EN

COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, …

Proposals for a

DECISION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

On the European Community 7th Research Framework Programme 2007-2013

and a

DECISION OF THE COUNCIL

On the EURATOM 7th Research Framework Programme 2007-2011

BUILDING THE EUROPE OF KNOWLEDGE

EN

EXPLANATORY MEMORANDUM

1. KNOWLEDGE FOR GROWTH

1. A major policy objective of the European Union is the achievement of the "Lisbon agenda": the blueprint for growth, competitiveness, employment and sustainable development that the EU adopted five years ago and is currently implementing. "Reinvigorating" the Lisbon agenda is a key goal of the EU and the European Commission for the coming years. This implies, as a first priority, the full realisation of the knowledge society.

2. Knowledge is what holds together all the components of the Lisbon agenda. Knowledge and its exploitation are the key to economic growth and the competitiveness of enterprises and employment, but also to the future of the "European way of life" and European values. It offers the EU the means of becoming "the most dynamic and competitive […] economy in the world", while maintaining and strengthening the "European Model": as history shows, the improvement of welfare and well-being, quality of life, health and the environment, rely significantly on the progress of knowledge and its many applications.

3. In its contribution to the 2005 European Spring Council, the Commission identified "Knowledge and innovation for growth" as one of the three major domains of the future Lisbon Action Programme, a key domain for the future of Europe. Research and technological Development are at the core of the efforts the EU is invited to accomplish on this theme.

4. Scientific research and technological innovation, as, respectively, the main source of new knowledge and a major field for its application, are indeed at the heart of the knowledge economy and society which is currently developing at high speed and on a global scale.

5. As a consequence, following the report from the High Level Group on Lisbon chaired by Wim Kok[1], the Commission, in its Communication of February 2004, stress the necessity, for the EU, to increase significantly its spending on research and development.

2. INCREASING EU RESEARCH FUNDING

6. Like many other aspects of the Lisbon agenda, the realisation of the Knowledge Society relies mainly on the efforts of EU Member States. It is however clear that the Union itself can and must help substantially, including through its financial support.

---

[1] "Facing the Challenge: The Lisbon strategy for Growth and Employment", November 2004. Similar message in the reports "An Agenda for a Growing Europe: Making the EU Economic System deliver", July 2003, from André Sapir, and "Building a Political Europe-Fifty Proposals for the Europe of Tomorrow", may 2004, from Dominique Strauss-Kahn.

7. In the Commission's two Communications on the financial perspectives for 2007-2013 of 26 February and 14 July 2004[2], the Commission proposed to increase significantly the EU research budget as a key contribution to the realisation of the knowledge economy and society.

8. A host of converging and combined reasons plead in reality in favour of a doubling of the EU research budget. In particular:

   − The necessary shift, to achieve the Lisbon agenda, in the EU as in Member States budgets, from "redistribution" spending to "investment/growth enhancers" spending, with a strong macro-economic impact and multiplying effect as highlighted in the impact assessment which accompanies the proposal.

   − The powerful leverage effect of public spending at EU level on private investments in research and development in Europe, of which a strong increase (up to two thirds of the total) is a condition of achieving the objective of raising the overall European research effort to 3 % of EU GDP set by the Barcelona European Council of March 2002.Today (according to latest official data), this EU overall research effort represents 1. 96 % of GDP, compared to 2.59 % for United States, 3.12 % for Japan and 2.91% for Korea. The gap between US and EU, in particular, is currently about €120 billion a year, 80 % of it due to the difference in business spending in research and development.

   − The strong added value of European research funding manifesting itself particularly in terms of critical mass of resources, sharing of knowledge and facilities, strengthening excellence through both cooperation and competition at a European scale, co-ordination of national activities, and support to EU policies. EU funding demonstrably has an impact in terms of the number of scientific publications and co-publications, the quality of research, applications for patents, as well as direct and indirect economic return (€7 is the estimated average long term net return for each € 1 invested by participants in the Framework Programme according to case studies and several economic models).

   − The rising costs of research, due in particular to increased use of expensive instruments and medium to large-scale infrastructures, such as radiation sources, data banks and bases, imaging systems, and high performance computers, in molecular biology, medical research, nanotechnology (eg, clean rooms), climate research, etc.

   − The impossibility of funding, in the present situation, a large number of projects of very high quality submitted to the Union, resulting in a high rejection rate of excellent proposals owing purely to the lack of resources.

   − The necessity and willingness to fund at EU level new categories of activities and new kinds of initiatives, without endangering existing activities which demonstrate high value and impact.

---

[2] COM (2004) 101 of 26.02.2004 and COM (2004) 487 of 14.07. 2004

3. THE TRIANGLE OF KNOWLEDGE

9. An increased European research effort will constitute a core element of the coherent set of actions and initiatives the EU will implement to stimulate the different components of the "triangle of Knowledge": research, education, and innovation.

10. In particular, a reinforced EU Research Framework Programme will be complementary to, and closely linked with, three categories of initiatives covering the same period 2007-2013:

    – The new generation of Education and Training programmes, with a series of subject of common interest calling for joint actions such as the future of universities, science education or the training and careers of researchers;

    – The new Structural Funds, with research and development, innovation and the transition to a knowledge economy among the top priorities inside the three new objectives (Convergence, Regional Competitiveness, and European Territorial Co-operation);

    – The Competitiveness and Innovation Framework Programme, strictly complementary to the Research Framework Programme, with which multiple operational links will be established.

4. A STRENGTHENED AND SIMPLIFIED FRAMEWORK PROGRAMME

11. In the preparation of the present proposals, the Commission took into account the views expressed during a very broad consultation of the scientific community, industry and all stakeholders in European research.

12. These proposals are also relying on an in-depth impact assessment. This impact assessment was based upon inputs from stakeholders, internal and external evaluation and other studies, and contributions from recognised European evaluation and impact assessment experts. The assessment's finding was that Europe faces many economic, social and environmental challenges that science and technology help address; that the European scientific and technological system has flaws, however; and that the EU should support research and has done so successfully through past Framework Programmes. A key finding of the impact assessment was that a larger Framework Programme would be far superior to other options in terms of contributing to Europe's key policy objectives.

13. The 6th EU Research Framework Programme was designed as a tool to help realise the "European Research Area". This objective explains its main features and major characteristics: strong concentration on a few themes and topics; an emphasis on the "instruments"; and the importance of the coordination of national research activities.

14. Because the European Research Area is still far from a reality, the efforts undertaken to create it must therefore be continued and strengthened. While building on the achievements of its predecessor, the 7th Framework Programme is designed in

order to help achieve the current primary policy objective of the EU: fully developing the knowledge economy and society in Europe.

Continuity of the themes

15. The 7th Framework Programme presents strong elements of continuity with its predecessor, mainly as regards the themes which are covered. In order to create critical masses of resources and to avoid dispersion in the context of a limited envelope, the 6th Framework Programme concentrated strongly on a selected number of themes and topics. Without losing focus, the themes of the 7th Framework Programme are defined in sufficiently broad a way as to accommodate specific and/or emerging topics where necessary.

16. The themes identified correspond to major fields of advancement of knowledge, promising scientific and technological avenues which are today opening up, as well as the many social, economic and industrial issues Europe is facing. They follow from extensive consultations with the scientific community, industry (including Technology Platforms) and other stakeholders, and incorporate new areas where EU level research is needed. The social, economic and industrial impact of research in these themes is analysed in the Impact Assessment document.

17. The nine themes are:

   – **Health:** to improve further the health of European citizens and the competitiveness of European health-related industries;

   – **Food, agriculture and biotechnology :** to create a European knowledge-based bio-economy;

   – **Information and communication technologies:** to fully develop the European Information Society to the greater benefit of Europe's citizens, businesses and governments;

   – **Nanosciences and nanotechnologies, materials and new production technologies:** to promote the development of a knowledge-based European industry;

   – **Energy:** to enable the long-term transformation towards a competitive and sustainable energy system;

   – **Environment and climate change:** for managing better the natural resources, and mitigating the impacts of pressures on the environment and climate;

   – **Transport** (including aeronautics): as a key dimension of sustainable development and the competitiveness of European industry;

   – **Socio--economic sciences and the humanities**: to address the challenges of the European knowledge-based society;

– **Space and Security:** to support the development of the *European Space Policy* and to enhance security in Europe in the broadest sense.

18. For legal reasons a separate proposal for a decision by the Council on a research and training programme is submitted under the Euratom Treaty. Also for legal reasons, the proposal under the Euratom Treaty extends to 2011, but its continuation to 2013 is envisaged. This explanatory memorandum is equally applicable to Euratom research except where specific reference is made to Articles in the EC Treaty for which there is no equivalent in the Euratom Treaty. In addition, where appropriate, specific provisions of the Euratom Treaty will apply.

The themes identified are:

– **Fusion energy research:** to develop the technology for a safe, sustainable, environmentally responsible and economically viable energy source.

– **Nuclear fission and radiation protection:** to promote the safe use and exploitation of nuclear fission and other uses of radiation in industry and medicine.

19. The present package of proposals comprises also two proposals for the activities of the Joint Research Centre (JRC) in, respectively, the nuclear and non nuclear fields. The JRC provides a scientific and technical support to the conception and implementation of EU policies.

New modes of support

20. With the proposed introduction of several new areas for EU support, the Communication from the Commission of 16 June 2004[3] marked a move towards a fully-fledged research policy at European level, covering all kinds of research needs and categories of research with a diversified range of "instruments".

21. The objective is to offer to the scientific community, industry and European society in general, the set of tools ("tool box") that is necessary to strengthen and better exploit European research capacities, performances and results. From support to frontier ("investigator-driven") research to applied, policy-oriented, industrial and technological research and technology transfer; and from support to individual researchers and individual research teams to the co-ordination of national research programmes on a large scale, passing through collaborative projects and networks.

22. Two main features of this evolution are:

– The creation of a "European Research Council" supporting frontier research projects proposed by individual teams in competition at European level;

---

[3] COM (2004) 353 of 16.06.2004

- The introduction of three categories of actions (Joint Technology Initiatives, Co-ordination of national research programmes on a large scale, and support to the creation of new infrastructures):

    - The decision (with their topic) by the Council and the Parliament or the Council in consultation with the Parliament, on the basis of articles 169 and 171 of the Treaty or of the specific programmes;

    - Suitable in particular for "variable geometry" initiatives associating a limited number of countries;

    - Implemented through financial plans schemes which will combine, in variable proportions, several sources and kinds of funding: private funding (by definition a substantial proportion for Joint Technology Initiatives); national funding (part or the total of national research programmes in the case of actions based on article 169); direct support from the Framework Programme; contributions from the Structural Funds and loans from the European Investment Bank (EIB).

At this stage, Joint Technology Initiatives are envisaged in the fields of innovative medicine, nanoelectronics, aeronautics and air transport, and hydrogen and fuel cells. Other themes could be proposed.

Up to now, the possibilities linked with article 169 have been exploited only once, with a project on clinical trials of vaccines and therapeutics against diseases linked with poverty (Aids, malaria and tuberculosis). This pilot initiative, despite its particular features, has demonstrated both the potential of Article 169 and the challenges and difficulties involved in preparing and implementing actions of this nature.

As subjects for EU participation in national research programmes a number of initiatives on themes such as, for instance, metrology, biotechnology, social sciences or water research are currently under examination.

Complementing direct financial support and in order to leverage private investment in European research projects, the 7th Framework Programme will comprise a "Risk-sharing finance facility" aimed at helping to improve access to the European Investment Bank loans for large research initiatives, to which it would not lend otherwise due to their size and/or risk profiles. This mechanism will generate a leverage effect so that the volume of extra lending by EIB will be a multiple of the Community funds allocated to the "Risk Sharing Finance Facility".

4. AN ORGANIZATION IN FOUR PROGRAMMES

23. In accordance with this approach described, the 7th Framework Programme will be organised according to four basic components of European research:

    - **Cooperation**

The whole range of research activities in cooperation, from projects and networks to large scale coordination of national research programmes, on topics linked with the major EU policy objectives including the development of a powerful knowledge-based European industry. The aim is to create European Poles of excellence in major fields of the advancement of knowledge.

Topics with industrial relevance (to be addressed in a selected number of cases through Joint Technology Initiatives), are being identified by relying, in particular, on the common long term research agenda defined by "Technology Platforms" associating private and public stakeholders in the field.

– **Ideas**

A European Research Council will support investigator-driven "frontier research" in all scientific and technological fields, including engineering, socio-economic sciences and the humanities. The implementation of this action will be overseen by a Scientific Governing Council composed of renowned scientists from all disciplines, set-up by the Commission in close relationship with the scientific community.

– **People**

Building on past experience, the Marie Curie action evolve to focus better on key aspects of skills and career development, while strengthening the structuring effort and the link with national systems.

– **Capacities**

Support to research infrastructures, both existing ones and the creation of new ones; the development of "regional research driven clusters" closely associating universities, research centres and enterprises; the full development of the potential of excellence existing in the "Convergence" regions of the EU; supporting research for and by SMEs and associations of SMEs; reflection, debate, research and action on "Science in Society" issues; and "horizontal" activities of international co-operation.

For reasons of logic and simplicity, these four components will be the subject of as many Specific Programmes. The first one (on Cooperation) will be organised in a number of sub-programmes, each of which will be operationally autonomous as far as possible while at the same time demonstrating coherence and consistency.

In addition, there will be two Specific Programmes for the Joint Research Centre (non-nuclear and nuclear activities) and one Specific Programme for Euratom "indirect" activities.

5. RATIONALISATION OF THE INSTRUMENTS

24. In the 6th Framework Programme, new funding "instruments", in particular, "Integrated Projects" and "Networks of Excellence" have been introduced, with a view to increasing the impact of EU research funding on research activities in Europe, and to help structure the European Research Area.

25. The positive results of this introduction, together with the need to avoid frequent changes in the way the EU funds research, plead in favour of maintaining a significant level of continuity as regards forms of funding between the 6th and the 7th Framework Programmes.

26. At the same time, experience acquired with the 6th Framework Programme shows the possibility and need to improve the practical implementation, but also the presentation and the design of these schemes. Building on the recommendations of the panel chaired by Mr. Ramon Marimon and the Five Year Assessment of the Framework Programme by the panel chaired by Mr. Erkki Ormala, there is room for adjustment while preserving the desired degree of continuity.

27. Increased impact must not be obtained at the price of increased complexity and rigidity. In fact, the political objectives of EU research policy can be achieved more easily and efficiently through a simpler set of funding schemes, used in a more open and flexible way.

28. The spirit of the 6th Framework Programme will be fully maintained. The number of instruments *as such* will be reduced to a smaller set of funding schemes. These schemes will be used either alone or in combination to implement the different actions throughout the 7th Framework Programme according to their specificities. Grants to individual projects, for instance, will be mainly used for the "frontier research" projects funded by the European Research Council; grants to co-ordination actions will be used in several parts of the Framework Programme, but above all for funding the ERA-NET networks; support to existing infrastructure can rely on a combination of grants to collaborative projects, grants to co-ordination actions and fellowships.

29. Research goals and research policy objectives will be clearly and explicitly set, in a transparent way, in the work programmes. In the actions where different funding schemes can be used, the work programmes may specify the funding scheme to be used for the topic on which proposals are invited. The research policy objectives will thus be transferred from the funding schemes to the work programmes, where they will be materialised in the definition, for each topic on which a proposal is invited, of scientific goals, the scope of activities and indications on the results expected. In some case, an indicative budget may be given.

30. In doing so, the 7th Framework Programme will be able to better achieve European research policy objectives, while introducing a welcome flexibility in the implementation of actions and a significant simplification in the preparation of proposals and subsequent management by participants.

5. SIMPLIFYING AND RATIONALISING THE FRAMEWORK PROGRAMME

31. Such an expansion of the scope, span and volume of EU action in research requires, as a *conditio sine qua non*, a substantial simplification and rationalisation (indispensable in any case) of the way the Framework Programme works in all its aspects and dimensions:

- Reducing the burden of the administrative and financial rules and procedures, by cutting red tape, lowering the number of requests to participants, and decreasing the volume of paperwork and the time needed to launch the projects;

- Improvement of the financial scheme and modalities of funding with a simplified system for calculating the financial contribution, controlling the use of money and reporting the results;

- Improvement and simplification of the presentation and the language used in all documents related to the Framework Programme (legal decisions, technical annexes, work programmes, calls for proposals, contracts, etc).

32. Among other benefits, such a process will help to stimulate, in particular, the participation in the Framework Programme of small actors, SMEs, small teams, and researchers from young universities, less advanced regions and new Member States.

33. Programme evaluation and monitoring will be strengthened and simplified. It will be based on clear objectives and robust indicators. The Commission will ensure that the different exercises complement each other. At the mid-term of the 7th Framework Programme, there will be an assessment of its scientific and technical progress. Two years after the end of the 6th Framework Programme, when the first overall results of research can be identified, there will be an in-depth evaluation of its implementation and achievements.

6. MANAGEMENT

34. By allowing better exploitation of existing human resources, the simplification and rationalisation of the Framework Programme will help the Commission absorb and manage an increased budget properly and efficiently.

35. Moreover, as mentioned in the 16 June Communication, large volumes of funding will be directly managed by the stakeholders (national research organisations, Member states, industry), in close partnership with the Commission. They correspond to the EU part in the budget of large scale actions based on articles 169 and 171 of the present Treaty, in the three fields of infrastructures, Joint Technology Initiatives and Coordination of national research programmes.

36. In addition, the management of several categories of activities will be ensured by external structures, namely Executive agencies. Aside from the one established in relation with the European Research Council, such a structure will be set up for the management of administrative tasks related with Marie Curie Actions and support to SMEs, as well as part of these tasks in the case of the management of collaborative projects and networks.

6. NEXT STEPS

37. On the basis of the first results of the debate on the present proposals, the Commission will present after the summer to the Council and the European

Parliament the proposals for the Specific Programmes and for the "Rules for Participation" in the Framework Programme.

38. For actions under Article 169, Joint Technology Initiatives, and New Infrastructures, a first batch of proposals will be presented in the Commission's proposals for the specific programmes, or in specific proposals in the case of actions based on Articles 169 or 171 of the Treaty. Another batch is envisaged to be presented later..

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 166(1) thereof,

Having regard to the proposal from the Commission[4],
Having regard to the opinion of the European Economic and Social Committee[5],
Having regard to the opinion of the Committee of the Regions[6],
Acting in accordance with the procedure laid down in Article 251 of the Treaty[7],

Whereas:

(1)   For the fulfilment of the tasks laid down in Article 2 of the Treaty, Article 163 of the Treaty provides that the Community is to have the objective of strengthening the scientific and technological bases of Community industry and encouraging it to become more competitive at international level, while promoting research activities deemed necessary by virtue of other Community policies.

(2)   Article 164 of the Treaty enumerates the activities the Community is to carry out in pursuing these objectives, complementing the activities carried out in the Member States.

(3)   The Treaty provides for the adoption of a multiannual framework programme setting out all Community research, technological development and demonstration (RTD) activities. This framework programme fully respects the principle of subsidiarity as set out in Article 5 of the Treaty.

(4)   Pursuant to Article 165 of the Treaty, the Community and Member States are to coordinate their research and technological development activities so as to ensure that national policies and Community policy are mutually consistent.

(5)   On … 2005 the Commission submitted the conclusions of the external assessment of the implementation and results of the Community activities carried out in the five years preceding that assessment, accompanied by its observations.

(6)   In accordance with Article 166(1) of the Treaty, it is necessary to establish the scientific and technological objectives and to fix the relevant priorities for the activities envisaged, the maximum overall amount of the Community financial contribution, the detailed rules for Community financial participation, as well as the respective shares in each of the activities envisaged, and to indicate the broad lines of the activities in question, which will be implemented in compliance with the objective of protecting the Community's financial interests.

---

[4]   OJ C […], […], p. […].

[5]   OJ C […], […], p. […].

[6]   OJ C […], […], p. […].

[7]   OJ C […], […], p. […].

(7)   Joint national and European efforts in the area of research are essential to promote and ensure economic growth and citizen's wellbeing in Europe.

(8)   The seventh framework programme complements other Community actions in the area of research policy that are necessary for the implementation of the Lisbon strategy, alongside in particular those on education, training, industry, employment and environment.

(9)   This framework programme builds on the achievements of its predecessor towards the creation of the European Research Area, and carries them further towards the development of the knowledge economy and society in Europe.

(10)   Research activities carried out within the seventh framework programme should respect fundamental ethical principles, including those which are reflected in Article 6 of the Treaty on European Union and in the Charter of fundamental rights of the European Union.

(11)   Implementation of the seventh framework programme may give rise to the participation of the Community in programmes undertaken by several Member States or to the setting up of joint undertakings or other arrangements within the meaning of Articles 169 and 171 of the Treaty.

(12)   It is important to ensure sound financial management of the seventh framework programme and its implementation in the most effective and user-friendly manner possible, as well as ease of access for all participants.

HAVE DECIDED AS FOLLOWS:

Article 1

1. A multiannual framework programme for Community research, technological development and demonstration activities, hereinafter referred to as the "seventh framework programme" is hereby adopted for the period 2007 to 2013.

2. The seventh framework programme shall comprise all Community activities envisaged in Article 164 of the Treaty.

3. Annex I sets out the scientific and technological objectives and the related priorities and indicates the broad lines of the activities envisaged.

Article 2

1. The maximum overall amount for Community financial participation in this seventh framework programme shall be EUR … million. The proportion assigned to each of the activities is fixed in Annex II.

2. The instruments to be used in this framework programme and the general financial rules governing its implementation are identified in Annex III.

3. The detailed rules for financial participation by the Community shall be governed by the Rules for Participation that will be adopted for this framework programme.

Article 3

All the research activities carried out under the seventh framework programme must be carried out in compliance with fundamental ethical principles.

Article 4

In the context of the annual report to be submitted by the Commission pursuant to Article 173 of the Treaty, the Commission shall report in detail on the implementation of the seventh framework programme, and in particular progress towards achieving its objectives and meeting its priorities (as set out under each heading of Annex I), and on financial aspects and its management.

Article 5

The seventh framework programme shall be implemented through specific programmes. These programmes shall establish precise objectives and detailed rules for their implementation.

Article 6

1. The Commission shall carry out, with the assistance of external experts, a mid term assessment of this framework programme and its specific programmes on the quality of the research activities under way, progress towards the objectives set and the scientific and technical results achieved.

2. Within two years of the adoption of this framework programme, the Commission shall have carried out an external assessment by independent experts of the rationale, implementation and achievements of the previous research framework programme.

The Commission shall communicate the conclusions thereof, accompanied by its observations, to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions.

Done at Brussels, […]

For the European Parliament
The President
[…]

For the Council
The President
[…]

ANNEX I

SCIENTIFIC AND TECHNOLOGICAL OBJECTIVES, THEMES AND ACTIVITIES

The 7th EU Research Framework Programme is organised in four parts corresponding to four major components of European Research.

- Cooperation

- Ideas

- People

- Capacities

Each of them will be subject of a Specific Programme.

I COOPERATION

In this part of the 7th Framework Programme, support will be provided to transnational co-operation at every scale across the European Union and beyond, 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 and industrial challenges. The 9 high level themes determined for EU action are the following:

1. Health

2. Food, agriculture and biotechnology

3. Information and communication technologies

4. Nanosciences, Nanotechnologies, Materials and new Production Technologies

5. Energy

6. Environment and Climate Change

7. Transport

8. Socio-economic sciences and the humanities

9. Space and Security Research

They are broadly defined, at relatively high level. For each of them, a series of research topics have been identified as priority subjects for EU support. In the case of subjects of industrial nature and relevance in particular, the topics have been identified relying, among other sources, on the work of different "European Technology Platforms" set up in various fields.

Under each theme, beside these topics, the possibility will be ensured to address in an open and flexible way two types of opportunities and needs:

- **Emerging needs:** through a specific support to spontaneous research proposals aiming at identifying or further exploring, in a given fields and/or at the intersection of several disciplines, new scientific and technological opportunities, in particular linked with a potential for significant breakthroughs;

- **Unforeseen policy needs:** to respond in a flexible way to new policy needs that arise during the course of the Framework Programme, for instance related with unforeseen developments or events requiring a quick reaction like, in the past, the SARS epidemic or emerging concerns in food safety.

In order to strengthen research capacities across Europe, and the exploitation of the output of EU research, the dissemination of knowledge and transfer of results will be supported in all thematic areas, through the funding of networking initiatives, seminars and events, assistance by external experts and information and electronic services.

Support will also be provided to initiatives aiming at engaging the dialogue on scientific issues and research results with a broad public beyond the research community, and in the field of scientific communication and education. Ethical principles and gender aspects will be taken into account.

Across all these thematic areas, EU support to European collaboration in research and technological development will be implemented through four types of tools and categories of activities:

- Collaborative research;

- Joint Technology Initiatives;

- Co-ordination of national research programmes;

- International Co-operation

Collaborative research

Collaborative research will continue to constitute the bulk and the core of EU research funding. The objective is to establish, in the major fields of advancement of knowledge, European "Poles of excellence" able to attract researchers and investments from Europe and the entire world.

This will be achieved by supporting collaborative research through a range of differentiated instruments: Collaborative projects, Networks of Excellence, Co-ordination/support actions.

Joint Technology Initiatives

The objective is to undertake, in fields which are a key for Europe's future, economic growth and welfare, large-scale programmes of technological research and development implying and stimulating a strong effort of industrial research, co-ordinated at European scale.

Technology initiatives will mainly be created on the basis of the work undertaken by the European Technology Platforms, which gather Industry, research institutions, public authorities and other stakeholders with the aim of defining, in the domain concerned, a common long term research agenda. In most cases, the EU contribution to the implementation of this research agenda will be ensured through the funding of collaborative research projects and networks.

In some cases, the scope of the issue and the resource justifies setting up long term public private partnerships in the form of Joint Technology Initiatives in order to mobilise and pool effectively the resources of industry, national governments and the EU. Covering one or a small number of selected aspects of research in the field concerned, these initiatives will be implemented on the basis of a combination of private and public funding, national and European: grants from the Research Framework Programme and loans from the European Investment Bank. A specific structure will be in charge of the implementation.

A first series of subjects for Joint Technology Initiatives will be identified on the basis of a series of criteria including:

– Strong industrial financial commitment;

– Scale of the industrial impact;

– Importance of the contribution to public objectives;

– Capacity to leverage additional national support and industry funding;

– Added value of European coordination;

– Impossibility to achieve the objectives through funding schemes based on calls from proposals by the Commission.

Particular attention will be given to the overall coherence and coordination between Joint Technology Initiatives and national programmes and projects in the same fields.

Co-ordination of national research programmes

The action undertaken in this field will be strengthened thanks to reinforcement and/or a larger use of the two main tools used in these fields: the ERA-NET networks and the participation of the Union in jointly implemented national research programmes.

ERA-NETs will be developed and strengthened by:

– Encouraging the actors implementing public research programmes (national research organisations, research administrations), to make larger use of the scheme, and those of them which are already implementing an ERA-NET to deepen and/or broaden its scope in the course of their development, e.g. by extending their partnership, as well as opening mutually their programmes;

– Providing an additional EU financing support to the entities which create a common fund for the purpose of joint calls for proposals between the participating national or regional programmes represented (scheme "ERA-NET PLUS").

The participation of the EU in national research programmes jointly executed on the basis of Article 169[(*)] is especially adapted to the support of European co-operations on a large scale in "variable geometry" between some Member States sharing common needs and/or interests, for instance due to their geographical proximity.

Article 169 initiatives will be launched in areas to be identified in close association with the Member States where this approach appears the most appropriate with regard to a series of criteria:

- EU relevance (theme of major interest for EU policies);

- Scientific and technological relevance;

- Pre-existing basis (national research programmes existing or envisaged);

- European value of European co-ordination on a large scale;

- Impossibility to achieve the objectives through funding schemes based on calls for proposals by the Commission.

The tools available for supporting the coordination of research activities in Europe will be further used to enhance the complementarity and synergy between the EU actions undertaken under the Framework Programme and those of other European scientific cooperation organisations as well as among these organisations themselves. Examples of such organisations are the intergovernmental structures: COST, for the co-ordination of projects; EUREKA, which supports transnational projects in industrial research; and EIROforum, which unites various large organisations. This part of the Framework Programme covers only the co-ordination of national research programmes in the nine thematic areas. The "horizontal" activities in support of the co-ordination of research policies will be carried out in the "Capacities" part under other headings.

International co-operation

International co-operation constitutes an important field for the realization of the European Research Area. In the 7th Framework, this component of EU research policy, in particular the EU policy to support research, will be strengthened through:

- Opening of all activities carried out in the thematic areas to researchers and research institutions from all third countries, with an increased effort to encourage them to seize this opportunity;

[(*)]**Article 169** refers to the Article in the Treaty that enables the Community to participate in research programmes undertaken jointly by several Member States.

- In each thematic area, dedicated co-operation actions targeted at countries or groups of countries especially interested in co-operating on specific topics. Implemented on the basis of cost-shared funding, and closely associated with the bilateral or interregional scientific co-operation agreements concluded by the EU with these countries or groups of countries, these programmes will serve as privileged tools for implementing the co-operation between the EU and:

  - Industrialised advanced countries like US, Canada, Japan or Russia;

  - Emerging economies such as Brazil, China and India and regional associations like ASEM for Asia or MERCOSUR for Latin America;

  - Developing countries, with a specific action in support to the EU Development policy focusing of their particular needs in fields such as health, agriculture, energy and environment, and implemented in financial conditions adapted to the capacities;

  - Candidate countries, through specific actions aiming at reinforcing their research capacities.

  They will imply a strengthened effort to improve the coherence of national activities by supporting the co-ordination of national programmes of international scientific co-operation.

This part of the Framework Programme covers only the international co-operation in the nine thematic areas. "Horizontal" actions and measures in support of international co-operation will be carried out and funded in the parts "Capacities" and "People" of the Framework Programme.

THEMES

1   Health

Objective

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

Rationale

The sequencing of the human genome and the recent advances in post-genomics have revolutionised research into human health and diseases. Integrating vast amounts of data and understanding underlying biological processes requires bringing together critical masses of various expertises and resources that are not available at a national level. Significant advances in translational health research, which is essential to ensure that biomedical research provides practical benefits, also requires multidisciplinary and pan-

European approaches involving different stakeholders. Such approaches allow Europe to contribute more effectively to international efforts to combat diseases of global importance. Clinical research on many diseases (cancer, cardiovascular diseases, neurological diseases, in particular those linked with ageing, such as Alzheimer and Parkinson diseases) relies on international multi-centre trials since the required number of patients cannot often be recruited in a single country 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 require multi-country approaches to increase the number of patients for each study. And performing health policy-driven research at the European level offers a possibility to compare 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. Research-based SMEs are the main economic drivers of the healthcare biotechnology and medical technology industries. Although Europe now has more Biotechnology companies than US, most of them are small and less mature than their competitors. Public-private research efforts at the EU level will facilitate their development. EU research will also contribute to the development of new norms and standards to set up an appropriate legislative framework for new medical technologies (e.g. regenerative medicine).

The themes and activities that will be addressed, which also include research essential to policy requirements, are set out below. To complement these and respond to new policy needs, additional actions may be supported for example in the areas health policy issues and occupational health and safety.

Themes and activities

- **Tools and biotechnology for health.**

  - *Tools and technologies for high-throughput research.* To catalyse experimental progress in biomedical research by enhancing data generation, standardisation, acquisition and analysis.

  - *Tools and technologies for detection, diagnosis and monitoring.* With emphasis on non-invasive or minimally invasive approaches.

  - *Tools and technologies for predicting suitability, safety and efficacy of therapies.* To develop and validate biological markers, methods and models, including simulation, pharmacogenomics and targeting approaches.

  - *Tools and technologies for innovative therapeutic approaches and intervention.* To ensure further development of tools essential for the success of innovative therapeutic approaches 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 massive amount of data needed to better

understand 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.* To explore the process of healthy ageing and the way brain activity interacts with genes and environment, under normal conditions as well as in brain diseases.

– *Translational research in infectious diseases.* To address anti-microbial drug resistance, the global threats of HIV/AIDS, malaria and tuberculosis as well as emerging epidemics (e.g. SARS).

– *Translational research in major diseases: cancer, cardiovascular disease, diabetes/obesity; rare diseases; and other chronic diseases (e.g. osteoarthritis).* 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 and especially addressing the specificities of children, women and elderly population.

  – *Quality, efficiency and solidarity of health systems including transitional health systems.* To translate effective interventions into management decisions, to ensure an adequate supply of human resources, to analyse factors influencing equity of access to health care.

  – *Analysing changes in population.* To analyse how European health systems, as presently configured, will respond to the challenges of ageing and migration.

  – *Challenges in the pharmaceutical sector.* To identify successful interventions in different health care settings for improving the prescription of medicines and improving their use by patients.

2. Food, agriculture and biotechnology

Objective

Building a European *Knowledge Based Bio-Economy*[8] by bringing together science, industry and other stakeholders, in order to exploit new and emerging research opportunities, with the view of addressing new social and economic challenges: Growing demand for safer and healthier food, and for renewable bio-resources; increasing risk of epizootic and zoonotic diseases and food related disorders; threats to the sustainability and security of agricultural production resulting from climate change.

---

[8] The term "bio-economy" includes all industries and economic sectors that produce, manage and otherwise exploit biological resources (and related services, supply or consumer industries, such as agriculture, food, fisheries, forestry, etc.

Rationale

Innovations and advancement of knowledge in the sustainable management, production and use of biological resources (micro-organism, plants, animals), will provide the basis for new, sustainable, eco-efficient and competitive products for agriculture, food, health and related industries. In line with the European strategy on life sciences and biotechnology[9], this will help increase the competitiveness of European Biotechnology and food companies, in particular high tech SME's, while improving social welfare and wellbeing. Research into the safety of food and feed chains, diet related diseases, food choices and the impact of food and nutrition on health will help to fight food related disorders (obesity, allergies, etc) and infectious diseases (TSE, avian-flu), while making important contributions to the implementation of existing and the formulation of future policies and regulations in the area of public health and consumer protection.

The diversity of the European food and agricultural industry leads to fragmented approaches to similar problems. These are better addressed by increased collaboration and sharing of expertise, for example on new methodologies, processes and standards as a result of changing EU legislation in the field of food safety, animal welfare and environmental standards, and of the reform of the common agriculture and fishery policies.

Several Technology Platforms have contributed in setting the priorities of this area, in the fields of: plant genomics and biotechnology, forestry, global animal health, farm animal breeding, food and industrial biotechnology. This will ensure integration of all relevant stakeholders within EU research actions, in particular biotechnology, food and feed industries and researchers, but also farmers, forestry managers, energy, and chemical industries, retailers and consumers.

In addition, the relevant policy, regulatory and standardisation issues will be addressed, (Common Agricultural Policy and Common Fisheries Policy; agriculture and trade issues; food safety regulations; animal health and welfare standards), including by responding flexibly to new policy needs that arise.

Themes and activities

- **Sustainable production and management of biological resources from land, forest, and aquatic environments:** Enabling research, including 'omics' technologies, such as genomics, proteomics, metabolomics, systems biology and converging technologies for micro-organisms, plants and animals, including exploitation of their biodiversity; improved crops; sustainable, competitive and multifunctional agriculture, including rural development and forestry; animal welfare, breeding and production; aquaculture and fishery management and competitiveness; infectious diseases in animals, including zoonoses.

- **"Fork to farm": Food, health and well being:** Consumer, societal and health aspects of food and feed, including behavioural and cognitive sciences; nutrition and diet related diseases, including obesity; innovative food and feed processing technologies (including functional foods); improved quality and safety, both chemical and microbiological, of

---

[9] "Life Sciences and biotechnology – A strategy for Europe", COM(2002)27

food, beverage and feed; integrity of the food chain; environmental impacts on food chains and of food chains; total food chain concept including traceability.

- **Life sciences and biotechnology for sustainable non-food products and processes**: Improved crops, feed-stocks and biomass (including marine resources) for energy, environment, materials and chemicals, including novel farming systems, bio-processes and bio-refinery concepts; bio-catalysis; forestry and forestry related products and processes; environmental remediation and cleaner processing.

3   Information and communication technologies

Objective

The objective is 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. Community support will strengthen Europe's scientific and technology base in ICT. It will 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.

Rationale

Information and Communication Technologies are critical to Europe's future and underpin the realisation of the Lisbon agenda. Half of the productivity gains in our economies are explained by the impact of ICT on products, services and business processes. ICT is the leading factor in boosting innovation and creativity and in mastering change in value chains across industry and service sectors. ICT is essential to meet the rise in demand for health and social care and to modernise services in domains of public interest such as education, learning, security, energy, transport and the environment. And ICT is catalytic in the advance of other fields of science and technology as it transforms the way researchers conduct their research, co-operate and innovate.

The escalating economic and societal demands, together with the continued mainstreaming of ICT and the need to push further the technology limits set a growing agenda for research. To bring technology closer to people and organisational needs means: hiding technology complexity and revealing functionality on demand; making technology very simple to use, available and affordable; providing new ICT-based applications, solutions and services that are trusted, reliable, and adaptable to the users' context and preferences. Driven by the demand of more-for-less, ICT researchers are involved in a global race to achieve further miniaturisation, to master the convergence of computing, communications and media technologies, and the convergence with other relevant sciences and disciplines, and to build systems that are able to learn and evolve. From these diverse efforts a new wave of technologies is emerging.

ICT is one the most research intensive sectors. The ICT research effort, public and private, represents a third of the total research effort in all major economies. Although Europe already enjoys industrial and technological leadership in key ICT fields it lags in investing in ICT research behind its major competitors. Only through a renewed and more intensive pooling of the effort at European level will we be able to make the most of the opportunities that progress in ICT can offer.

The theme will include also research on Future and Emerging Technologies that will act as the ICT research pathfinder and as a structured foresight service for future ICT research

programmes. It will also cover research on the socio-economic dimensions of ICT and international cooperation initiatives. It will ensure that ICT research is closely articulated with policy actions for ICT deployment and with regulatory measures within a comprehensive and holistic strategy. Priorities have been set following extensive consultations with industry and academia including input from a series of Technology Platforms and industrial initiatives in areas such as nano-electronics, embedded systems, mobile communications, electronic media and software, services and Grids.

Themes and activities

- **Technology Pillars**

  - *Nano-electronics, photonics and integrated micro/nano-systems*. To push the limits of miniaturisation, integration, variety and density of nano components and systems with the aim of increasing performance and manufacturability at lower cost and to facilitate the incorporation of ICT in a wide range of application domains. These will be complemented by research into new device principles, architectures and interfaces which may require the development of new materials for ICT exploitation. Device and materials aspects could be followed jointly with Theme 4.

  - *Ubiquitous and unlimited capacity communication networks*: To offer ubiquitous access over heterogeneous networks - fixed, mobile and broadcasting networks spanning from the personal area to the regional and global area - allowing the seamless delivery of ever higher volumes of data and services anywhere, anytime.

  - *Embedded systems, computing and control*: To enable the design and building of new generations of powerful, secure and distributed computing and communication systems that are embedded in objects and physical infrastructures and that can control and adapt to their environment. Parts of these themes and activities may be the subject of a Joint Technology Initiative.

  - *Software, Grids, security and dependability*: To strengthen capabilities to develop and manage dynamic, adaptive, dependable and trusted knowledge-intensive software and services, as well as new processing architectures, including their provision as a utility.

  - *Knowledge, learning and cognitive systems*: To capture knowledge embedded in web and multimedia content and making information understandable to people and machines. To develop artificial systems that perceive, understand, learn and evolve, and act purposefully and autonomously toward achieving goals and to advance learning by machines and humans based on a better understanding of human cognition.

  - *Simulation, visualisation, interaction and mixed realities*: To develop new ICT tools for innovative design and for creativity in products, services and digital media and to progress towards natural and context-rich interaction with technology, machines and devices.

- **New perspectives in ICT**

  - *New perspectives* are emerging in ICT drawing on other science and technology disciplines. They include ICT devices miniaturised to sizes compatible and interacting with living organisms; research on the way information is processed in the living world; a better understanding of the biological and neural basis of cognition, and modelling and simulation of the living world

- **Multi-technology, Multi-disciplinary Integration**
  - *Personal environments*: To provide people with the means to use applications and services in the most seamless and effortless way, anytime, anyplace and on any device.
  - *Home environments*: To maintain and build on Europe's leadership in the next generation of consumer electronics, home appliances and automation systems as well as interactive digital media services to the home.
  - *Advanced Robotics*: To advance miniaturisation and to build advanced robotics, based on ICT systems, that integrate cognition, control, and action skills and naturally interact with people for driving innovation in service, entertainment, security and industrial engineering applications, as well as in environmental surveillance and medical treatment.
  - *Intelligent infrastructures*: To embed intelligence in the infrastructures that are critical to everyday life spanning from energy, transport and water supply to financial service systems.
- **Application Poles**
  - ***ICT meeting societal challenges***: To enable the modernisation of administrations and of services of public interest. The aim is to improve access to and interactivity of services, to bring completely new customised services and to enable services to be developed and delivered more efficiently.

    For *health*: To improve prevention, diagnosis and quality of care through ICT based systems as well as to contribute to autonomy and increased mobility of patients through personal health monitoring systems. To support health information infrastructure for research and healthcare, including bringing health knowledge discovery into clinical practice.

    For *inclusion*: to improve equal participation in the information society, preventing digital divides due to disability, low skills, culture, gender or age, through support to assistive technology, design-for-all and ambient assisted living.

    For *mobility*: to develop intelligent ICT-based transportation systems and vehicles enabling people and goods to move safely, comfortably and efficiently.

    For *the environment*: to support sustainable development and to reduce vulnerability and mitigate consequences of natural disasters and industrial accidents.

    For *governments*: to achieve world-class public administrations in Europe by enhancing their efficiency, openness and accountability, by improving links between governments and citizens and businesses, and by supporting eDemocracy.
  - ***ICT for content, creativity and personal development***: to foster the creation and delivery of interactive content, to improve technology-enhanced learning and to facilitate access to Europe's cultural assets, in a multilingual environment.

    For media and entertainment: to develop and integrate new media paradigms and new forms of content, enabling enriched user experiences and cost-effective content delivery.

    For *learning*: to develop adaptive and contextualised learning solutions improving people's active learning abilities.

For *culture*: to provide systems supporting the accessibility and use over time of digital cultural resources.

– ***ICT supporting businesses and industry*:** To provide ICT support to productivity growth across the economy through faster and innovative product and service development, improvements in business processes and organisational change.

For *organisations and work*: To support new forms of dynamic networked co-operative business processes and optimised work environments.

ICT for manufacturing. To support manufacturing of miniature, integrated ICT products, and to integrate ICT into the rapid and adaptive production of highly customised goods.

– ***ICT for trust and confidence***: To support the wider uptake of ICT and its applications. Research will target multiple identity management, authentication and authorization, privacy enhancing technologies, rights and asset management, as well as tools to protect against cyber threats.

- **Future and Emerging technologies**

By supporting upfront collaborative basic research at the frontier of knowledge in core ICTs and in their combination with other relevant areas and disciplines, the activity will support radically new ideas, in the areas of components, systems and intelligence, up to their first proof of concept and will narrow down options that would lead to the industrial solutions of tomorrow.

4   Nanosciences, Nanotechnologies, Materials and new Production Technologies

Objective

Ensure the transformation of European industry from a resource-intensive to a knowledge-intensive industry, by generating breakthrough knowledge for new applications at the crossroad between different technologies and disciplines, in particular nanosciences and nanotechnologies, often converging with other emerging technologies.

Rationale

The decline in industrial activities appears no longer to be limited to traditional sectors with a high labour density, but is beginning to be observed in intermediate sectors – which constitute the established strengths of European industry – and even in some high-technology sectors. This trend can and must be reversed by building, in Europe, a strong knowledge-based, knowledge intensive industry. This will include the modernisation of the existing SME base and on the creation of new knowledge-driven SMEs, thanks to the dissemination of knowledge and expertise through collaborative programmes.

EU recognized leadership fields such as in nanotechnologies and materials has to be reinforced in order to secure and increase the EU position in a highly competitive global context. World-class European-scale multidisciplinary poles of excellence attracting and retaining the best scientists must be developed. This requires a critical mass of interdisciplinary resources easier to gather at European level.

An important number of European Technology Platforms have been set up in this area, in fields such as, for instance, nanoelectronics, manufacturing, nanomedicine, steel, chemistry, construction, industrial safety and textiles, which have and will further help establish common research priorities and targets. Step changes in production, manufacturing and hence productivity will result from these common approaches.

In addition to industry relevant priorities which are set out in the themes and activities below, the relevant policy, regulatory and standardisation, and impact issues will be addressed, including by responding flexibly to new policy needs that arise.

Themes and activities

- **Nanosciences, Nanotechnologies**

  – Expanding knowledge of size, dimension and geometry dependent phenomena and interface phenomena;

  – Extending the limits of control and material properties at the nano-scale to realise new micro- and macro-applications, e.g. in biotechnologies, medicine, energy and environmental technologies;

  – Study the integration of technologies at the nano-scale: the self-assembling properties of matter; nano-scale mechanisms; nano-motors; nano-machines and nano-systems.

  – Developing models, instruments, methods and tools for characterisation and manipulation at nano dimensions;

  – Impact of nano-scale entities on human health and the environment; metrology, nomenclature and standards;

  – Expanding knowledge to support new evolutions in electronics through the development of new materials, e.g for molecular/polymer electronics.

- **Materials**

  – Knowledge-based materials with tailored properties and the ability to process them; more direct molecular-level control of their properties;

  – More reliable design and simulation – enhancing the concept of "materials engineering"; recyclability and environmental compatibility; higher complexity of materials;

  – Integration of nano-molecular-macro levels in the chemical processing and materials technology industries;

  – New nano-materials, bio-materials and hybrid materials.

- **New Production**

    – New concepts for design, production and delivery of high added-value products and services. Development and validation of new industrial paradigms;

    – Adaptive production adopting agility and adaptability for flexible, small or single batch oriented production, including miniaturized products. Resource efficient, sustainable production processes.

    – Affordable intelligent sensor technologies and control of processes. Customer orientation and co-operation in product development;

    – Digital and virtual production, modelling, simulation and presentation tools. New generation of planning tools, software and ICT to integrate new technologies;

    – Networked production based on dynamic, co-operative and value-adding operations for global production capability.

    – Knowledge-intensive products and processes, exploiting the convergence of the most promising technologies (nano, bio, info and cognitive technologies); integration of organisational knowledge and advanced engineering.

5   *Energy*

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.

Rationale

Energy systems are confronted with major challenges. The urgency to develop adequate and timely solutions is justified by the alarming trends in global energy demand (predicted to rise by 60% in the next 30 years), the need to curb dramatically emissions of greenhouse gases to mitigate the devastating consequences of climate change, the damaging volatility of oil prices and geopolitical instability. Research is needed to develop the most environmentally and cost-effective technologies and measures enabling the EU to meet its targets under the Kyoto Protocol and beyond, in line with EU policy on sustainable development. Europe has developed world leadership in a number of energy technologies.

It is the pioneer in modern renewable energy technologies, such as bio-energy and wind energy. The EU is also a global competitor in power generation and distribution technologies and has a strong research capability in the area of carbon capture and sequestration. These positions, however, are under severe threat from competition (in particular from the US and Japan).

Radically transforming the energy system requires new technologies with risks that are too high and the benefits too uncertain for private firms to provide all the investment needed for research, development and deployment. Public support should therefore play a key role in mobilising private investment and European efforts and resources should be combined in a coherent and more effective manner, to compete with economies that are investing heavily and consistently in similar technologies. The themes and activities to meet the objective are set out below. A specific theme 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.

Themes and activities

- **Hydrogen and fuel cells**

  Technological research, demonstration and system verification for stationary, portable and transport applications. To provide a strong technical foundation for building EU fuel cell and hydrogen supply and equipment industry, supported by sound transition strategies and cross-cutting, pre-normative and socio-economic research. The Hydrogen and Fuel Cells Technology Platform helps define a pre-competitive research agenda in this field, with the view of achieving breakthrough on critical technologies and processes.

- **Renewable electricity generation**

  Development, validation and demonstration of advanced and innovative technologies. To contribute to lowering EU dependence on imports and to limit CO_2 emissions by increasing overall conversion efficiency, driving down the cost of electricity production from indigenous renewable energy sources, and developing technologies suited to different regional conditions (eg, through achieving the full potential of photovoltaics, and further developing wind energy).

- **Renewable fuel production**

  Development, validating and demonstration of advanced and integrated conversion technologies. To develop and drive down the unit cost of solid, liquid and gaseous (including hydrogen) fuels produced from renewable energy sources, by developing cost-effective carbon-neutral fuels in particular liquid biofuels for the transport sector.

- **Near zero emission power generation**

  Research, development, validation and demonstration of advanced and clean conversion technologies. To create highly efficient power plants with near-zero emissions by paying attention to technologies which drastically reduce the adverse environmental impact of fossil fuels, especially those allowing the clean use of coal in coming decades (CO_2 capture and storage will be a major element).

- **Smart energy networks**

  Research, development and demonstration of technologies and systems. To increase the efficiency and security of the European electricity and gas transport and distribution system 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 savings and energy efficiency**

  Optimisation, validation and demonstration of new concepts and technologies. To improve energy savings and efficiency for buildings, transport, services and industry, as well as to create opportunities offered by innovative use of new and renewable energy sources for energy production, in particular for heating and cooling.

- **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.

6   Environment and Climate Change

Objective

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 integrated way global environmental issues and support sustainable development. Emphasis will be put on improved understanding and prediction of climate, earth and ocean systems changes; on tools for monitoring, prevention and mitigation of environmental pressures and risks, as well as for the management and conservation of natural resources.

Rationale

Environmental problems go beyond national frontiers and require a coordinated approach at a pan-European and often global level. Earth's natural resources and the man-made environment are under intense pressures from growing population, urbanisation, continuous expansion of the agriculture, transport and energy sectors, as well as climate variability and warming at local, regional and global scales. EU-wide cooperation is needed to attain critical mass given the scale, scope and high level of complexity of environmental research. It facilitates common planning, the use of connected and inter-operable databases, and the development of coherent and large scale observation and forecasting systems. Research is needed at EU level for the implementation of international commitments such as the Kyoto protocol, the Millennium Development Goals, and contributions to the International Panel on Climate Change and the Earth Observation initiative. In addition there are significant research needs arising from EU level policies (e.g. environmental aspects of agricultural and fisheries policies, the action plans on Environmental Technologies and Environment and Health, and new Directives such as the Water Framework).

The EU needs to strengthen its position in world markets for environmental technologies. Such technologies help deliver sustainable growth providing eco-efficient solutions to regional and global environmental problems. Environmental requirements act as a stimulus for innovation and can provide business opportunities. The technology platforms on water supply and sanitation and on sustainable chemistry confirm the need for EU level action and their research agendas are taken into consideration in the themes below.

A series of themes and activities are listed below many of which are directly relevant to policy needs. However, additional support may be provided to new policy needs that emerge, for example relating to sustainability impact assessments of EU policies; the follow up to the Kyoto strategy; and new environmental policies, standards and regulations.

Themes and activities

- **Pressures on environment and climate, impacts and feedback:** Functioning of climate and the earth system; adaptation and mitigation measures; pollution in air, soil and water; changes in atmospheric composition and water cycle; interactions between climate and the ocean; and impacts on biodiversity and ecosystems.

- **Environment and health :** Interaction of environmental stressors with human health including identification of sources, impact and emerging risk factors; integrated risk assessment approaches for effective prevention strategies; quantification and cost-benefit analysis of environmental health risks and indicators.

- **Conservation and sustainable management of natural resources:** Conservation and sustainable management of ecosystems; water resources management; waste management; protection and management of biodiversity, soil protection, approaches against desertification and land degradation; data management and information services; assessment and foresight relating to natural processes.

- **Evolution of marine environments:** Impacts of human activities on the marine environment; pollution and eutrophication in regional seas and coastal areas; deep sea ecosystems; assessment of marine biodiversity trends, of ecosystem processes and of ocean circulation; seabed geology.

- **Environmental Technologies:** Technologies for observation, prevention, mitigation, adaptation, and restoration, related to: water, climate, marine, urban environment, soil, waste treatment, recycling, clean production processes, protection of cultural heritage. environmental technology and life cycle assessment, verification and testing.

- **Natural hazards: understanding and prevention:** Improve prediction and integrated hazards- vulnerability -and risks assessments for disasters related to geological hazards (such as earthquakes, volcanoes, tsunamis) and climate (such as storms); develop early warning systems and improve prevention strategies.

- **Forecasting methods and assessment tools:** modelling economy/environment, externalities, thresholds and sustainability impact assessment on key issues such as land use, urban management and marine issues.

- **Earth observation:** Contribute to the development of space and ground observation systems for environmental and sustainability issues; interoperability between systems and use of information for understanding, modelling and predicating environmental phenomena.

7   Transport

Objective

Developing, based on technological advances, enhanced, 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.

Rationale

Transport is one of Europe's strengths - the air transport sector contributes to 2.6% of the EU GDP (with 3.1 million jobs) and the surface transport field generates 11% of the EU GDP (employing some 16 million persons). However, transport is responsible for 25% of all the EU emissions of CO_2, hence the absolute need for a "greening" of the system to ensure more sustainable transport patterns and compatibility with growth rates.[10]

The enlargement of the EU (increasing land surface by 25% and population by 20%) presented new challenges for transporting people and goods efficiently, cost-effectively and in a sustainable manner. Transport also has direct relevance on other major policies such as trade, competition, employment, cohesion, energy, security and the internal market. Investment in RTD in EU transport industries is a prerequisite to ensure technological competitive advantage in global markets.[11]

The research agendas developed by Technology platforms[12][13][14][15] support the need to take a new "transport systems" perspective that is considering the interactions of vehicles and transport networks, which can only be developed at European level. RTD costs in all these fields are rising substantially, and collaborative activity at EU-level is essential to enable a "critical mass" of diverse RTD providers to address the scale and multi-disciplinary challenges in a cost-effective way, as well as meeting the technological and socio-economic challenges on issues such as interconnectivity, intermodality, affordability, safety, capacity, security and environmental impacts in an enlarged Union. Activities at European level will also stimulate the restructuring of the industry, including the integration of the supply chain and in particular SMEs.

As well as the strong industry relevance of the themes and activities set out below, the needs of policy makers will be addressed.

---

[10] The White Paper on "*European Transport Policy for 2010: time to decide*" COM (2001) 370 final

[11] The European aeronautics industry invests 14% of its turnover in research, the European car industry almost 5% of its turnover; and the EU shipbuilding industry competitive advantage relies exclusively on RTD.

[12]   ACARE: Advisory Council for Aeronautics Research in Europe. Launched in 2001, it is the first operational example of a Technology Platform.

[13]   ERRAC: European Rail Research Advisory Council

[14]   ERTRAC: European Road Transport Research Advisory Council

[15]   WATERBORNE Technology Platform

In addition, support will be provided to respond to new policy needs that arise, for example relating to developments in maritime policy and the implications for transport policy of trends in global warming and changes in the demographics, lifestyles and expectations of society.

<u>Thematic domains and objectives</u>

- **Aeronautics and air transport**

  - *The greening of air transport:* reduction of CO_2 and NOx emissions and noise disturbance, incorporating work on engines and fuel, structures and new aircraft designs, airport operations and traffic management.

  - *Increasing time efficiency:* improvement of the efficiency of operating schedules focusing on innovative air traffic management systems which integrate air, ground and space components, including traffic flow and more aircraft autonomy.

  - *Ensuring customer satisfaction and safety:* improvement of passenger comfort, innovative in-flight services and more efficient passenger handling; safe separation of aircraft, prevention of hazards, human performance and control aspects; wider choice of aircraft ranging from wide body to small size general aviation vehicles.

  - *Improving cost efficiency:* reduction of product development and operating costs focusing on zero maintenance aircraft, check in procedures, cheaper manufacturing costs, increased use of automation and simulation.

  - *Ensuring security:* absolute prevention measures such as improved data and identification methods, securing the aircraft against attack, auto recovery and improved security design of aircraft.

  - *Pioneering the Air Transport of the Future:* more radical and innovative combinations of technologies which would lead to radical steps forward in air transport, answering to longer term challenges to aviation. Focus will be on new concepts of propulsion and lifting; total automation during flight; new concepts in the air cabin; reduced maintenance; airports of the future; remote automation.

Surface transport (rail, road and waterborne)

  - *Ensuring mobility*: development of intermodal transport, innovative urban transport, inter-connection between regional and national transport networks, new and regenerated transport infrastructures, intelligent systems and information exchange between vehicle and transport infrastructure.

  - *The greening of surface transport*: solutions for the "greening" of products and operations with focus on: atmospheric pollution, marine pollution and biodiversity, noise pollution and recycling, clean engines and the use of alternative fuels(including the use of hydrogen and the integration of fuel cells technologies into vehicles) for transport applications.

- *Improving safety and security*: improvement of safety and security in operations for passengers, crew and pedestrians, in particular integrated passive, active and preventive safety, human factor related aspects, security of terminals, vehicles, vessels and critical infrastructure.

- *Strengthening competitiveness*: production by design, development of cost-effective, high quality products and systems, efficient production; maximisation of infrastructure capacity, cost-effective infrastructure construction; advanced engine and vehicle production, innovative production and delivery organisations; end of life strategies for vehicles.

8 Socio-Economic Sciences and the Humanities

Objective

Generating an in-depth, shared understanding of complex and interrelated socio-economic 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 EU and national policies in the fields concerned.

Rationale

Europe has a strong and high quality research base in socio-economic sciences and the humanities fields. The diversity of approaches within the EU in the economic, social, political and cultural domains provides a highly fertile ground for research in these fields at EU-level. There is a high European added value in collaborative research addressing European socio-economic issues in the areas mentioned. 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.

The themes and activities to be supported are listed below and are expected to contribute significantly to improve the formulation, implementation and impacts of policy in a wide range of areas such as economic, social, education and training, external relations and justice and home affairs policies and relating to official statistics. In addition, opportunities will be provided to address emerging socio-economic issues challenges as well as to undertake research on new or unforeseen policy needs.

Themes and activities

- **Growth, employment and competitiveness in a knowledge society:** developing and integrating research on the issues affecting growth, employment and competitiveness,

ranging from innovation, education and the role of scientific and other knowledge, to national institutional contexts.

- **Combining economic, social and sustainability 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:** demographic change including ageing and migration; lifestyles, work, families and well-being; and cultural interactions and issues of racism and intolerance.

- **Europe in the world: understanding changing** interactions and interdependencies between world regions and their implications for the regions concerned, especially Europe; and addressing emerging threats and risks without undermining human rights, freedom and well-being.

- **The citizen in the European Union:** in the context of the future development of the EU, 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 in terms of culture, institutions, history, languages and values.

  - **Socio-economic and scientific indicators:** their use in policy and its implementation and monitoring, the development of new indicators for this purpose and for the evaluation of research programmes.

  - **Foresight activities** on major science, technology and related socio-economic issues such as the future demographic trends and the globalization of knowledge and evolution of research systems, as well as of the future developments in and across major research domains and scientific disciplines.

9   Space and Security Research

Objective

Supporting a European Space Programme for applications such as GMES and satellite communications with benefits for citizens and the competitiveness of the European space industry. 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.

To develop the technologies needed to ensure security of the citizens in view of threats like emerging terrorism and organised crime, while respecting human values, ethics, privacy and liberties; to ensure optimal and concerted use of available technologies in the civil and defence area to the benefit of European internal security; and to stimulate the co-operation of providers and users in security solutions.

Space

Rationale

The GALILEO experience has demonstrated that EU participation can be fundamental in the definition and implementation of important space applications bringing innovative solutions to Europe's indispensable requirements. The EU can contribute to the better definition of common objectives based on user requirements and policy objectives; to the coordination of activities, so as to avoid duplications; and to the definition of standards. Public authorities and decision-makers represent important potential users and the European industry will also benefit from a well defined European Space policy. European level actions are also needed to support EU policy objectives, for example in the fields of transport, agriculture, fisheries, telecommunications, security, as well as ensuring that Europe is a respected partner in regional and international cooperation.

In the last 40 years, Europe has built up excellent technological competence. Sustaining a competitive industry (including manufacturers, service providers and operators) requires new research and technologies.

Space applications bring important benefits to the citizens (e.g. radio navigation, communication by satellite, earth observation for monitoring in case of natural disasters or humanitarian aid).

The public policy benefits of the below themes and activities will also be maximised, included additional support for new policy needs that may arise, for example: space based solutions in support of developing countries; and use of space-observation tools and methods to support developments in Community policies.

Themes and activities

- **Space-based applications at the service of the European Society[16]**

    – GMES: satellite-based monitoring systems relating to the management of the environment and security; use and delivering of GMES data and enhanced monitoring techniques.

    – Galileo: precise navigation and timing services for use in a range of sectors; efficient use of satellite navigation and support to the definition of second generation technologies.

    – Innovative satellite communication services for citizens and enterprises in application sectors encompassing civil protection, e-government, telemedicine, tele-education and generic users.

    – EU space based security capability and the development of technologies for reducing the vulnerability of space-based systems.

---

[16] Such R&D applications could extend, through specific support instruments, to the provision of access to (pre)operational services in duly justified cases.

- **RDT for strengthening space foundations**

  – Space transportation technology: research to preserve the independence and the competitiveness of the European space transportation sector.

  – Space sciences: structure of the universe, life in space, improved understanding of Planet Earth; new technology developments and applications.

  – Space exploration activities and related technology.

Security Research

<u>Rationale</u>

Security in Europe is a precondition of prosperity and freedom. The EU Security Strategy: 'A Secure Europe in better World', adopted by the European Council, addresses the need for a comprehensive security strategy encompassing both civil and defence-related security measures. With enlargement, new external sea borders have increased by about 5000 km and new land borders by 4000 km. Furthermore, security-related research is an important building block in realising an EU-wide area of justice, freedom and security[17], as endorsed by The Hague programme. It also supports the Common Foreign and Security Policy. Existing security-related research activities in Europe however clearly prove the fragmentation of efforts, the lack of critical mass of scale and scope and the lack of connections and interoperability.

Security research at EU level will therefore reinforce the competitiveness of European security industry. Security research will also contribute to developing technologies in support of the EU policies in areas such as transport, civil protection, energy and environment. In addition, Europe needs to improve the coherence of its efforts and overcome the dividing line between defence and civil research. European security research will therefore maximise the benefit of the multi-purpose aspects of technologies and will, in addition, complement other priorities of the Framework Programme.

The themes and activities are set out below. It is also important to be able to respond to new security threats and related policy needs that may arise, and support may be provided for this purpose, for example concerning the analysis and vulnerabilities assessment of such threats and the management of possible consequences and impact assessment.

<u>Themes and activities</u>

- **Border security:** Research will focus on technologies and capabilities to enhance surveillance of Europe's land and coastal borders.

- **Security of individuals:** Research will aim at delivering technology solutions for threat detection, prevention, identification, protection and neutralisation as well as containment of terrorist attacks and organised crime.

---

[17] Prevention, Preparedness, and response to terrorist attacks, COM 698 (2004), COM 698, 700, 701, 702; Solidarity/ CBRN programme.

- **Security of infrastructures and utilities:** Research will aim at analysing and securing existing and future critical infrastructure systems and services and will focus on activities related to established and future networked systems.

- **Restoring security in case of crisis:** Research will focus on technologies and tools 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 co-ordination and communication, distributed architectures and human factors.

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

- **Security Systems Integration and interoperability:** Research will focus on technologies and tools to enhance the interoperability of equipment, processes and services (e.g. in the field of information exchange and international law enforcement communication systems), as well as on the dependability, organisational aspects, protection of confidentiality and integrity of information.

- **Security and society:** Research will focus on socio-economic analyses, scenarios building and other activities related to the citizen perception of the security, ethics, protection of privacy and societal foresight, and on technologies that better enable safeguarding privacy and liberties.

- **Security Research Co-ordination and structuring:** Research will focus on co-ordination of European and international security research efforts and ensure synergies between civil, security and defence research, improve legal conditions, provide efficient institutional arrangements and encourage the optimal use of existing infrastructures.

II IDEAS

Objective

The objective of this new action is to enhance the dynamism, creativity and excellence of European research, and to stimulate the progress of European research at the frontier of knowledge. This will be done by supporting "investigator-driven" research projects carried out across all fields by individual teams in competition at European scale. Projects will be funded on the basis of proposals presented by the researchers on subjects of their choice, which will be evaluated on the sole criterion of excellence as judged by international peer review.

Rationale

At the forefront of research, basic science - the quest for fundamental understanding of phenomena - is intimately bound up with engineering and technology –developing techniques for manipulating nature. Creative "frontier" research, which spans these dimensions, is a key driver of wealth and social progress, because it opens new opportunities for scientific and technological advance, and is instrumental in creating the new knowledge leading to future applications and markets.

Despite many achievements and a high level of performances in a large number of fields, Europe is far from making the most of its research potential and resources, human and material, in this respect, and needs a greater capacity to generate knowledge.

A Europe-wide competitive funding mechanism for frontier research projects executed by individual teams is a key component of the European Research Area, completing other EU and national activities. It will help create the conditions necessary to ensure the emergence of new ideas and promising avenues, reinforcing the dynamism and attractiveness of Europe for the best researchers from both European and third countries, and for industrial investment.

By extending the scope of the EU research support to a new key area, and filling a gap in its range of support schemes, it will complete the other EU actions and programmes, as well as national activities in this field, helping broaden the European Research Area to the key domain of basic, "frontier", "investigator-driven" research.

Activities

Implemented independently of the thematic orientations of the other parts of the Framework Programme, this action will be shaped as to 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.

It will be organised in a way to maximise its European added value as regards both the nature of the support scheme and the population of researchers concerned, paying attention to young researchers and new groups as well as established teams.

Implementation – the European Research Council

The management of the EU activities in frontier research will be implemented under the guidance of a Scientific Governing Council, an independent body, established by Community legislation, and entrusted to a dedicated Executive Agency.

The Governing 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. Its members will be nominated by the Commission following an independent procedure for their identification.

The Governing Council will ensure that the activity operates in the interests of European research. It will, inter alia, oversee decisions on the research to be funded and act as guarantor of the quality of the activity from the scientific and operational perspective.

Its the tasks will cover, in particular, the development of the scientific programme and the scientific management principles and modalities of the frontier research initiative, the selection of proposals, as well as the monitoring and quality control of the programme's implementation. A key function will be the establishment of an annual work programme, which will translate the scientific needs and opportunities into an implementation programme.

The Executive Agency will be responsible for all aspects of implementation and programme execution, as provided for in the annual work programme.

The Agency will set up and implement the peer review and selection processes according to the principles established by the Governing Council. It will ensure the financial and scientific management of the grants. It will also provide scientific and administrative support to the Governing Council.

Funding

Under the "ideas" programme, individual projects will be funded on the basis of a grant providing a high proportion of the required resources, as well as administrative and budgetary flexibility. Recipients of the grant will be given discretion to manage the project in the best interests of the research they are conducting, taking account of interim findings and the uncertainties and risks involved.

Reporting and evaluation

Both the Governing Council and the Executive Agency will be accountable for their actions to the Commission and through it, to Council and Parliament, via an annual reporting process.

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.

III PEOPLE

Objective

Strengthening, quantitatively and qualitatively, the human potential in research and technology in Europe, by stimulating people to enter into the researcher's profession, encouraging European researchers to stay in Europe, and attracting to Europe researchers from the entire world. This will be done by putting into place a coherent set of "Marie Curie" actions, addressing researchers at all stages of their careers, from the initial research training to their life long learning and career development.

Rationale

Abundant and highly trained researchers are a necessary condition to advance science and to underpin innovation, but also an important factor to attract and sustain investments in research by public and private entities. Against the background of a growing competition at world level, the development of an open European labour market for researchers and the diversification of initial skills and career paths of researchers are crucial to support a beneficial "brain circulation", thereby limiting "brain drain" both within Europe and in a global setting.

Mobility, both trans-national and intersectoral, and the opening of research careers and academic positions at European scale, are a key component of the European Research Area and indispensable to increase European capacities and performances in research.

Activities

"Marie Curie" actions, will be organised in 5 action lines:

- **Initial training of researchers** with a view to improving their career perspectives, both in the public and private sectors, including through the broadening of the spectrum of their scientific and generic skills, and enhancing the attraction of young researchers to scientific careers.

  This will be implemented through Marie Curie Networks of which the main objective is to overcome fragmentation of and to strengthen at European level the initial training and career development of researchers. Members of the networks shall exploit their complementary competencies, through integrated training programmes. In addition to the recruitment of early-stage researchers, the networks will have the possibility of organising short training events open both to members of the networks and researchers from outside, as well as asking for the financing of academic chairs or equivalent positions in industry, with a view to transferring new knowledge and participating in the supervision of the training programme.

- **Life-long training and career development** aims at supporting the career development of experienced researchers, with a view to complementing individual or acquiring different skills and competencies or to enhancing inter/multidisciplinarity and/or inter-sectoral mobility. The activity will be designed in priority to help researchers with a particular need for additional/complementary competences and skills. It will also assist researchers to resume a career in research after a break or to integrate researchers into a long term research position in Europe, including in their country of origin, after a mobility experience, as well as the reintegration of researchers wishing to resume a career in Europe after a research period abroad. This action line will be implemented through both individual fellowships awarded directly at Community level and the co-financing of regional, national or international programmes.

- **Industry-academia pathways and partnerships:** while industry participation in all "Marie Curie Actions" will be encouraged, industry-academia pathways and partnerships is the subject of a dedicated action. Support will be provided to longer term co-operation programmes between organisations from academia and industry, in particular SMEs, aiming at increasing knowledge sharing in the frame of joint research partnerships, supported through the recruitment of experienced researchers from outside the partnership, by staff secondments between both sectors, as well as by the organisation of events enhancing the inter-sectoral knowledge scheme. SMEs will be specifically supported to be able to participate in industry-academia partnerships.

- **The international dimension,** addressed in terms of improving the quality of skills development for European researchers, increasing the quality of European research by attracting research talent from outside Europe, and fostering long standing and mutually beneficial research collaboration between researchers in Europe and other parts of the world. The first element will be addressed by outgoing international fellowships (with an in-built mandatory return phase), to enable European researchers to acquire new skills and knowledge. The second element will be

addressed through international incoming fellowships to attract highly qualified third country researchers to Europe. The third element will be implemented through partnerships to support the exchange of researchers and common initiatives between European organisations and organisations from countries neighbouring the EU and countries with which the EU has an S&T agreement. The action will include measures to counter the risk of "brain drain" from developing countries and emerging economies, as well as to increase contacts with European researchers working abroad.

- **Specific actions** to support the creation of a genuine European labour market for researchers. In this context a coherent set of accompanying actions is to be implemented, with a view to remove obstacles to mobility and to enhance the career perspectives of researchers in Europe. Furthermore, to address the public awareness of Marie Curie actions and its objectives, specific awards will be provided to the highest quality researchers participating in the scheme.

IV CAPACITIES

RESEARCH INFRASTRUCTURES

Objective

Optimising the use and development of the best research infrastructures existing in Europe, and helping to create in all fields of science and technology new research infrastructures of Pan-European interest needed by the European scientific community to remain at the forefront of the advancement of research, and able to help industry to strengthen its base of knowledge and its technological know how.

Rationale

Research infrastructures play an increasing role in the advancement of knowledge and its exploitation. Radiation sources, data banks and data bases in genomics and molecular biology, systems of imaging for medical purposes and the study and development of new materials, are at the core of research. They are expensive, need a broad range of expertise to be developed, and should be used and exploited by a large community of scientist and customer industries on a European scale.

The development of a European approach with regard to research infrastructures, including *e*-infrastructures, and the carrying out of activities in this area at Union level, can make a significant contribution to boosting European research potential and its exploitation.

The EU can and should play a catalysing and leveraging role by helping to ensure wider and more efficient access to -and use of- the infrastructures existing in the different Member States, by stimulating the development of these infrastructures in a coordinated way and by fostering the emergence of new research infrastructures of Pan-European interest in the medium to long term.

<u>Activities</u>:

Activities carried out in this field will be executed in the whole field of science and technology. They will be implemented in close cooperation with the activities taking place in the thematic areas to ensure that all the actions undertaken at European level in the EU framework respond to the needs for research infrastructures in their respective area.

These activities will be the following:

- **In support of existing research infrastructures**

    – *Support to Transnational Access* to ensure that European researchers may have access to the best research infrastructures to conduct their research, irrespective of the location of the infrastructure;

    – *Integrating Activities* to structure better, on a European scale, the way research infrastructures operate in a given field and promote their coherent use and development;

    – *Support to a European research e-infrastructure* by fostering high-capacity and high-performance computing and communication infrastructures, enhancing their global relevance and increasing the level of trust and confidence, building on the achievements of GEANT and Grid infrastructures.

- **For new research infrastructures**

    – *Support to the construction of new infrastructures* to promote the creation of new research infrastructures, based on the work done by the ESFRI[18], on the basis of article 171 of the Treaty.

    – *Support to design studies*, through a bottom-up approach, to promote the creation of new research infrastructures by funding exploratory awards and feasibility studies for new infrastructures.

Infrastructures projects proposed for funding in this respect will be identified on the basis of a series of criteria among which in particular:

    – Capacity to offer a service to users from the scientific community at European level;

    – Relevance at international level;

    – Technological feasibility;

---

[18] The European Strategy Forum on Research Infrastructures (ESFRI) was launched in April 2002. ESFRI brings together representatives of the 25 EU Member States, appointed by Ministers in charge of Research, and a representative of the European Commission. The countries associated with the Framework Programme for Research were invited to join in 2004.

–   Possibilities for European partnership and commitment of major stakeholders;

–   Construction and operating costs evaluated.

RESEARCH FOR AND BY SMEs

Objectives

Strengthening the innovation capacity of European SMEs and their contribution to the development of new technology based products and markets by helping them outsource research, increase their research efforts, extend their networks, better exploit research results and acquire technological know how.

Rationale

SME's are at the core of European industry. They should be a key component of the innovation system and in the chain of transformation of knowledge into new products, processes and services. Faced with an increasing competition in the internal market and globally, European SMEs need to increase their knowledge and research intensity, expand their business activities on larger markets and internationalize their knowledge networks. Most Member states actions relevant to SMEs do not encourage and support trans-national research cooperation and technology transfer. Actions at EU level are necessary to complement and enhance the impact of actions undertaken at national and regional level.

Activities

- **Specific support to research for SMEs or SME Associations**

  Specific actions in support to SME's will be significantly strengthened. These actions are specifically conceived to support SMEs or SME associations in need of outsourcing research to universities and research centres: mainly low to medium tech SMEs with little or no research capability. Research intensive SMEs who need to outsource research to complement their core research capability may also participate. Actions will be carried out in the entire field of science and technology. Increased financial means will be allocated through two schemes:

  –   *Research for SMEs:* To support small groups of innovative SMEs to solve common or complementary technological problems

  –   *Research for SME associations:* To 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.

- **Actions and measures to encourage the participation SMEs in Framework Programme activities.**

  Although numerous SMEs, whether research intensive or not, take part in the framework programme, the further simplification and rationalisation of administrative and financial

procedures, particularly heavy and detrimental for them, will facilitate and enhance their effective involvement in the various EU research actions.

In addition, the research needs and perspective of SMEs will be taken into account in defining research topics and implementing the activities carried out in the thematic areas. Furthermore, the Community will support: actions undertaken by trans-national networks of intermediary organisations to help SMEs to participate in the Framework Programme and national schemes based on the previous Community "exploratory awards" action to support SMEs and SME associations in the preparation of proposals.

REGIONS OF KNOWLEDGE

Objectives

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.

Rationale

Regions are increasingly recognised as important players in the continent's research and development landscape. Research policy and activities at regional level often rely on the development of "clusters" associating public and private actors from every level of the chain of research and innovation.

The *Pilot Action* on "*Regions of Knowledge*" demonstrated the dynamic of this evolution and the necessity to support and encourage the development of such structures.

The actions undertaken on this theme will enable European regions to strengthen their capacity for investing in RDT and carry out research activities, while maximising their potential for a successful involvement of their operators in European research projects.

Activities

The new *Regions of Knowledge* initiative will involve and put together all research actors: universities, research centres, industry, public authorities (regional councils or regional development agencies). Projects will cover joint analysis of common issues to research driven regional clusters (in coordination with other activities on the broader issue of regional innovation clusters) and the elaboration of a set of instruments to address them in concrete research activities. They will comprise measures aiming at encouraging a better exploitation of research results and improving access to sources of research funding as well as inducing RDT spill-overs to the regional economies. These activities will be implemented in close relationship with the EU regional policy.

Independently of the specific activity of "Regions of Knowledge" major synergies will be sought between the Framework Programme and the Structural Funds. In the case of regions eligible to the Structural Funds, in particular the "Convergence" regions, measures will be taken to ensure complementarity and synergy between activities related with research,

development and innovation supported by the Structural Funds. Mechanisms to encourage the use of Structural Funds in this field and to maximise their use in synergy with the Framework Programme will be implemented or increasingly used where there exists, such as the possibility of additional funding ("Bonus") from the Structural Funds for projects supported by the Framework Programme.

RESEARCH POTENTIAL

Objective

Stimulating the realisation of the full research potential of the enlarged Union by unlocking and developing the potential of research groups in the Convergence Regions of the European Union, and helping them to strengthen the capacities of their researchers to take part successfully in research activities of international level in European collaboration.

Rationale

Europe doesn't fully exploit its intellectual and research potential, in particular the one present in many less advanced regions remote from the European core of research and industrial development. In order to help the researchers and institutions of these regions to contribute to the overall European research effort, while taking advantage of the knowledge and experience existing in other regions of Europe, a special effort is needed, aiming at establishing the conditions allowing them exploiting their potential. A specific action undertaken on this theme will help fully realize the European Research Area in the enlarged Union.

Activities

The action in this domain will comprise support to:

- Transnational two-way secondments of research staff, whether at an advanced stage or a more advanced level between the selected centres in the Convergence Regions, and one or more partner organisations; the recruitment by the selected centres of incoming experienced researchers from other EU countries;

- The acquisition and development of research equipment and the development of a material environment enabling a full exploitation of the intellectual potential present in the participating research institutions;

- 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.

- "Evaluation facilities" through which any research centre in the qualifying regions can obtain an international independent expert evaluation of the level of their overall research quality and infrastructures.

SCIENCE IN SOCIETY

Objective

With the view of building an effective and democratic European Knowledge society, the aim is to stimulate the harmonious integration of scientific and technological endeavour, and associated research policies in the European social web, by encouraging at European scale reflection and debate on science and technology, and their relation with society and culture.

Rationale

The influence of science and technology on our daily lives becomes ever more profound. Products of the social activity and shaped by social and cultural factors, science and technology remain nevertheless a remote domain far from the daily concerns of a large part of both the public and policy decision makers, subject of misunderstandings and unfounded hopes and fears. Contentious issues relating to emerging technologies should be addressed by society on the base of well informed debate leading to well based choices and decisions.

Activities

The substantial and integrated initiative undertaken in this field will comprise support to:

- A broader joint engagement from both researchers and the public at large, including organised civil society, on science-related questions, to anticipate and clarify political and ethical issues;

- The strengthening and improvement of the European science system: the question of scientific advice and expertise; the future of scientific publications; safeguards for scientific domains open to misuse; frauds and trust and "self regulation" options ; the role and place of women in science and research;

- Reflection and debate on science and technology and their place in society, drawing on history, sociology and philosophy of science and technology;

- The creation of an environment which triggers curiosity for science in young people, and which provides fair and rewarding career opportunities for women and men by bolstering science education at all levels and promoting interest and participation in science among young people;

- The reflection on the role of university and the engagement of universities in the necessary reforms to face the challenges of globalisation;

- An improved communication between the scientific world and the wider audience of policy-makers, the media and the general public by helping scientists better communicate their work and supporting scientific information and media;

These activities will take the form of in particular research projects, studies, networking and exchanges, public events and initiatives, prizes, surveys and data collection. In many cases they will be imply international partnerships with organisations from third countries.

COHERENT DEVELOPMENT OF RESEARCH POLICIES

The aim is to increase the effectiveness of Europe's research system by improving framework conditions and increasing the leverage effect of public spending on private investment. This will be achieved by enhancing the effectiveness and coherence of national and EU research policies and their articulation with other policies (e.g. education, innovation, competition, intellectual property, public procurement, fiscal, financial markets).

Activities that will be supported include:

- Monitoring and analysis of research related public policies and industrial strategies to underpin the formulation, development, implementation and evaluation of research policies, including the development of indicators;

- Coordination of research policies including cooperation initiatives undertaken by several Member States on issues of common interest (e.g. industry-university relations, research clusters, knowledge management and dissemination, creation of spin-offs and their growth, fiscal measures and other financing instruments, policy mixes)

- Preparation of Community initiatives (legislations, recommendations, guidelines) to improve the coherence and impact of Member States policies.

They will be implemented through studies, expert groups, seminars, conferences, information systems, and where appropriate calls for proposals.

SPECIFIC ACTIVITIES OF INTERNATIONAL CO-OPERATION

In addition to the thematic activities of international co-operation carried out under the "Cooperation" part of the Framework Programme "horizontal" support actions and measures will be implemented with a view to strengthen the scientific and technological partnership between the EU and third countries, and to helping the less advanced of those countries to develop and strengthen their research capacities.

NON NUCLEAR ACTIVITIES OF THE JOINT RESEARCH CENTRE

Objective

Providing scientific and technical support to the policy making process, while ensuring stability of support to the implementation of existing policies and adapting to changing policy demands.

Rationale

The JRC's position combined with its technical expertise, experience and neutrality allow it to facilitate communication and consensus building between stakeholders (industry associations, environmental action groups, Member States' competent authorities, other research centres etc.) and policy makers, especially at the EU level. Through S&T support the JRC helps to make EU policy process by making it more effective, transparent and based on sound science.

While the JRC is involved in all stages of the policy cycle, it has an increasing involvement in the early stages which requires delivering appropriate expertise in thematic areas as well as prospective technological economical or scenario modelling and in the implementation phase of the established regulatory framework. In specific areas, the JRC acts as a Community Reference Laboratory. Furthermore, the JRC is more and more involved in pre-operational or operational services to support Community in security related issues. The priorities for the JRC will be in fields which are strategically important for the Community and where the JRC's input can make a difference.

Importantly, the usefulness and credibility of the JRC in its support to EU policies is closely linked to the quality of its scientific expertise and its integration in the international scientific community. The JRC will therefore continue investing in research and participating in indirect actions in all its aspects with emphasis on common scientific reference systems, networking, training and mobility, research infrastructure and participation in Technology Platforms and co-ordination instruments where it has the relevant expertise to produce added value.

Themes and activities

Scientific and technical support to EU policies will be delivered in areas linked to environment and natural resources, agriculture, climate change, food, energy, chemicals, alternative methods, information technologies, reference methods and materials, biotechnology, risks and hazards and sustainable development. The detailed implementation plan for those activities will be adjusted to the needs of the relevant stakeholders. Growth will be in the areas of key concern for the Union:

- **Prosperity in a knowledge-intensive society**

    – To develop and use advanced econometric and statistical tools in the context of policy definition and monitoring like the follow-up of the Lisbon agenda, the implementation of the Internal Market and the Research and Education Policies.

- To develop indicators, establish threshold values, provide reference materials and measurements, and to develop commonly agreed models to support a new balance between regulation and sustainability in order to decrease the burden of regulation in a responsible way.

- **Solidarity and responsible management of resources**

  - To become a recognised S&T reference centre at the Community level on sustainable agriculture, including food quality, spatial management and cross-compliance.

  - To develop a more effective scientific advice process with respect to the Common Fisheries Policy as well as improve technologies to monitor compliance.

  - To enhance the provision of harmonised European geo-referenced data and spatial information systems in order to improve environmental information for EU reporting (INSPIRE), and to continue developing new approaches to global environmental and resources monitoring (support to GMES).

- **Security and freedom**

  - To develop activities are planned in emerging issues related to terrorism, organised crime and anti-fraud, border security and prevention of major risks, in relation with law enforcement agencies in the Members States, with Europol and EU services responsible for Internal Security.

  - To pursue the setting up of a community integrated Environment and Health information system for identifying and monitoring interactions between health and environment issues.

  - To extend support to the Community response to natural and technological disasters.

- **Europe as world partner**

  - To strengthen support for EU external policies in specific areas such as in external aspects of internal security (political crises, energy, trans-border challenges such as non-proliferation, terrorism, migration, and organised crime), environment (climate change impacts, land cover change, desertification), development cooperation, and humanitarian aid.

  - To promote the integration of New Member States and Candidate Countries in the JRC activities to the level currently enjoyed by the 15 Member States, including also helping neighbouring countries in the implementation of their science-based policies.

ANNEX II

STRUCTURE AND BUDGET

ANNEX III

FUNDING SCHEMES

The activities supported by the 7th Framework Programme will be funded through a range of "Funding schemes". These schemes will be used, either alone or in combination, to fund the activities carried out as part of the different categories of actions implemented throughout the Framework Programme.

The decisions for specific programmes, work programmes and calls for proposals will mention, as and when appropriate:

- The type(s) of scheme(s) used to implement the different categories of actions;

- The categories of participants (research organisations, universities, industry) which can benefit from it;

- The types of activities (research, development, demonstration, training, dissemination, transfer of knowledge and other related activities) which can be funded through each of them.

In the actions where different funding schemes can be used, the work programmes may specify the funding scheme to be used for the topic on which proposals are invited.

The funding schemes are the following:

1) To support actions which are implemented on the basis of calls for proposals:

- **Collaborative projects**

    Support to research projects carried out by consortia with participants from different countries, aiming at developing new knowledge, new technology, products or common resources for research. The size, scope and internal organisation of projects can vary from field to field and from topic to topic. Projects can range from focused research actions to a combination of research and other related activities.

- **Networks of Excellence**

    Support to joint research programmes implemented by a number of research institutions integrating their activities in a given field, carried out by research teams in the framework of longer term co-operation. The implementation of these joint programmes will require a formal commitment from the institutions integrating part of their resources and their activities.

- **Individual projects**

    Support to projects carried out by individual research teams. This scheme will mainly be used to support investigator-driven "frontier" research projects funded in the framework of the European Research Council.

- **Coordination/support actions**

    Support to activities aimed at coordinating or supporting research (networking, exchanges, studies, conferences, etc).

- **Research projects for third parties (SMEs)**

    Support to research projects performed by universities or research centres for third parties, mainly SMEs or associations of SMEs.

- **Fellowships**

    Support to individual researchers. They will be mainly used for the implementation of the Marie Curie actions.

2) To support actions implemented directly <u>on the basis of decisions by the Council and the European Parliament</u>[19], on the basis of a proposal from the Commission, taking the form of a contribution from the Community to multi-financed large-scale initiatives.

This scheme will be used to support:

- The contribution from the Community to the joint implementation of well identified national research programmes, on the basis of Article 169 of the Treaty. This joint implementation will require the establishment or existence of a specific implementation structure. Community financial support will be provided subject to the definition of a financing plan based on formal commitments from national authorities.

- The contribution from the Community to the implementation of Joint Technology Initiatives to realise objectives that cannot be achieved through the funding schemes implemented through calls for proposals. Joint Technology Initiatives will mobilise a combination of funding of different nature and from different sources, private and public, European and national. This funding can take different forms and can be allocated or mobilised though a range of mechanisms: support from the Framework Programme, loans from the European Investment Bank, support to risk capital. They will be decided on the basis of Article 171 of the Treaty, or through the specific programmes. Community support will be provided subject to the definition of an overall blueprint of financial engineering, based on formal commitments from all parties concerned.

- The contribution from the Community to the development of new infrastructures of European interest. This contribution will be decided on the basis of Article 171 of the Treaty or through the specific programmes. The development of new infrastructures will mobilise a combination of funding of different nature and origin: national funding, Framework Programme, Structural funds, loans from the European Investment Bank and others. Community support will be provided

---

[19] Or by the Council in consultation with the European Parliament

subject to the definition of an overall financial plan based on a formal commitment from all parties concerned.

The Community will implement the financial instruments in compliance with the provisions of the regulation adopted pursuant to Article 167 of the Treaty, the Community framework for state aid to research and development, as well as international rules in this area. In compliance with this international framework, it will be necessary to be able to adjust the scale and form of financial participation on a case-by-case basis, in particular if funding from other public sector sources is available, including other sources of Community financing such as the European Investment Bank (EIB) and European Investment Fund (EIF).

In addition to direct financial support to participants, the Community will improve access to EIB loans by providing appropriate support to the Bank through the constitution of a "Risk-Sharing Finance Facility". The funds shall be used by the Bank in addition to its own funds to cover the provisioning and capital allocation for its loan financing. This mechanism will enable broader EIB lending to EU RTD actions, in particular the support to joint technology initiatives and new research infrastructures, and possibly to other European RTD collaborative projects.

In the case of regions lagging in development ("Convergence regions"), when a project receives the maximum intensity of Community financial support authorised, an additional contribution may be provided to any participant in that project established in a convergence region from the Structural Funds. In the case of participation of entities from the candidate countries, an additional contribution from the pre-accession financial instruments could be granted under similar conditions.

THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Atomic Energy Community, and in particular Article 7 thereof,
Having regard to the proposal from the Commission[20],
Having regard to the opinion of the European Parliament[21],
Having regard to the opinion of the European Economic and Social Committee[22],
Whereas:

1. A framework programme covering all research activities, including demonstration and training activities in the field of nuclear energy, to be implemented by means of research and training programmes may be adopted pursuant to Article 7 of the Treaty.

2. On … 2005 the Commission submitted the conclusions of the external assessment of the implementation and results of the Community activities carried out in the five years preceding that assessment, accompanied by its observations.

3. Joint national and European efforts in the area of research and training are essential to promote and ensure economic growth and citizen's wellbeing in Europe.

4. The seventh framework programme complements other Community actions in the area of the research policy that are necessary for the implementation of the Lisbon strategy, alongside in particular those on education, training, industry, employment, and environment.

5. This framework programme builds on the achievements of its predecessor towards the creation of the European Research Area, and carries them further towards the development of the knowledge economy and society in Europe.

6. It is important for the overall coherence of the research efforts carried out in the context of the European Research Area that the seventh framework programme has effectively the same duration as the seventh framework programme of the European Community for research, technological development and demonstration activities for the period 2007-2013.

7. The Commission Green Paper 'Towards a European strategy for energy supply' highlights the contribution of nuclear power in reducing emissions of greenhouse gases and in reducing Europe's dependence on imported energy.

---

[20]   OJ C […], […], p. […].

[21]   OJ C […], […], p. […].

[22]   OJ C […], […], p. […].

8. With reference to the Council Decision of 26th November 2004 amending the directives of negotiations on ITER[23], the realisation of ITER in Europe, in a broader approach to fusion energy, will be the central feature of the activities on fusion research carried out under the seventh Framework Programme

9. Research activities carried out within the seventh framework programme should respect fundamental ethical principles, including those which are reflected in Article 6 of the Treaty on European Union and in the Charter of fundamental rights of the European Union.

10. Implementation of the seventh framework programme may give rise to the setting up of joint undertakings within the meaning of Title II, Chapter 5 of the Treaty.

11. It is important to ensure sound financial management of the seventh framework programme and its implementation in the most effective and user-friendly manner possible, as well as ease of access for all participants.

---

[23] Not published in the OJ.

HAS DECIDED AS FOLLOWS:

Article 1

1. A multiannual framework programme for nuclear research and training activities, hereinafter referred to as the "seventh framework programme" is hereby adopted for the period 2007 to 2011.

Research activities supported by this framework programme in the context of the European Research Area should be coordinated with those under the seventh framework programme of the European Community for research, technological development and demonstration activities for the period 2007-2013. For this reason, this framework programme will, unless extenuating circumstances arise, be renewed for the period 2012-2013, in accordance with the foreseen legislative procedure.

2. The seventh framework programme shall comprise Community research, technological development, international cooperation, dissemination and exploitation activities as well as training under the following headings:

- fusion energy research,

- nuclear fission and radiation protection,

- nuclear activities of the Joint Research Centre.

3. Annex I sets out the scientific and technological objectives and the related priorities and indicates the broad lines of the activities envisaged.

Article 2

1. The overall amount for the implementation of the seventh framework programme for the period 2007 to 2011 shall be EUR … million and EUR … million for the period 2012-2013. The proportion assigned to each of the activities is fixed in Annex II.

2. The instruments to be used in this framework programme and the general financial rules governing its implementation are identified in Annex III.

3. The detailed rules for financial participation by the Community shall be governed by the Rules for Participation that will be adopted for this framework programme.

Article 3

All research activities carried out under the seventh framework programme must be carried out in compliance with fundamental ethical principles.

Article 4

In the context of the annual report to be submitted by the Commission pursuant to Article 7 of the Treaty, the Commission shall report in detail on the implementation of the seventh framework programme, and in particular progress towards achieving its objectives and meeting its priorities (as set out under each heading of Annex I), and on financial aspects and its management.

Article 5

The seventh framework programme shall be implemented through specific programmes on research and training. These programmes shall establish precise objectives and detailed rules for their implementation.

Article 6

1. The Commission shall carry out, with the assistance of external experts, a mid term assessment of this framework programme and its specific programmes on the quality of the research activities under way, progress towards the objectives set and the scientific and technical results achieved.

2. Within two years of the adoption of this framework programme, the Commission shall have carried out an external assessment by independent experts of the rationale, implementation and achievements of the previous research framework programme.

The Commission shall communicate the conclusions thereof, accompanied by its observations, to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions.

Done at Brussels, […]

For the Council
The President
[…]

<center>**ANNEX I**</center>

<center>**SCIENTIFIC AND TECHNOLOGICAL OBJECTIVES, THEMES AND ACTIVITIES**</center>

INTRODUCTION

THE 7th EURATOM Research Framework Programme 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.

FUSION ENERGY RESEARCH

<u>Objective</u>

Developing 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.

<u>Rationale</u>

There are serious shortcomings in Europe's energy supply with respect to near, medium, and long-term considerations. In particular, measures are needed to address the issues of security of supply, climate change, and sustainable development, while ensuring that future economic growth is not threatened.

Fusion has the potential to make a major contribution to the realisation of a sustainable and secure supply for the EU in a few decades from now. Its successful development would provide energy which is safe, sustainable and environmentally friendly. The long-term goal of European fusion research, embracing all the fusion activities in the Member States and associated third countries, is the joint creation of prototype reactors for power stations which meet these requirements, and are economically viable.

The strategy to achieve the long-term goal 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 dynamic programme of supporting R&D for ITER and for the developments in fusion materials, technologies and physics required for DEMO. This would involve European industry, the fusion Associations and third countries, in particular Parties to the ITER Agreement.

<u>Themes and activities</u>

- **The realisation of ITER**

  This includes activities for the joint realisation of ITER (as an international research infrastructure), in particular for 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 and support to the project during construction.

- **R&D in preparation of ITER operation**

  A focused physics and technology programme will exploit the facilities and resources in the fusion programme, including JET. It will 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**

  This entails the vigorous 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. It will include irradiation testing and modelling of materials, studies of the DEMO conceptual design, and studies of the safety, environmental and socio-economic aspects of fusion energy.

- **R&D activities for the longer term**

  The activities will include further development of improved concepts for magnetic confinement schemes with potential advantages for second generation Fusion power stations beyond DEMO (focussed on the completion of the construction of the W7-X stellarator device), theory and modelling aimed at a comprehensive understanding of the behaviour of fusion plasmas and co-ordination, in the context of a keep-in-touch activity, of Member States' civil research activities on inertial confinement.

- **Human resources, education and training**

  In view of the immediate and medium term needs of ITER, and for the further development of fusion, initiatives aimed at ensuring that adequate human resources will be available, in terms of numbers, range of skills and high level training and experience will be pursued.

- **Infrastructures**

  The construction of the international fusion energy research project ITER will be an element of the new research infrastructures with a strong European dimension.

NUCLEAR FISSION AND RADIATION PROTECTION

Objective

Establishing a sound scientific and technical basis for the safe 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.

Rationale

Nuclear power currently generates one third of all electricity consumed in the EU and is the most significant source of carbon-free base-load electricity presently available. The European nuclear sector as a whole is typified by cutting-edge technology and provides highly skilled employment for several hundred thousand people. As an indigenous and dependable source of energy, nuclear power contributes to the EU's independence and security of supply, with more advanced nuclear technology offering the prospect of significant improvements in efficiency and use of resources, at the same time ensuring even higher safety standards and producing less waste than current designs.

There are, however, important concerns that affect the continued use of this energy source in the EU. The key issues are operational reactor safety and management of long-lived waste, both of which are being addressed through continued work at the technical level, though allied political and societal inputs are also required. In all uses of radiation, throughout industry and medicine alike, the overriding principle is the protection of man and the environment. All thematic domains to be addressed here are characterised by an overriding concern to ensure high levels of safety. Similarly there are clearly identifiable needs throughout nuclear science and engineering relating to availability of research infrastructures and expertise. In addition, the individual technical areas are linked by key cross-cutting topics such as the nuclear fuel cycle, actinide chemistry, risk analysis and safety assessment and even societal and governance issues.

Aiming at identifying or further exploring new scientific and technological opportunities and/or responding in a flexible way to new policy needs that arise during the course of the Framework Programme.

Themes and activities

- **Management of radioactive waste**

  Research on deep geological disposal of spent fuel and long-lived radioactive waste to establish a sound scientific and technical basis for demonstrating the technologies and safety, and to underpin the development of a common European view on the main issues related to the management and disposal of waste. 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), taking into account new challenges such as life-time extension and development of new advanced safety assessment methodologies (both the technical and human element), and to assess the potential and safety aspects of future reactor systems in the short and medium term, thereby maintaining the high safety standards already achieved within the EU.

- **Radiation protection**

  Research, in particular on the risks from low doses, on medical uses and on the management of accidents, to provide the scientific basis for a robust, equitable and

socially acceptable system of protection that will not unduly limit the beneficial and widespread uses of radiation in medicine and industry (including the generation of nuclear energy). Research to minimise the threat posed by nuclear and radiological terrorism and mitigate its impact.

- **Infrastructures**

  To support the availability of research infrastructures such as material test reactors, underground research laboratories and radiobiology facilities and tissue banks, necessary to maintain high standards of technical achievement, innovation and safety in the European nuclear sector.

- **Human resources and training**

  To support the retention and further development of scientific competence and human capacity in order 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

Objective

Providing 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.

Rationale

The Joint Research Centre is supporting the objectives of the European strategy for energy supply keeping the nuclear option open in order to reduce the energy dependence and to reach the Kyoto objectives. The EU has a recognised competence in many aspects of nuclear technology, and this is built on a solid basis of past successes in the domain. The usefulness of the JRC in its support to EU policies and in its contribution to the new trends in nuclear research are based on its scientific expertise and its integration in the international scientific community. On the one hand the JRC has competent staff and state-of-the-art facilities to carry out recognized scientific/technical work; and on the other hand it supports the policy of the EU to maintain basic competencies and expertise for the future by training young scientists and fostering their mobility. New demand has emerged in particular in the external relations and security related policies (control of illicit trafficking of nuclear material, the radioactivity threat of dirty bombs, measurements in the environment). In these cases, in-house and secure information/analyses/systems are needed which cannot always be obtained on the market.

The nuclear activities of the JRC aim to satisfy the R&D requirements based on customers' demand and to support both Commission and Member States in the field of safeguards and non-proliferation, waste management, safety of nuclear installation and fuel cycle, radioactivity in the environment and radiation protection. The objective of this programme is to develop and assemble knowledge, to provide input to the debate on nuclear energy production, its safety and reliability, its sustainability and control, its threats and challenges and its future exploitation potential, including innovative/future reactor systems.

<u>Themes and activities</u>

- **Nuclear Waste Management and Environmental Impact**

  – To understand the nuclear fuel processes (from production of energy to waste storage) which is underpinned by basic actinides research activities and constitutes the "academic window" of the JRC activities in the field.

  – To develop effective solutions for the management of high level nuclear waste following the two major options (direct storage or partitioning and transmutation): obtaining data concerning the long-term behaviour of spent fuel and the integrity of the engineered waste packages; providing neutron data, developing methods and materials for the partitioning, transmutation and conditioning.

- **Nuclear Safety**

  – To work on existing as well as on new fuel cycles. In particular, the JRC will pursue the development of fuels in order to improve fuel safety and reduce civil and military stockpiles of plutonium.

  – To perform research on reactor safety on the aspects related to long term operation of both Western and Russian reactor types as well as on new reactor design.

  – To contribute and to co-ordinate the European contribution to the Generation IV International Forum R&D initiative, in which the best world-wide research organisations are involved.

- **Nuclear Security**

  – To support the implementation of the Euratom Treaty, with, in particular, a focus on the control of the fuel cycle facilities (enrichment, fuel fabrication and reprocessing) emphasising the back end of the fuel cycle.

  – To monitor the radioactivity in the environment, another obligation of the Euratom Treaty.

  – To support the IAEA, in particular the implementation of the additional protocol by developing appropriate tools aimed at reaching real-time follow-up, including the use of improved declaration systems and secure communications, and implementation of integrated safeguards.

  – To prevent the diversion of nuclear material or theft of radioactive sources associated with illicit trafficking of such material.

ANNEX II

STRUCTURE AND BUDGET

ANNEXE III

INSTRUMENTS

Subject to the rules for participation established for the implementation of the 7th Framework Programme, the EU will support research and technological development activities, including demonstration activities in the specific programmes trough a range of "instruments".

1.   INSTRUMENTS IN FUSION ENERGY

In the field of fusion energy research, the particular nature of the activities in the area necessitates the implementation of specific arrangements. The activities undertaken will be carried out on the basis of procedures set out for:

The Contracts of Association, between the Commission and Member States or fully Associated Third States or entities within Member States or fully Associated Third States which provide for the execution of part of the EU fusion energy research programme according to Article 10 of the Treaty;

The European Fusion Development Agreement (EFDA), a multilateral agreement concluded between the Commission and organisations in, or acting for, Member States and Associated States providing *inter alia* the framework for further research on fusion technology in associated organisations and in industry, use of the JET facilities and the European contribution to international cooperation;

The European Joint Undertaking (based on the provisions of Article 45-51, Title II of Chapter V of the Treaty) for ITER;

International agreements between Euratom and third countries covering activities in the field of fusion energy research and development, in particular the ITER Agreement;

Any other multilateral agreement concluded between the Community and associated organisations, in particular the Agreement on Staff Mobility

Cost-sharing actions to promote and contribute to fusion energy research with bodies in the Member States or the States associated with the Euratom framework programme in which there is no Contract of Association.

In addition to the above instruments, actions to promote and develop human resources, fellowships, integrated infrastructures initiatives as well as specific support actions may be undertaken in particular to coordinate fusion energy research, to undertake studies in support of these activities, to support publications, information exchange; and training in order to promote technology transfer.

2.   INSTRUMENTS IN OTHER FIELDS

Instruments in other fields than fusion are those mentioned in ANNEX III of the proposal for the European Community 7th Research Framework Programme