consult member countries on the scope and instruments for the FP 7 Euratom Programme in the areas of existing and future reactors, management of radioactive waste, horizontal aspects of the implementation of FP 7 and Radiation Protection (Source: Euratom 2004).

- **Other non nuclear energy research**

Several other energy research areas not mentioned so far are also funded by FP 6. These include the following:

- EU-funded research in the area of *fuel cell systems* under FP 6 is aimed at reducing the cost and improving the performance, durability and safety of fuel cell systems for stationary and transport applications, to enable them to compete with conventional combustion technologies. This will include materials and process development, optimisation and simplification of fuel cell components and sub-systems as well as modelling, testing and characterisation. The long-term goal is to achieve commercial viability for many applications by 2020.
- Under FP 6 several strategic areas of research are currently being pursued for *hydrogen*[48]: Clean production (development and techno-socioeconomic assessment of cost-effective pathways for hydrogen production from existing and novel processes), storage (exploration of innovative methods, including hybrid storage systems, which could lead to breakthrough solutions), basic materials (functional materials for electrolysers and fuel processors, novel materials for hydrogen storage and hydrogen separation and purification), safety (pre-normative RTD required for the preparation of regulations and safety standards at EU and global level), and preparing the transition to a hydrogen energy economy (supporting the consolidation of current EU efforts on hydrogen pathway analysis and road mapping).
- *Energy Conservation and Efficiency* research in the 6th Framework Programme supports several EU energy policy goals including the reduction of energy intensity, achievement of a community-wide target for electricity production from cogeneration,

[48] Source of this and the following paragraph: (EC 2004m)

doubling the share of renewables in the fuel mix by 2010; and enhancing Europe's overall energy security through demand management. This is pursued through research in areas like eco-buildings, polygeneration (combined production of electricity, heat, cooling and other products (e.g., hydrogen, chemicals).

Observations and recommendations

1. Importance of energy research

High priority should be allocated to research leading to technologies with the potential to to meet the challenges of alarming trends in global energy demand, of emissions with devastating consequences for climate change and of the damaging volatility of oil prices, the necessary transformation of the current fossil-fuel based energy system into a more sustainable one. For this purpose, research on a diverse portfolio of energy sources and carriers combined with enhanced energy efficiency, should be supported by FP 7 appropriately.

At the same time progress in energy related research should be able to contribute to the achievement of the Lisbon targets through contributions to innovation, economic growth and job creation in a foreseeable time. For this purpose an appropriate budget should be allocated to energy research in FP 7.

2. Choices to make

Current FP 6 funding for nuclear research exceeds funding for renewable energy research considerably. For FP 7, both renewable energy and the nuclear energy research ask for budgets in the Billion Euro range. Even in the light of the proposed overall FP 7 budget increase, it is not yet clear if both initiatives can and should be supported in this order. Criteria to be observed in this decision include:

- Potential and time horizon of proposed initiatives
  - Many of the technologies in the *renewable energies* and *sustainable energy systems* sector are at the border of large scale commercialization with rapidly growing markets and global competition and reduced dependency on subsidies. New industries with significant economic and employment potential are evolving and the race for global technology and market leadership has begun. At the same time the resulting critical mass of innovation potential will also accelerate the availability of competitive new technologies for reducing greenhouse emissions, dependency on fossil fuels and the use of natural resources.
  - *Nuclear fusion* is a much longer term option which still needs to demonstrate its technical and economic feasibility through further large scale research for several decades. But even if all these uncertainties were resolved, expectations are that it will not be available as a reliable energy supply in the next decades, presumably not before the second half of the century. Therefore it will not have a short to medium term impact on energy supply, economic growth and fulfilment of ecological/emission targets.
  - As the current generation of nuclear power plants will reach the end of its lifetime, the Commission proposes in the field of *nuclear fission* (1) research into new, safer nuclear fission concepts for a next generation of power plants and (2) continued research to find solutions for current issues like final disposal of radioactive waste, etc.
- Research strategies
  - European leadership in *renewable energies* and *sustainable energy systems* requires investment (1) in research on fundamental elements to enhance understanding of and progress in the foundations of state-of-the-art technologies, (2) in accelerated technology and process development (including for example necessary knowledge for the development of competitive manufacturing processes) and

(3) the creation of critical masses on a European scale in key research areas. Further research needs and priorities are manifold, depending on the type of technology. But their individual resource needs are mostly in a sizeable range and have the potential to create benefits for European societies already in the next years.

- *Nuclear fusion development* will continue to require a highly concentrated, long term, multi Billion Euro "heavy weight" research program, working towards an expected technological breakthrough in an international cooperation. To get leverage from this investment, the commitment of a significant budget over an extended period and the readiness to accept the related technological and economic risks will be required, far beyond the currently planned FP 7 research investment.
- Research in *nuclear fission* has two different aspects:
  - Current issues concerning existing nuclear power plants, etc. require short term solutions for final disposal of radioactive waste, nuclear safety, etc. The decommissioning of nuclear power plants after having reached the end of their lifetime is becoming an issue of growing importance. Experience so far shows that there is a high need to invest further in the development of technologies for certain tasks in this area and for an efficient diffusion of know how generated.
  - Research investment in the future ability of European industry to build new generations of nuclear power plants is only useful if the EC's and the member states' energy and environmental policies support the construction and use of new nuclear power plants[49].

3. Integration of energy research on a European level

The success of energy research and of harvesting its results in the sense of the Lisbon objectives depends to a large extent on the capability to bundle the skills and resources of all stakeholders on a European level. Therefore research strategies under FP 7 should work consequently towards the creation of an Energy ERA. This includes for example

- support for existing or emerging European initiatives bringing the stakeholders together (e.g. the Technology Platforms Hydrogen and Fuel Cells, Photovoltaics);
- support for strengthening integrated, seamless innovation chains from research to successful market implementation (including the prerequisites necessary for successful energy technology research, e.g. new materials, manufacturing skills and systems integration);
- support for the integration of SME's in this initiative through appropriate measures: due to their limited resource base for research and time horizon SME's are much more dependent on an efficient diffusion of state of the art technologies;
- support for complementary interdisciplinary approaches, integrating for example economic, ecological and social science skills, to create a better understanding of the underlying economical, political and social framework as a basis for successful implementation of new energy technologies.

4. Dedicated renewable energy/sustainable energy systems research

In view of the economic, employment and ecological potential of advanced energy technologies in this sector, the European position in this dynamic technological and market environment should be further strengthened. European leadership in this area needs a dedicated research effort.

For this purpose research efforts at European level should be increased to create a critical mass of research capability and initiatives in key areas. Such key areas should be

[49] Decisions in this area involve a complex set of aspects of energy policy, nuclear safety, etc., going beyond the research policy scope of this study.

chosen as a function of their technological, economical and ecological potential in all relevant steps, including generation, transformation, storage, consumption, etc.

To realise this, a dedicated own programme element with a significant budget, addressing the specific research needs of the renewables/sustainable energy sector and integrating all necessary skills where necessary (ranging from materials, e.g. for photovoltaics via manufacturing technologies to systems integration and supporting socio-economic research) should be established under FP 7. Such an advanced energy research programme should cover the whole value added chain of the energy sector, from generation through energy storage technologies and efficient distribution concepts to further improvement on the side of energy consumption.

5.4 Proposed new research areas

5.4.1 Space

Proposal by the Commission

The proposed Space Programme aims at the exploitation of space assets for the implementation of applications, namely GMES (Global Monitoring for Environment and Security) and their contribution to law enforcement in EU policies; as well as space exploration, allowing international cooperation opportunities and technological breakthroughs and at the exploitation and exploration of space supported through enabling activities guaranteeing the strategic role of the European Union.

For this purpose the Commission proposes to support a European Space Programme focusing on applications such as GMES with benefits for citizens and for the competitiveness of the European space industry. This shall contribute to the development of a European Space Policy, complementing efforts by Member States and by other key players, including the European Space Agency. The following activities are proposed:

- Space-based applications at the service of the European Society (GMES: development of satellite-based monitoring systems and techniques relating to the management of the environment and security and their integration with ground-based components; innovative satellite communication services, technologies for reducing the vulnerability of space-based services);
- Exploration of space (Contribution to international space exploration initiatives);
- RTD for strengthening space foundations (Space transportation technology: research to increase the competitiveness of the European space transportation sector; Space sciences including life in space).

Status and options

In its policy paper "Space: A New European Frontier for an Expanding Union" (EC 2003b) the Commission suggests that Europe needs a space policy, driven by demand, in support of the Union's policies and objectives. For this purpose the Commission calls for substantial additional spending on space and recommends action to ensure Europe's independent access to space, to enhance space technology, promote space exploration, attract more young people into careers in science and strengthen European excellence in space science.

According to the Commission, space technologies and applications can bring essential support to the Union's policies and objectives. Therefore the Commission recommends:

- to put additional efforts into a variety of space infrastructures and applications, which will make a crucial contribution towards satisfying the needs of the citizens and in response to the Union's political objectives;
- to consolidate the existing scientific and technical basis of space activities;

- to update the institutional structure to give the Union new responsibilities for driving, funding and co-ordinating activities within an enlarged Space Policy.

The Commission argues that Europe faces important risks if it does not adopt a new approach to space policy: A decline as a space power, space companies suffering from weak commercial markets, and a permanent loss of critical knowledge and skills for Europe.

The Commission proposes three main budget scenarios to support the Action Plan. A first option would be to support the needs identified during the consultation on the European Commission's space policy and would involve an annual expenditure growth rate of 4.6%, with respect to the overall public level of funding in 2003 (€5,380 billion). The second scenario presents an annual growth rate of 3.4%, a higher rate than the global growth rate of the EU economy. The third is more modest and is based on the current level of EU expenditures with a growth rate of 2.3%, which, it is argued, would not be sufficient to guarantee EU independence with respect to technology and access to space.

In order to coordinate and facilitate cooperative activities between the European Community and ESA a Framework Agreement was adopted in 2003 and entered into force in May 2004 with two aims:

- Coherent and progressive development of an overall European Space Policy, which links demand for services and applications using space systems in support of EU policies with the supply through ESA of space systems and infrastructures necessary to meet that demand.
- Establishment of a common basis and appropriate practical arrangements for efficient and mutually beneficial cooperation between ESA and the European Community, fully respecting the institutional and operational frameworks of each institution, to facilitate the setting up of joint initiatives and to provide a stable framework for EC-ESA cooperation.

Over the last three years, the EU and ESA have worked together to outline a European Space Policy that identifies and prioritises objectives for space. The European Space Programme – expected to be endorsed by a Space Council session at the end of 2005 – will constitute a common platform including all activities and measures to be undertaken by the EC, ESA and other stakeholders in order to achieve the objectives set by the European Space Policy.

Under FP 6 space research is part of the Aeronautics & Space Programme which has two major components:

- *Aeronautics* supports research to meet society's needs for a more efficient, safer and environmentally friendly air transport and to win European leadership in the aeronautics sector with a competitive supply chain including SMEs.
- *Space* supports the European Strategy foe Space with appropriate application oriented research particularly in the areas of satellite navigation and position fixing, Global Monitoring for Environment & Security (GMES) and satellite telecommunications.

The FP 6 space research programme is built on 3 pillars: Galileo, Satellite Communications and Global Monitoring for the Environment and Security (GMES). The last was intended to be the central pillar but in terms of funding, but Galileo is likely to have received more funding by the end of the second call.

Future space research funding by the European Commission, including funding under FP 7 will depend on the European Space Programme. The possible contents of this programme are still under development, but might include (Source: EC 2004n):

- *Space-based applications at the service of the European Society*
  Communications, global Monitoring for Environment and Security, positioning navigation and timing, Security

- *Strengthening Space foundations*
  Technology in support of pre-defined applications, technology transfer, guaranteed & independent access to space infrastructure, support & specific R&D for future launchers
- *Enhancing scientific knowledge*
  Space exploration, Microgravity, future missions, space science, basic research & access to research infrastructures, archiving and distribution of data
- *Strengthening implementation of the European Space Policy*
  International cooperation, Vocations and outreach, Legal environment

Observations and recommendations

1. Positioning of Space Research, research priorities and funding under FP 7

The European Space Policy and the framework agreement with ESA create an important binding commitment of the EC to Space research. Therefore space applications research should continue to be funded under the Framework Programme, but could be funded via the respective application areas where appropriate[50].

Little has been published so far about the detailed structure of future space research under FP 7. A comprehensive European Space Policy will only be endorsed in the course of 2005. Therefore it is not possible to make specific recommendations here. Discussion should be taken up again after publication of more tangible proposals for Space research.

5.4.2 Security

Proposal by the Commission

According to the Commission security related research is an important building block in supporting the Common Foreign and Security Policy, for realising a high level of security within the EU and in support of other EU policies in areas such as transport, civil protection, energy and environment. Existing security related research activities in Europe suffer from the fragmentation of efforts, a lack of critical mass of scale and scope and the lack of connections and interoperability.

Therefore the proposed FP 7 programme element 'Security' aims at improving the coherence of Europe's efforts by developing efficient institutional arrangements and by instigating the various national and international actors to co-operate and co-ordinate in order to avoid duplication and to explore synergies wherever possible. According to the Commission's proposal, security research at Community level shall focus on activities of clear added value to the national level, to (1) develop the technologies and knowledge for building capabilities needed to ensure the security of citizens from threats such as terrorism, and crime, while respecting fundamental human rights; (2) to ensure optimal and concerted use of available technologies to the benefit of European security, and (3) to stimulate the cooperation of providers and users for security solutions. The following activities are proposed:

- Protection against terrorism and crime, delivering technology solutions for threat awareness, detection, prevention, identification, protection, neutralisation and containment of effects of terrorist attacks and crime;
- security of infrastructures and utilities, analysing and securing existing and future public and private critical/networked infrastructure, systems and services;
- border security, focusing on technologies and capabilities to enhance the effectiveness and efficiency of all systems, equipment, tools and processes required for improving the

[50] The development of launchers and the implementation of space projects should continue to be funded by ESA.

security of Europe's land and coastal borders, including border control and surveillance issues;

- restoring security in case of crisis: focusing on technologies in support of diverse emergency management operations (such as civil protection, humanitarian and rescue tasks, support to CFSP), and on issues such as inter-organisational coordination and communication, distributed architectures and human factors.

The above four areas shall be supported by the following themes of a more cross-cutting nature:

- Security Systems Integration and interoperability, focusing on technologies to enhance the interoperability of systems, equipment, services and processes, including law enforcement information infrastructures, as well as on the reliability, organisational aspects, protection of confidentiality and integrity of information and traceability of all transactions and processing.
- Security and society: mission orientated research focussing on socio-economic analyses, scenario building and activities related to crime, the citizen's perception of security, ethics, protection of privacy and societal foresight;
- Security Research Coordination and structuring and development of synergies between civil, security and defence research, improvement of legal conditions, and encouragement to the optimal use of existing infrastructures.

Status and options

In its Communication "Towards an EU Defence Equipment Policy" of March 2003 (EC 2003c), the Commission underlined the need for a competitive industrial base to support the European Security and Defence Policy (ESDP). According to the Commission, a coherent security research programme at the level of the European Union is essential to address the growing and diversifying security challenge of today's fluid security environment, where risks and vulnerabilities are more diverse and less visible.

To address the need for strengthened and better coordinated security research, the Commission has launched a *Preparatory Action* in the domain of security research (EC 2004o) and set up a high level *Group of Personalities* to advise on a long term strategy for security research in the European Union.

The *Preparatory Action* on 'Enhancement of the European industrial potential in the field of Security Research 2004-2006' focuses in particular on the development of a security research agenda to bridge the gap between civil research, as supported by EC Framework Programmes, and national and intergovernmental security research initiatives. With a budget of 15 Mio Euro for 2004, 15 Mio Euro for 2005, and 25 Mio Euro expected for 2006, the Preparatory Action is a first step in addressing the need for Community action and preparing the basis for a fully-fledged ESRP from 2007. Its first call for proposals was published in 2004, a second call for proposal was published on 5 February 2005 with the aim to develop, demonstrate and validate technology solutions for security problems[51].

[51] Results of first call: 170 responses, 12 proposal selected: Remote detection of hidden weapons and explosives, Integrating European chemical, biological, radiological and nuclear technological capabilities, Crisis management system, On-demand secure communication provision, Integration of earth & space observation to support security operations, Surveillance of crowded areas exposed to terrorists attacks, Protection of critical infrastructure, Early warning system, General roadmap for security research, Crisis management in the nuclear area, Strategic plan for security technology research, Provision of geospatial data for improving situation awareness (Source: http://europa.eu.int/comm/external_relations/news/ferrero/2005/memo05_38.htm);
Target areas of the second call: Situation awareness, protection of networked systems, protection against terrorism, crisis management and interoperability of control and communications systems. A last call will be issued in early 2006.

The report of the Group of Personalities identifies the role for European coordination and development of advanced technologies in monitoring and controlling perceived threats, preventing major incidents such as terrorist attack, and in crisis management and humanitarian operations. It indicates the strong potential leveraging effect of a European Security Research Programme (ESRP) and the contribution it could make to address the new security challenges of a changing world. The report's recommendations include (GOP 2004):

- Establishment of an ESRP, focussing in particular on internal security questions, from 2007 onwards, with funding of at least €1 Billion per year, additional to that ensured today by the Community Research Framework Programme, national or other intergovernmental sources;
- Creation of a "European Security Research Advisory Board" to define strategic lines of action, user involvement, mechanisms for implementation and a strategic research agenda for the ESRP;
- In view of the political developments and many current initiatives, the need for cooperation between European institutions as well as all other stakeholders involved.

In its Communication "Security Research-The Next Steps" of 7 September 2004 (EC 2004p), the Commission proposes its action plan towards an ESRP:

- Consulting and cooperating with stakeholders, especially via the "European Security Research Advisory Board" to be established in early 2005 and establishment of a working relationship with the new European Defence Agency (EDA).
- Developing the ESRP, to become part of the FP 7 programme, as indicated in the FP 7 orientation Communication
- Ensuring an effective institutional setting, taking into account CFSP and ESDP and other relevant Community policies (e.g. fighting against terrorism including bio-terrorism, cross border control, transport, environment,...), and developing cooperation and synergies with the European Defence Agency EDA.
- Establishing a governance structure responding to the specificity of security research work in terms of contract, participation rules and funding mechanisms.

The next steps towards the ESRP are the pursuit of the 3-year Preparatory Action, the establishment of the "European Security Research Advisory Board" (ESRAB) and the Proposal of a programme, by mid 2005, on the content, multi-annual financial plan and institutional framework for a specific ESRP to become an integral part of FP 7. Security research is included in the proposed Financial Perspectives of the Union for 2007-2013.

Observations and recommendations

1. Importance and Positioning of ESRP

In view of current threats and recent events, making the potential of modern technology available for European security needs is an attractive approach. But experience with typical recent threats and events shows also that efficient security strategies (e.g. for monitoring and early warning systems, crisis management, socio-economic approaches to prevent crisis, etc.) often require complex, integrated approaches, combining the potential of advanced technologies for example with socio-economic approaches, political sciences, etc. Therefore the programme should emphasise interdisciplinary approaches.

2. Further precision of the term "security research"

Current considerations are mostly based on a technological definition of term "security research", highlighting the importance of technology for security of persons, infrastructure, etc. against terrorism, etc. In a wider definition however security might also include for example efficient measures against pandemic diseases or natural disasters like the recent surge catastrophe in Asia, etc.

Therefore a clear definition of the term "security" and of its desired benefits for European society and economy should be developed as the basis for defining clear targets for research in this area.

3. Clear objectives

To exploit Europe's scientific, technological and industrial strength and to overcome the current absence of specific frameworks for security research at the EU level; the limited cooperation between Member States and the lack of coordination among national and European efforts, FP 7 should foster the development of state-of-the-art industries, a strong knowledge infrastructure, appropriate funding and an optimal use of resources.

But the definition of objectives for an ESRP depends on its priorities:

- A priority on using technology as a 'force enabler' for a secure Europe would emphasize Europe's security needs. In this case research programmes and the development of the research and industrial base will follow lines defined by European security needs.
- A priority on the Lisbon objectives would emphasize the competitiveness of the European security and defence industry and its potential to secure economic success and employment.

4. Compatibility with European values

Because of the close relationship between civilian and military technologies and the interaction with various policy areas, the necessary decision on the strategic direction described in the previous paragraph must also be based on the ethical standards, which the Commission has defined itself (EC 2004p):

> *"…Union values on individual rights, democratic values, ethics and liberties need to be respected. A balance must be struck between surveillance and control to minimise the potential impact of terrorist action, and respect for human rights, privacy, social and community cohesion and the successful integration of minority communities. Progress in technology should go hand in hand with policy making and a strong EU policy on technology development for security may benefit the quality of legislation and other policy initiatives…"*

An additional element of these considerations must be a clear position vis-à-vis the interface with military technologies and applications, "multiple use" technologies, etc.

5. Programme volume of ESRP

Based on the recommendations of the Group of Personalities the Commission proposes a minimum funding of 1 Billion Euro per year for the ESRP (additional to existing funding), with the possibility to progressively increase it further, if appropriate, to bring the combined EU (Community, national and intergovernmental) security research investment level close to that of the U.S[52]. Even if the split of the proposed FP 7 budget of 3987 Mio. Euro between Space and Security is not clear, apparently this level will not be reached in the period 2007-2013 by the average budget.

But more important: A concrete ESRP will only be presented later in 2005. Therefore it is impossible to evaluate this proposal at this point in time without knowing what value the Commission proposes to deliver through the ESRP. Therefore a realistic and rational evaluation of this point has to be postponed until this information is available.

[52] According to (EC 2004p) an ESRP should not replace or duplicate Member States efforts. Its aim should be to support and supplement them, and to give them new coherence.

5.5 Socio-economic Sciences and the Humanities

Proposal by the Commission

The Commission puts forward three arguments for developing and exploiting the European research base in socio-economic sciences and the humanities: First, the issues and challenges concerned are of high priority at the EU level and are addressed by EU policies. Second, comparative research across several or all EU countries offers a particularly effective tool as well as important learning opportunities across countries and regions. Third, EU-level research has particular advantages in being able to develop Europe-wide data collection and to employ the multiple perspectives needed to understand complex issues. Finally, the development of a genuinely European socio-economic knowledge base on these key challenges will make an essential contribution to promoting their shared understanding across the European Union and, most significantly, on the part of the European citizens.

It is proposed to focus on collaborative research for value added on a European level to account for the diversity of approaches within the EU in the economic, social, political and cultural domains. The objective is to generate an in-depth, shared understanding of complex and interrelated socioeconomic challenges Europe is confronted with, such as growth, employment and competitiveness, social cohesion and sustainability, quality of life and global interdependence, in particular with the view of providing an improved knowledge base for policies in the fields concerned. Results are expected to contribute significantly to improving the formulation, implementation, impacts and assessments of policy in a wide range of areas and in addressing emerging socio-economic challenge.

The activities to be supported are listed below:

- Growth, employment and competitiveness in a knowledge society to develop and integrate research on the issues affecting growth, employment and competitiveness;
- Combining economic, social and environmental objectives in a European perspective by addressing the two key and highly interrelated issues of continuing evolution of European socio-economic models and economic and social cohesion in an enlarged EU;
- Major trends in society and their implications, such as demographic change including ageing and migration; lifestyles, work, families, gender issues, health and quality of life criminality; the role of business in society, population diversity, etc;
- Europe in the world, understanding changing interactions and interdependencies between world regions and their implications for the regions concerned;
- The citizen in the European Union, addressing the issues of achieving a sense of democratic "ownership" and active participation by the peoples of Europe, effective and democratic governance and building a shared understanding and respect for Europe's diversities and commonalities;
- Socio-economic and scientific indicators, for use in policy and its implementation and monitoring;
- Foresight activities on major science, technology and related socio-economic issues.

Status and options

Under FP 6 research in social sciences and humanities (SSH) is funded in Priority 7 "Citizens and governance in the knowledge based society"[53] with a Budget: 225 Mio. Euro (< 2% of overall FP 6 funding). The objectives are to

[53] The first socio-economic research programme - TSER – was created under FP4 in 1994. This was continued FP5 with the key action "Improving the socio-economic knowledge base, which financing of 345 projects, corresponding to >260 Mio Euro of funding.

- mobilise European research capacities in the economic, political, social and human sciences for an improved understanding of the emergence of the knowledge-based society.
- draw on a wealth and diversity of reflection to imagine new forms of relationships between the people of Europe and these people and their institutions.
- study and manage the issues facing society and to which science can provide some of the answers

As major fields of Community action were identified:

- knowledge-based society and social cohesion (incl. improved means of communicating and using knowledge and opportunities for lifelong learning, socio-economic and demographic context which itself is being called into question);
- citizenship, democracy and new forms of governance (including a view to increasing globalisation, European integration, Union enlargement and the emergence of new forms of cultural identity and social dialogue.

The current FP 7 proposal accounts for the increased importance which the Commission allocates to SSH. The European Research Advisory Board recommended in January 2004 (EURAB 2004):

> *"…Social Sciences and Humanities research activities "in their own right" should command a more prominent place in future Framework Programmes in addressing social, economic and political issues and challenges facing the further construction of the European Union and its relations with the rest of the world. Research themes should be concerned with the interactive and multilevel character of Europeanization and the transformation of modern societies beyond culturally-integrated nation-states. Examples are given of high "European-Added-Value" topic areas in relation to "Democracy" and "European Cultural Heritage" as pointers towards how FP 6 Priority 7 might be built upon in future, but SSH researchers are best placed to formulate a fuller range of topics, scientific models and approaches…"*

To identify priorities for SSH research under FP 7 a Web consultation on possible priorities for research in Social Sciences and Humanities has been launched in the period 11-12/2004[54].

In parallel the Advisory Group on "Social Sciences and Humanities and the European Research Area" (SSH-ERA), created by the Commission in order to enhance the strategic monitoring of FP 6, is working on advice regarding the following objectives:

- Identifying the research priorities in the thematic priority 7 "Citizens and Governance in a knowledge based society"
- Enhancing the interface between SSH and the other thematic priorities
- Developing the interfaces between SSH and Community policies
- Anticipating new problems and scientific and technological needs
- Developing a SSH approach on Research and Innovation
- Defining the strategy to build the European Research Area

[54] At the time of completion of this study results were not available; actual status to be found under http://europa.eu.int/comm/research/future/ssh/index_en.cfm

Observations and recommendations

As the necessary key inputs from these two activities are not available at the completion of this study, only general recommendations can be made for the design of FP 7:

1. **Importance of SSH research and priority in FP 7**

   An in-depth, shared understanding of the complex and interrelated socioeconomic challenges Europe is confronted with is a necessary prerequisite for efficient policy making. Therefore the positioning of Socio-economic Sciences and the Humanities as an own research priority with a dedicated budget is welcomed. Already under FP 7's predecessor programmes a multitude of projects have made important contributions to areas like employment and unemployment in Europe, social trends and structural changes, governance and citizenship, enhancing the role of Europe in international governance, reforming political institutions at European and national levels, etc.

2. **Interdisciplinary integration of SSH**

   Beyond such policy contributions, SSH research can also contribute to research in other areas of FP 7, working on some of Europe's major challenges. Research areas like health, energy, etc. move towards a more system drive problem solving approach, which requires in-depth understanding of underlying socio-economic and other issues. As research in other sectors, traditionally dominated by natural and technical sciences becomes increasingly complex and interdisciplinary; SSH contributions gain importance. For example core themes of the "Life Science" priority like 'ageing society' go beyond medical and pharmaceutical development and require in-depth understanding of underlying socio-demographic and related issues.

   Therefore the research potential in Socio-economic Sciences and the Humanities should be exploited in interdisciplinary projects and teams with a maximum of integration in such research areas addressing important challenges facing European societies.

   If such a contribution is not possible on the basis of funds currently planned for this element, an extension should be considered. As an alternative, funding of socio-economic/humanities research in such areas could also be provided by the respective thematic programme elements.

6. Instruments and implementation

6.1 Situation and learnings from predecessor programmes

A mid term evaluation of FP 6 instruments confirms that the new instruments introduced in FP 6, namely Networks of Excellence and Integrated Projects, are efficient means to foster transnational research cooperations. Therefore continuity in their use should be ensured. However significant room for improvement in their design and operative use is identified (see (Marimon 2004a) and (Marimon 2004b) for response of Commission). In particular, the report points out that the new instruments are not very small business friendly and that clarifications concerning the new instruments' goals are necessary. In parallel European Technology Platforms (ETP's) are emerging rapidly as new instruments with an expected key role in FP 7.

An additional extensive public discussion, initiated by the Commission, has generated numerous statements and recommendations from stakeholders[55]. Especially important and representative are the following:

- A stakeholder consultation initiated by the Commission has lead to the following summary statements (EC 2004q):
  - There is strong support for an increased effort to strengthen the support of research at the European level and for the six objectives of the initial draft concept (EC 2004a);
  - Particularly high importance is attached to improving science and society relations, to supporting innovation, to supporting research by and for SMEs and to focusing EU efforts on topics of major European interest.
  - Common concerns were expressed about two issues: (1) Stakeholders require further information about the Commission's proposals in order to further the debate. This applies, in particular, to the new approaches proposed for basic research and for European technology initiatives; (2) Stakeholders want improvements in implementation of the Framework Programme. Many of the concerns coincide with those found in the mid term (Marimon 2004a).
- Statements from national governments recognize the overall importance of continuing and extending support for research on a European level with the Framework Programme as key mechanism, even if individual perspectives on the elements of FP 7 vary[56]. High priorities are attached in particular to achieving greater integration within the European Research Area (ERA), structuring the ERA and strengthening the foundations of the ERA by attacking structural weaknesses of European research. Support for basic research and for the establishment of an ERC are broadly endorsed. The aim of industry driven research should be to increase private sector R&D investment, encourage technological innovation and attract high added-value international investment. Another important concern is an appropriate involvement of SME's.
- Statements from other stakeholders, especially those who are involved in the research and development process can only be quoted in the form of representative examples because of their high number:
  - From the scientific side, there is strong support for the establishment of the ERC, for example from the European Science Foundation, Euroscience and sectoral/national research associations. However, for example the ESF warns that European research cannot be developed through competition alone. An ERC should therefore include

[55] Because of the large number of comments and statements triggered by the FP 7 draft concept, a comprehensive summary description would go beyond the scope of this study. Therefore this chapter is limited to representative statements.

[56] Because of their large number, statements from national governments, science and industry associations, NGO's and other stakeholders can not be quoted individually. However, almost all of those are available on the Internet.

mechanisms to involve the major sources of research funding that are currently national. An opening of national funding sources to all EU researchers is also discussed.

- Many stakeholders like the European Life Scientist Organization (ELSO) are also calling for the EU to decrease the administrative burden of its Framework Programmes by simplifying application procedures and using grants rather than contracts.
- From an industry perspective the most important objective is to secure the competitiveness of European industry and of Europe as an attractive location to perform research and business. Scientific and technological excellence and economic relevance for Europe as a whole are important criteria for the selection of themes, programmes and projects. UNICE states further that the European Research programmes should not make a goal of compensating for missing national research programmes or under developed research infrastructures.
- Other recommendations include a consequent strategic focus on priority themes with high leverage instead of previous dispersion of available funds in too many thematic and regionally oriented initiatives. Special importance is also given to streamlining and simplifying administrative processes in projects funded by the FP's. The long-term research agenda should be driven by businesses, as those economic actors are in a position to exploit the research outputs.

The Marimon Report (Marímon 2004a) has summarized the current status of instruments and of their use in the Framework programmes and has made clear recommendations for further improvement (see figure 16).

1. The New Instruments introduced in FP6 are a powerful means to foster trans national collaborative research in the European Research Area (ERA). Moreover, too much discontinuity is detrimental with respect to other forms of public and private funding. The New Instruments should therefore be maintained in FP7. There are however many design and implementation aspects that need to be improved, possibly already during FP6.
2. The European Commission should clearly classify instruments according to the goals to which they are expected to contribute, establish clear guidelines and criteria for their use and communicate them to the participants to help them prepare their proposals.
3. The European Commission should specify the portfolio of Instruments available and the strategic objectives. Participants should define the specific research objective they will pursue and why this can best be met by the Instrument they have chosen.
4. It is a common misconception that the New Instruments should be very large. "Critical mass" depends on the topic, the thematic area, the participants and the potential impact and added value. The concept of 'one size fits all' should not be applied across all thematic areas and Instruments. Participants should justify in their proposal the way they have built their consortium to reach the adequate critical mass.
5. Networks of Excellence (NoEs) have met with a significant level of criticism but the general concept of structuring and strengthening the ERA has been well appreciated. Problems with the processes need attention but the major problem has been the concept of "durable integration". NoEs should be designed as an instrument to cover different forms of collaboration and different sizes of partnerships.
6. Integrated Projects (IPs) have gained general approval but, as with NoEs, processes such as consortia-building, proposal submission, proposal evaluation and contract negotiation need to be improved. The concept that Integrated Projects are primarily concerned with delivering new knowledge and competitive advantage to European industry needs to be emphasised. As IPs and Specific Targeted Research Projects (STREPs) have many common characteristics, the differences between these Instruments should be clarified.
7. A greater role must be played by instruments such as STREPs and small consortium IPs. Such instruments are better adapted to risk-taking, industry, participants from new Member States and to smaller players in general. Their role for the research community is essential. This must be reflected in a substantial increase in the total share of the budget finally allocated to STREPs in future calls of FP6 and in the future FP7.
8. Emerging groups should be attracted rather than discouraged from participation. The best research groups and the most innovative firms should be attracted since they must play a leading role in structuring the ERA.
9. The position and participation of small and medium sized enterprises (SMEs) in the New Instruments has not been satisfactory. SMEs have found it almost impossible to become involved in NoEs and SMEs have tended to be dominated by larger organisations and disadvantaged in IPs. The emergence of more research-intensive SMEs as participants in the New Instruments is to be welcomed but, in general, SMEs prefer the traditional instruments of STREPS, Cooperative (CRAFT) and Collective Research.
10. The portfolio of Instruments for collaborative research should be designed and developed to enhance co-ordination and collaboration with other forms of public and private funding across the European Union.
11. To improve the efficiency and reduce the costs for participants, a well conceived two-step evaluation procedure should be introduced.
12. Administrative procedures and financial rules should be significantly simplified and further improved to allow more efficiency and flexibility in implementing participation instruments.

Source: Evaluation of the effectiveness of the New Instruments of Framework Programme VI

Figure 16: Conclusions and recommendations of the Marimon Report

Another issue merits also special attention: In the design and application of its portfolio of instruments the Commission has to maintain a careful balance between addressing very specific needs with a 'tailored' instruments and the necessity to avoid over-complexity to keep the overall portfolio manageable and transparent. This dilemma in FP 6 is obvious from contradicting statements. One hand the Commission stated that it would be difficult to meet al diverse needs with a limited number of instruments. On the other hand various stake-holders and (potential) participants complained about overcomplexity and intransparency of instruments applied and the high required effort and bureaucratic burden necessary to identify the appropriate funding scheme and to get access to funds (See Figure 17 for an overview over instruments applied under FP 6).

1. **Network of excellence (NOE)**
2. **Integrated project (IP)**
3. **Programmes implemented jointly by several Member States ("Article 169")**
4. **Specific targeted research projects (STREP) & specific targeted innovation projects (STIP)**
5. **Coordination action (CA)**
6. **Specific support action (SSA)**
7. **Specific research projects for SMEs**
   - 7.1 *Co-operative research projects (CRAFT)*
   - 7.2. *Collective research projects*
8. **Specific actions to promote research infrastructures**
   - 8.1. *Integrating Activities*
   - 8.2. *Communication Network Development*
   - 8.3. *Trans national Access*
   - 8.4. *Design studies*
   - 8.5. *Construction of new infrastructures*
9. **Marie Curie actions on mobility, training, knowledge transfer and excellence recognition**
   - 9.1. *Host-driven actions (Research Training Networks (RTN), host Fellowships for Early Stage Research Training (EST); Host Fellowships for the Transfer of Knowledge (ToK); Conferences and Training Courses (SCF, LCF)*
   - 9.2. *Individual-driven actions (Intra-European Fellowships (EIF), Outgoing International Fellowships (OIF), Incoming International Fellowships (IIF)*
   - 9.3. *Promoting and recognising excellence (Excellence Grants (EXT), Excellence Awards (EXA) Marie Curie Chairs (EXC))*
   - 9.4 *Return and Reintegration Mechanisms (*European Reintegration Grants (ERG), International Reintegration Grants (IRG)

Figure 17: Available instruments and schemes under FP 6

6.2 The proposal of the Commission

Simplification

In its 2605th Council Meeting, 24 September 2004, the Council of the European Union (Council 2004a)

> *"… RECALLS that the European Council of 25/26 March 2004 stated that the Framework Programme for Research and Development should be simplified and made more user friendly in particular for SMEs and start-ups, and that the Council in its conclusions of 19 July 2004, invited the Commission to continue its efforts to improve its organisational and management approaches to the implementation of the Sixth Framework Programme and to report on this before the end of 2004 …"*

In various stakeholder statements this need has been confirmed and recommendations have been made. The Commission has announced that the development of such improvements will be a priority in the design of FP 7.

The Commission has reacted to these recommendations and proposes (EC2005b):

> *"…A key feature of FP 7 will be a significant simplification of its operation. Measures are being considered, in line with the future revision of the Financial Regulation, to make the programme as straightforward as possible for potential participants. The European Commission has established a sounding board composed of representatives of small companies and research teams – groups which seem to face the biggest difficulties in participating in the programme. This sounding board will advise on whether measures proposed to make the programme simpler will in fact have the required effect.*
>
> *By focussing more on themes and less on instruments, the programme will be more flexible and adaptable to the needs of industry, as well as more straightforward for its participants.*
>
> *The programme will have more focus than in the past on developing research that responds to the needs of European industry, through the work of Technology Platforms and the new "Joint Technology Initiatives". These will be projects in fields of major*

European public interest on subjects identified through dialogue with industry, in particular in the European Technology Platforms.

Since simplification of the administrative and financial rules and procedures of FP 7 is perceived as a decisive factor for its success, the Commission proposes a series of measures to address issues relating to implementation at every level of the programme. These measures include:

- Rationalising the funding schemes – a new approach based on a simpler set of funding instruments;
- Using simpler, less bureaucratic languages, that is free of jargon and user friendly;
- Reducing the number and size of documents;
- Reducing the number of request to participants and instituting a light submission procedure;
- Reducing a priori controls (i.e. controls before the project is approved);
- Increasing the autonomy of consortia;
- Streamlining the selection process;
- Exploring new modes of funding and simplifying the cost-based funding system.

Operative Management

Concerning the operative management of FP 7, the FP 7 proposal (EC 2005a) states:

"A key feature of the 7th Framework Programme is a significant simplification of its operation compared with its predecessors. The measures envisaged in this respect are described in the Working Document on implementation accompanying the proposal. They will cover the entire funding cycle, including the simplification of funding schemes, administrative and financial rules and procedures, as well as the readibility and user-friendliness of documents. The Commission intends to externalise, under its responsibility, activities which generate a large number of small operations. An executive agency will manage, in particular the Marie Curie actions, the support to SMEs, as well as administrative tasks related to other research projects, including collaborative research projects. This approach will also be taken for implementing the activities of the European Research Council (ERC)."

With this principle in mind, the following approaches are proposed for the management of the various blocks of the Framework Programme (Source: EC2005a):

- For **actions** deriving from Article 169 or Article 171 of the Treaty – notably for joint technological initiatives and new infrastructure actions - the management structures will be decided on a case-by-case basis according to the specific characteristics of the action concerned and will be created by the decisions establishing the actions and will involve management outside the Commission services.
- For all **RTD projects, including collaborative research projects**, the hypothesis used is that it will not be possible to manage them as previously (i.e. full internal direct management with limited use of outsourcing through commercial contracts). In this case, for "upstream" implementation tasks an executive agency will be used for reception and administrative management of proposals submitted, inviting and paying expert evaluators (chosen by the Commission), providing logistical support, financial viability checking and provision of statistics. The evaluation, contracting and project management of RTD projects, except for those identified in the last three points of this list, would be carried out by the Commission services, in order to maintain the close link between such activities and policy formulation.
- For the **frontier research and the European Research Council (ERC)**, a scientific council will oversee the implementation of the programme from the scientific perspective. This will involve the preparation of the annual work programmes (which will be adopted

by the Commission), the establishment of the peer review process and the quality control of project evaluation and selection. The administration of the programme and the tasks associated with the implementation of the individual projects will be assured by an executive agency.

- In the case of the **mobility actions** (other than the new scheme mentioned in the following point) and **SME-specific support actions**, the Commission will handle the policy oversight and preparation of procedures and work programmes as well as the selection of projects and the budgets allocated to them. Operative upstream and downstream contract management will be provided by an executive agency. The feedback into the work programme, future programmes and other policy initiatives will be ensured by the Commission.
- For the new scheme of **co-funding of national mobility programmes,** for policy reasons the Commission will retain full responsibility for the evaluation and funding decisions at the highest level (i.e. the decisions on which national programmes to co-fund). The detailed implementation of the individual grant schemes under this heading will, though, be passed to the relevant national or regional public-sector bodies or private bodies with a public service mission established in the Member States, since there is no link from the individual grants to policy formulation.

Flexibility should be maintained to allow the possibility of adapting these management arrangements depending on experience acquired during the first years of the 7th Framework Programme.

Monitoring and evaluation

To ensure efficiency and effectiveness of FP/ and its implementation, the Commission proposes the following elements:

- ***Monitoring*** of implementation management would be ensured by operational senior management within the Commission on a continuous basis with annual check points and using a common set of management performance indicators. The annual results of this exercise will be used to inform senior management and as an input to the multi-annual assessment exercise[57].
- ***Evaluation*** takes place at several levels
  - An ***ex ante evaluation*** of the FP 7 legislative proposals has been undertaken (EC 2005a). This evaluation is incorporated in the overall Impact Assessment report of the European Commission's proposals for the European parliament and Council decisions on FP 7. It was based upon inputs from stakeholders, internal and external evaluation and other studies, and contributions from recognised European evaluation and impact assessment experts. The Impact Assessment exercise covered the period from April 2004 to April 2005.
  - ***Intermediate/ex-post evaluations*** will be carried out further, based on lessons learned from similar experiences in the past (e.g. the Five Year Assessment of the implementation and achievements of Community research over the five preceding years, carried out between June-December 2004 by a panel of independent high level experts). These assessments are based on analysis of an extensive database of evaluation and policy reports concerning Community research, separate studies and analyses prepared specifically as inputs to the assessment exercise; interviews with and presentations by Commission staff; and discussion by panel members within their own constituencies. The results of such assessments are made available to the Commission which communicates the conclusions, accompanied by its observations,

[57] The requirements and systems for data collection regarding proposal evaluation and contract preparation are currently under review given the needs of providing a robust and simplified data set while imposing minimum burden on research programme participants

to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions.

- ***Future evaluations*** will be carried out. Not later than 2010, the Commission shall carry out with the assistance of external experts, an *interim evaluation* of the seventh framework programme and its specific programmes on the quality of the research activities under way and progress towards the objectives set. A coordinated programme of studies for *horizontal assessments* of such topics as the impact of research on issues such as productivity, competitiveness and employment; structuring effects of the Framework Programme on the ERA, etc. will be carried out. Two years following the completion of this framework programme, the Commission shall have carried out an external *ex-post evaluation* of its rationale, implementation and achievements. This would be supported by a coherent set of independent studies, the interim evaluation and other evaluation activities carried out over the life-time of the Framework Programme, as listed above. The report of this exercise would be presented to all interested stakeholders, including the Parliament and Council.

6.3 Observations and recommendations

Overall the European Commission's proposal for the implementation of FP 7 seems to meet most of the weaknesses identified and suggestions for improvement at this stage. For the success of FP 7 it will be vital that these guidelines are now implemented consequently.

Particular attention should be paid to the following issues:

1. **Instruments applied**

   The proposed priority of research themes over instruments is a step in the right direction. Flexibility in the application of instruments should make sure that excellent proposals for attractive research can be formulated on the basis of what support the specific project needs and of which support it needs while being carried out.

   Financial instruments used in FP 7 must be coherent and compatible with relevant other programmes (e.g. TEN, EAFRD, and the Education and Training programmes) and should be applied in a mutually supportive and not in a competing way.

   For this purpose the proposed simplification of instruments and funding schemes is essential. Reduced complexity should contribute to more efficient administrative processes as well as to increased attractiveness and accessibility for potential participants.

   For specific target groups with particular needs – in particular SMEs and smaller research organisations – instruments, type of projects funded, etc. should be adapted to increase attractiveness and leverage for them.

2. **Operative implementation**

   The measures proposed for streamlining administrative processes and for partial externalisation of programme management should be implemented consequently.

3. **Accessibility**

   Special attention should be paid to easy and efficient access of potential participants. In the past potential participants often have refrained from participation because of (perceived) level of effort in the application phase and/or lack of knowledge about available funding.

Appendix: Literature quoted

Quotation	Source
AGE 2005a	Position paper by the Strategic Working Group of the Advisory Group for Energy, EUR 21352, "Key Tasks for future European Energy R&D; A first set of recommendations for research and development by the Advisory Group on Energy", published by the European Commission, DG Research, Brussels, 2005
AGE 2005b	Position paper by the Energy Research Area Working Group (ERAWOG) of the Advisory Group for Energy, EUR 21353, "Towards the European Energy Research Area; Recommendations by the ERA Working Group of the Advisory Group on Energy", published by the European Commission, DG Research, Brussels, 2005
Berlin 2003	"Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities", signed at the Conference on Open Access to Knowledge in the Sciences and Humanities; Berlin, 22. October, 2003; accessible under http://www.zim.mpg.de/openaccess-berlin/berlindeclaration.html
Blair 2003	Joint letter from Mr. Blair, the prime Minister, and the president of France, the Chancellors of Germany and Austria, and the Prime Ministers of the Netherlands and Sweden, to H.E. Prof. Romano Prodi, President of the European Commission, dated 15 December 2003
BMBF 2004	Bundesministerium für Bildung und Forschung, "Kernforderungen der Bundesregierung an das 7. EU-Forschungsrahmenprogramm - Den europäischen Forschungsraum voranbringen!", Bonn/Berlin, 26.11.2004
COST 2005	"Introduction to COST/Mission", http://cost.cordis.lu/src/whatiscost.cfm
Council 2004a	Press Release of the Council of the European Union, 12487/04 (Press 269), "2605th Council Meeting, Competitiveness (Internal Market, Industry and Research), Brussels, 24 September 2004
EC 2005a	Commission of the European Communities, "Proposal for a Decision of the European Parliament and of the Council, concerning the seventh framework programme of the European Community for research, technological development and demonstration activities (2007 to 2013)", COM(2005) 119 final, Brussels, 6 April 2005
EC 2005b	European Commission, "EU research – Building Knowledge Europe: The EU's new Research Framework Programme 2007-2013"; Memo/05/114; Brussels, 7 April 2005; accessible under http://www.europa.eu.int/rapid/pressReleasesAction.do?reference=MEMO/05/114&format=HTML&aged=0&language=en&guiLanguage=en
EC 2005c	Communication from the Commission, "Building the ERA of knowledge for growth", COM(2005) yyy final, Brussels, 2005; accessible under http://www.kowi.de/rp/download/communication_7RP.pdf
EC 2005d	Communication from President Barroso in agreement with Vice-President Verheugen to the Spring European Council, "Working together for growth and jobs A new start for the Lisbon Strategy", COM (2005) 24, Brussels, 02.02.2005 Speech of Commission President José Manuel Barroso, Speech/05/67, "Working together for growth and jobs: A new start for the Lisbon Strategy", Conference of Presidents, European Parliament, Brussels, 2 February 2005
EC 2005e	Commission Communication, COM(2005) 8 final, "Second Implementation Report on the 2003-2005 BEPGs", Brussels, 27.01.2005 Commission staff working paper SEC (2005) 91, Second Implementation Report on the 2003-2005 Broad Economic Policy Guidelines, Brussels, 27.1.2005

EC 2005f	Commission Staff working Paper, "Impact Assessment and ex ante evaluation; Annex to the Proposal for the Council and European Parliament decisions on the 7th Framework Programme (EC and Euratom), COM(2005) 119 final, SEC(2005) 430/3, Brussels, xxx
EC 2005g	European Commission, Press Release, "New proposals for growth and jobs under the next Financial Framework 2007-13", IP/05/389, Brussels, 6 April 2005; accessible under http://www.europa.eu.int/rapid/ pressReleasesAction.do?reference=IP/05/389& format=HTML&aged=0&language=EN&guiLanguage=en
EC 2004a	Communication from the Commission, COM(2004) 353 final, "Science and technology, the key to Europe's future - Guidelines for future European Union Policy to support Research", Brussels, 16.6.2004
EC 2004b	Communication from the Commission to the Council and the European parliament, COM(2004) 101 final/2, "Building our common Future - Policy challenges and Budgetary means of the Enlarged Union 2007-2013, Brussels, 26.2.2004
EC 2004c	Commission Staff Working Paper, SEC(2004) 1475, "European Innovation Scoreboard 2004, Comparative Analysis of Innovation Performance", Brussels, 19.11.2004
EC 2004d	Directorate General Joint Research Centre, Directorate General Research, Technical Report EUR 21399, "Monitoring industrial research: the 2004 EU industrial R&D investment scoreboard", Luxemburg, 2004
EC 2004e	"Five-year assessment of the European Union research framework programmes 1999-2003", dated December 2004, published by the European Commission
EC 2004f	Commission staff working document, SEC(2004)1397, "European competitiveness report 2004", Luxemburg, 2004, ISBN 92-894-8227-3
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EC 2004k	Communication from the Commission to the Council and to the European Parliament, COM(2004) 366 final, "The share of renewable energy in the EU", Brussels, 26. Mai 2004
EC 2004l	Communication from the Commission to the Council and to the European Parliament, COM(2004) 38 final, "Stimulating Technologies for Sustainable Development: An Environmental Technologies Action Plan for the European Union", Brussels, 28. January 2004
EC 2004m	European Commission, Directorate-General for Research, "European Hydrogen and Fuel Cell Research Projects", Brussels, 2004

EC 2004n Herbert von Bose, DG Research, European Commission, "Towards the 7th Framework Programme for Research", presented at the conference "Auf dem Weg zum nächsten Forschungsrahmenprogramm", Bonn, 11. November 2004

EC 2004o Commission Communication 'On the implementation of the Preparatory Action on the enhancement of the European industrial potential in the field of security research, Towards a programme to advance European security through Research and Technology', COM(2004) 72 final, 3.2.2004 and Commission Decision of 3 February 2004, (2004/213/EC), "on the implementation of the Preparatory Action on the Enhancement of the European industrial potential in the field of security research", published in OJ L 67, of 5. March 2004

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