II

(Acts whose publication is not obligatory)

COUNCIL

COUNCIL DECISION

of 30 September 2002

adopting a specific programme for research, technological development and demonstration: 'Integrating and strengthening the European Research Area' (2002-2006)

(2002/834/EC)

THE COUNCIL OF THE EUROPEAN UNION,

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

Having regard to the proposal from the Commission [1],

Having regard to the Opinion of the European Parliament [2],

Having regard to the Opinion of the Economic and Social Committee [3],

Whereas:

(1) In accordance with Article 166(3) of the Treaty, Decision No 1513/2002/EC [4] of the European Parliament and the Council concerning the sixth framework programme of the European Community for research, technological development and demonstration activities, contributing to the creation of the European Research Area and to innovation (2002-2006) (hereinafter referred to as 'the framework programme') is to be implemented through specific programmes that define detailed rules for their implementation, fix their duration and provide for the means deemed necessary.

(2) The framework programme is structured in three main blocks of activities, 'Focusing and integrating Community research', 'Structuring the European Research Area', and 'Strengthening the foundations of the European Research Area', the first and the third of which, as regards indirect actions, should be implemented by this specific programme.

(3) The rules for the participation of undertakings, research centres and universities and for the dissemination of research results, for the framework programme (hereinafter referred to as 'the rules for participation and dissemination') should apply to this programme.

(4) The importance of the new instruments (integrated projects and networks of excellence) is recognised as being an overall priority means to attain the objectives of critical mass, management simplification and European added value contributed by Community research in relation to what is already undertaken at national level, and of the integration of the research capacities. A smooth transition from the modalities used in the Fifth Framework Programme to those used in the Sixth Framework Programme will be ensured. The new instruments will be used from the start of the Sixth Framework Programme in each theme and, where deemed appropriate, as a priority means, while maintaining the use of specific targeted research projects and coordination actions. They should enable personnel and administrative expenses to be reduced to a maximum of 6,0 % of the overall amount deemed necessary for the implementation of the programme. In 2004 an evaluation will be undertaken by independent experts of the efficiency of each of these instruments in the execution of the framework programme.

(5) As provided for under Article 170 of the Treaty, this programme is open to the participation of countries having concluded the necessary agreements to this effect, and is also open on the project level, and on the basis of mutual benefit, to the participation of entities from third countries and of international organisations for scientific cooperation.

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(1) OJ C 118 E, 30.7.2002, p. 1.
(2) Opinion delivered 12 June 2002 (not yet published in the Official Journal).
(3) OJ C 221, 17.9.2002, p. 97.
(4) OJ L 232, 29.8.2002, p. 1.

(6) In implementing this programme, emphasis should be given to promoting the strategy of sustainable development; to the mobility of researchers, following the Commission communication 'A mobility strategy within the European Research Area'; to innovation; to the needs of SMEs and encouraging their participation, as well as to international cooperation activities with third countries and international organisations. Special attention should be paid to the candidate countries.

(7) Research activities carried out within this programme should respect fundamental ethical principles, including those which are reflected in the Charter of Fundamental Rights of the European Union.

(8) Following the Commission Communication 'Women and Science' and the Resolutions of the Council of 20 May 1999 ([1]) and 26 June 2000 ([2]) and the Resolution of the European Parliament of 3 February 2000 ([3]) on this theme, an action plan is being implemented in order to reinforce and increase the place and role of women in science and research, and further enhanced action is needed. Gender aspects in research will be taken into account in implementing this programme.

(9) To achieve the full potential of this programme, the active engagement of all relevant parties, in particular the Member States, associated candidate countries and other associated states, should be encouraged in a common endeavour to step up the coordination of research activities carried out in Europe, including through the opening up and networking of national programmes and the free circulation of information pertaining to research activities at all levels.

(10) This programme should be implemented in a flexible, efficient and transparent manner, taking account of relevant interests, in particular of the scientific, industrial, user and policy communities; the research activities carried out under it should be adapted where appropriate to the needs of Community policies and to scientific and technological developments.

(11) The participation of the outermost regions in Community RTD action through appropriate mechanisms adapted to their particular situation should be facilitated.

(12) Participation in the activities of this programme will be encouraged through publication of the necessary information on content, conditions and procedures, to be made available in a timely and thorough manner to potential participants, including those from the associated candidate countries and other associated countries. Specific activities will be undertaken in support of participation of scientists and institutions from developing countries, Mediterranean countries including the Western Balkans as well as Russia and the Newly Independent States (NIS).

(13) Since the measures for the implementation of this decision are essentially management measures, and should therefore be adopted by the management procedure provided for in Article 4 of Council Decision 1999/468/EC of 28 June 1999, laying down the procedures for the exercise of implementing powers conferred on the Commission ([4]); since on the other hand research involving the use of human embryos and human embryonic stem cells is subject to ethical parameters to be established in accordance with the evolution of scientific knowledge, the opinion of the European Group on Ethics, and, where appropriate, national and international ethical legislation and rules; and, therefore, measures for the financing of such projects should be adopted by the regulatory procedure provided for in Article 5 of Council Decision 1999/468/EC.

(14) The Commission will in due course arrange for an independent assessment based on comprehensive implementation data to be conducted concerning the activities carried out in the fields covered by this programme, bearing in mind the contribution of the programme to the creation of the European Research Area, which will be done in a spirit of openness with respect to all the relevant actors.

(15) Each thematic priority area should have its own budget line in the General Budget of the European Communities.

(16) The Scientific and Technical Research Committee (CREST) has been consulted on the scientific and technological content of the programme,

HAS ADOPTED THIS DECISION:

Article 1

1. In accordance with the framework programme, a specific programme on integrating and strengthening the European Research Area (hereinafter referred to as 'the specific programme') is hereby adopted for the period from 30 September 2002 to 31 December 2006.

([1]) OJ C 201, 16.7.1999, p. 1.
([2]) OJ C 199, 14.7.2001, p. 1.
([3]) OJ C 309, 27.10.2000, p. 57.
([4]) OJ L 184, 17.7.1999, p. 23.

2. The objectives and scientific and technological priorities for the specific programme are set out in Annex I.

Article 2

In accordance with Annex II of the framework programme, the amount deemed necessary for the execution of the specific programme is EUR 12 905 million, including a maximum of 6,0 % for the Commission's administrative expenditure. An indicative breakdown of this amount is given in Annex II.

Article 3

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

Article 4

1. The detailed rules for financial participation by the Community in the specific programme shall be those referred to in Article 2(2) of the framework programme.

2. The specific programme shall be implemented by means of the instruments defined in Annex III to the framework programme and described in Annex III.

3. The rules for participation and dissemination shall apply to the specific programme.

Article 5

1. The Commission shall draw up a work programme for the implementation of the specific programme, setting out in greater detail the objectives and scientific and technological priorities set out in Annex I, and the timetable for implementation.

2. The work programme shall take account of relevant research activities carried out by the Member States, Associated States and European and international organisations. It shall be updated where appropriate.

Article 6

1. The Commission shall be responsible for the implementation of the specific programme.

2. The procedure laid down in Article 7(2) shall apply for the adoption of the following measures:

(a) the drawing up and updating of the work programme referred to in Article 5(1), including the instruments to be used on a priority basis, any subsequent adjustment to their use, the content of the calls for proposals as well as the evaluation and selection criteria to be applied;

(b) the approval of funding of:

(i) RTD actions involving networks of excellence and integrated projects,

(ii) RTD actions under the following priority thematic areas:

'Life sciences, genomics and biotechnology for health',

'Information society technologies',

'Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices',

'Aeronautics and space',

'Food quality and safety',

'Sustainable development, global change and ecosystems',

where the estimated amount of the Community contribution under this programme is equal to or more than EUR 1,5 million,

(iii) RTD actions, other than those referred to in points (i) and (ii), where the estimated amount of the Community contribution under this programme is equal to or more than EUR 0,6 million;

(c) the drawing-up of the terms of reference for the external assessment provided for in Article 6(2) of the framework programme;

(d) any adjustment to the indicative breakdown of the amount as set out in Annex II.

3. The procedure laid down in Article 7(3) shall apply for the adoption of the following measures:

— detailed implementing provisions concerning research activities involving human embryos and human embryonic stem cells,

— RTD actions involving the use of human embryos and human embryonic stem cells.

Article 7

1. The Commission shall be assisted by a committee.

2. Where reference is made to this paragraph, Articles 4 and 7 of Decision 1999/468/EC shall apply.

3. Where reference is made to this paragraph, Articles 5 and 7 of Decision 1999/468/EC shall apply.

The period laid down in Articles 4(3) and 5(6) of Decision 1999/468/EC shall be set at two months.

4. The committee shall adopt its rules of procedure.

Article 8

1. The Commission shall regularly report on the overall progress of the implementation of the specific programme, in accordance with Article 4 of the framework programme; information on financial aspects and the use of instruments shall be included.

2. The Commission shall arrange for the independent monitoring and assessment provided for in Article 6 of the framework programme to be conducted concerning the activities carried out in the fields covered by the specific programme.

Article 9

This Decision is addressed to the Member States.

Done at Brussels, 30 September 2002.

For the Council

The President

B. BENDTSEN

ANNEX I

SCIENTIFIC AND TECHNOLOGICAL OBJECTIVES AND BROAD LINES OF THE ACTIVITIES

The programme is structured as follows:

1. FOCUSING AND INTEGRATING COMMUNITY RESEARCH

1.1. Priority thematic areas of research

1.1.1. Life sciences, genomics and biotechnology for health

(i) Advanced genomics and its applications for health

(ii) Combating major diseases

1.1.2. Information Society technologies

1.1.3. Nano-technologies and nano-sciences, knowledge-based multifunctional materials, and new production processes and devices

1.1.4. Aeronautics and space

1.1.5. Food quality and safety

1.1.6. Sustainable development, global change and ecosystems

(i) Sustainable Energy Systems

(ii) Sustainable surface transport

(iii) Global change and ecosystems

1.1.7. Citizens and governance in a knowledge-based society

1.2. Specific activities covering a wider field of research

1.2.1. Policy support and anticipating scientific and technological needs

1.2.2. Horizontal research activities involving SMEs

1.2.3. Specific measures in support of international cooperation

2. STRENGTHENING THE FOUNDATIONS OF THE EUROPEAN RESEARCH AREA

2.1. Support for the coordination of activities

2.2. Support for the coherent development of policies

INTRODUCTION

This programme will promote world class research in key priority areas of exceptional interest and added value to Europe and the competitiveness of its industry, which have been identified in the framework programme 2002-2006, as well as on topics that are identified as being of high importance during the course of implementation of the framework programme in view of the EU's policy needs and the opportunities arising in novel, leading edge research areas.

The programme will strive towards greater integration of research in Europe by means of:

— focused action in priority thematic research areas, using powerful financing instruments (integrated projects and networks of excellence) which bring together the research actors in appropriate configurations for the new challenges that these priority research areas represent, and with critical mass,

— systematic and coordinated planning and execution of research to support Community policies, and to explore new and emerging scientific and technological areas, taking account of needs expressed by the relevant actors throughout the European Union,

— promoting the networking and joint action of national and European frameworks for research and innovation, and the opening up of national programmes, in these priority areas, including where appropriate by the use of actions under Article 169 of the Treaty, as well as in other areas where such action would be of benefit to the performance of Europe's research base.

The programme is complementary to the programme 'structuring the European Research Area' and the specific programme for the JRC, and its implementation will be coordinated with them.

International cooperation represents an important dimension of the Framework Programme. In this specific programme, international activities are carried out in the two forms of:

— participation of researchers, teams and institutions from third countries in projects within the different thematic priority fields, related to issues arising at world level and being subjects of international efforts,

— specific international cooperation activities with some groups of countries, as a support to Community external relations and development aid policies.

The objectives and forms of the international cooperation activities in the Framework Programme are described under the heading 'Specific activities covering a wider field of research'.

Participation of the candidate countries in this programme will be encouraged.

Participation of small and medium sized enterprises (SMEs) will be encouraged and gender equity will, overall, be assured in the implementation of the activities.

The activities carried out within the programme will be implemented in an integrated fashion to assure coherence and synergy between their various elements and, as appropriate, with other parts of the framework programme ([1]).

1. FOCUSING AND INTEGRATING COMMUNITY RESEARCH

1.1. PRIORITY THEMATIC AREAS OF RESEARCH

The priority thematic areas represent the bulk of expenditure under the sixth framework programme. Through a highly focused Community research effort, the intention is to generate a substantial leveraging effect which, together with actions in other parts of the framework programme and through open coordination with other — regional, national, European and international — frameworks, will result in a coherent and highly effective common endeavour towards their overall objectives.

([1]) In view of facilitating such coherent implementation of the programme, for each meeting of the programme committee as defined in the agenda, the Commission will reimburse, in accordance with its established guidelines, the expenses of one representative per Member State, as well as of one expert/adviser per Member State for those agenda items where a Member State requires specific expertise.

The actions are therefore described in terms of:

— the overall objectives and expected achievements which are sought in each priority area,

— the research priorities to be pursued by means of Community action.

The priority thematic areas of research are described in terms of their overall objectives and the main research focus. The associated work programme will elaborate further on the detailed research content.

Within the thematic priority areas, the importance of the new instruments (integrated projects and networks of excellence) is recognised as being an overall priority means to attain the objectives of critical mass, management simplification and European added value contributed by Community research in relation to what is already undertaken at national level, and of the integration of the research capacities. The size of projects is not a criterion for exclusion, and access to new instruments is ensured for SMEs and other small entities.

Networks of excellence and integrated projects will be used from the start of the programme in each thematic priority area and, where deemed appropriate, as a priority means, while maintaining the use of specific targeted projects and coordination actions. In addition to research and technological development, they may incorporate the following types of activity, where they are of specific relevance to the objectives sought: demonstration, dissemination and exploitation; cooperation with researchers and research teams from third countries; human resource development, including the promotion of training of researchers; development of research facilities and infrastructure of specific relevance to the research being undertaken; and promotion of better links between science and society, including women in science.

Specific targeted research projects and coordination actions, as well as specific support actions, may also be used in the spirit of the 'stairway of excellence' in the implementation of the thematic priorities.

Innovation is an important dimension which must be taken into account in the design and implementation of RTD activities. In particular, networks of excellence and integrated projects will include activities relating to dissemination and exploitation of knowledge and, where relevant, to ensure transfer of technology and facilitate exploitation of results. Where appropriate, special attention will be given to technology transfer to SMEs and to the creation of research-based enterprises as a means of exploiting research results.

The priority research areas include, in certain cases, research at the borders of traditional disciplines where advances will require interdisciplinary and multidisciplinary effort. They will also each carry out, as appropriate, exploratory research at the leading edge of knowledge on subjects closely related to one or more topics within them. Measurement and testing aspects will also receive necessary emphasis. A particular attention will be given during the implementation of the programme to the coordination between the different priority areas, and between these areas and actions under the heading 'policy support and anticipating scientific and technological needs'.

The principle of sustainable development, and gender equality, will be duly taken into account. Furthermore, consideration of the ethical, social, legal and wider cultural aspects of the research to be undertaken and its potential applications, as well as socio-economic impacts of scientific and technological development and foresight, will where relevant form a part of the activities under this heading. Research on ethics related to scientific and technological developments will be carried out in the programme 'Structuring the European Research Area'.

During the implementation of this programme and in the research activities arising from it, fundamental ethical principles are to be respected. These include the principles reflected in the Charter of fundamental rights of the EU, including the following: protection of human dignity and human life, protection of personal data and privacy, as well as animals and the environment in accordance with Community law and relevant international conventions and codes of conduct, e.g. the Helsinki Declaration in its latest version, the Convention of the Council of Europe on Human Rights and Biomedicine signed in Oviedo on 4 April 1997, and the Additional Protocol on the Prohibition of Cloning Human Beings signed in Paris on 12 January 1998, the UN Convention on the Rights of the Child, the Universal Declaration on the human genome and human rights adopted by UNESCO, and the relevant World Health Organisation (WHO) resolutions.

Account will also be taken to the opinions of the European Group of Advisers on the Ethical Implications of Biotechnology (1991-1997) and the opinions of the European Group on Ethics in Science and New technologies (as from 1998).

In compliance with the principle of subsidiarity and the diversity of approaches existing in Europe, participants in research projects must conform to current legislation, regulations and ethical rules in the countries where the research will be carried out. In any case, national provisions apply and no research forbidden in any given Member State will be supported by Community funding in that Member State.

Where appropriate, participants in research projects must seek the approval of the relevant national or local ethics committees prior to the start of the RTD activities. An ethical review will be implemented systematically by the Commission for proposals dealing with ethically sensitive issues, in particular proposals involving the use of human embryos and human embryonic stem cells.

Any research project involving the use of human embryos and human embryonic stem cells, following the ethical review mentioned above, will be submitted to a Regulatory Committee.

In specific cases, an ethical review may take place during the implementation of a project.

The following fields of research shall not be financed under this programme:

— research activity aiming at human cloning for reproductive purposes,

— research activity intended to modify the genetic heritage of human beings which could make such changes heritable [1],

— research activities intended to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer.

In addition, funding of research activities that are prohibited in all the Member States is in all circumstances excluded.

In accordance with the Amsterdam protocol on animal protection and welfare, animal experiments must be replaced with alternatives wherever possible. Suffering by animals must be avoided or kept to a minimum. This particularly applies (pursuant to Directive 86/609/EEC) to animal experiments involving species which are closest to human beings. Altering the genetic heritage of animals and cloning of animals may be considered only if the aims are ethically justified and the conditions are such that the animals' welfare is guaranteed and the principles of biodiversity are respected.

These guidelines will apply in the implementation of this programme. Furthermore, scientific advances and national provisions will be regularly monitored by the Commission so as to take account of any relevant developments. This monitoring could lead as necessary to a revision of these guidelines.

1.1.1. **Life sciences, genomics and biotechnology for health**

The sequencing of the human genome and many other genomes heralds a new age in human biology, offering unprecedented opportunities to improve human health and to stimulate industrial and economic activity. In making its contribution to realising these benefits, this theme will focus on integrating post-genomic research, including research on related molecular mechanisms, into the more established biomedical and biotechnological approaches, and will facilitate the integration of research capacities (both public and private) across Europe to increase coherence and achieve critical mass. Integrated multidisciplinary research, which enables a strong interaction between technology and biology, is vital in this theme for translating genome data into practical applications. In addition, an essential element will be to involve key stakeholders, for example, as appropriate industry, healthcare providers and physicians, policy makers, regulatory authorities, patient associations, and experts on ethical matters, etc. in implementing the theme. Furthermore, attention will be paid to childhood diseases and related treatments, whenever appropriate, and gender equity in the research will be ensured [2].

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[1] Research relating to cancer treatment of the gonads can be financed.

[2] Causes, clinical manifestation, consequences and treatment of disease and disorders often differ between women, men and children. Therefore, all activities funded within this thematic priority must take the possibility of such differences into account in their research protocols, methodologies and analysis of results.

This thematic priority area will stimulate and sustain multidisciplinary basic research to exploit the full potential of genome information to underpin applications to human health. In the field of applications, the emphasis will be put on research aimed at bringing basic knowledge through to the application stage ('translational' approach), to enable real and consistent and coordinated progress at European level in medicine and improve the quality of life. This research may also have implications for research on areas such as agriculture and environment, which are addressed under other thematic priorities; such implications should be duly taken into account in the course of the implementation of the thematic priorities concerned.

It will be an integral component of the European Community effort to enhance the European biotechnology industry in line with the conclusions of the Stockholm European Council. It will endeavour to create strong links with all activities that improve the framework conditions for innovation in the health sector of the biotechnology industry, especially in SMEs, including stimulating entrepreneurship and opportunities for investment through venture capital and the involvement of the European Investment Bank. Attention will also be paid to the identification of regulatory bottlenecks in the development of new applications for genomics, to the anticipation at the earliest possible stage of the ethical implications and to the broader implications of developments in genomics research for society and citizens.

This thematic priority area will also foster the implementation and development of the health strategy of the European Community.

Throughout the thematic priority, international collaboration will be encouraged. Where appropriate, due account will be given to the European Community's commitment to poverty reduction in developing countries and the importance that improved health will bring to the process — in line with Article 177 of the Treaty and with the European Community's accelerated actions to combat HIV/AIDS, malaria and tuberculosis.

Research priorities

(i) *Advanced genomics and its applications for health*

Fundamental knowledge and basic tools for functional genomics in all organisms

The strategic objective of this line is to foster the basic understanding of genomic information, by developing the knowledge base, tools and resources needed to decipher the function of genes and gene products relevant to human health and to explore their interactions with each other and with their environment. Research actions will encompass the following:

— Gene expression and proteomics: The objectives are to enable researchers to better decipher the functions of genes and gene products as well as to define the complex regulatory networks (biocomplexity) that control fundamental biological processes.

  Research will focus on: developing high throughput tools and approaches for monitoring gene expression and protein profiles and for determining protein function and interactions of biological molecules within the living cell.

— Structural genomics: The objectives are to enable researchers to determine, more effectively and at a higher rate than is currently feasible, the 3-D structure of proteins and other macromolecules, which is important for elucidating protein function and essential for drug design.

  Research will focus on: developing high throughput approaches for determining high-resolution 3-D structures of macromolecules.

— Comparative genomics and population genetics: The objectives are to enable researchers to use well-characterised model organisms for predicting and testing gene function and to take full advantage of specific population cohorts available in Europe to determine the relationship between gene function and health or disease.

  Research will focus on: developing model organisms and transgenic tools; developing genetic epidemiology tools and standardised genotyping protocols.

— Bioinformatics: The objectives are to enable researchers to access efficient tools for managing and interpreting the ever-increasing quantities of genome data and for making it available to the research community in an accessible and usable form.

  Research will focus on: developing bioinformatic tools and resources for data storage, mining and processing; developing computational biology approaches for in silico prediction of gene function and for the simulation of complex regulatory networks.

— Multidisciplinary functional genomics approaches to basic biological processes: The objectives are to enable researchers to study fundamental biological processes by integrating the above innovative approaches.

Research will focus on: elucidation of the mechanisms underlying fundamental cellular processes, to identify the genes involved and to decipher their biological functions in living organisms.

Applications of knowledge and technologies in the field of genomics and biotechnology for health

The strategic objective of this line is to foster the competitiveness of Europe's biotechnology industry by exploiting the wealth of biological data produced by genomics and advances in biotechnology. Research actions will encompass the following:

— Technological platforms for the developments in the fields of new diagnostic, prevention and therapeutic tools: In the context of preventing and treating diseases, the objectives are to foster academic and industrial collaboration through technological platforms where multidisciplinary approaches using cutting edge technologies arising from genomic research may contribute to health care progress and cost reduction through more precise diagnosis, individualised treatment and more efficient development pathways for new drugs and therapies (such as the selection of new drug candidates), and other novel products of the new technologies.

Research will focus on: rational and accelerated development of new, safer, more effective drugs including pharmacogenomics approaches; development of new diagnostics; development of new in vitro tests to replace animal experimentation; development and testing of new preventive and therapeutic tools, such as somatic gene and cell therapies (in particular stem cell therapies, for example those on neurological and neuromuscular disorders) and immunotherapies; innovative research in post-genomics, which has high potential for application.

With a view to ensuring socially responsible choices, public acceptance and an efficient development pathway for these new technologies, an active and early involvement in the above activities of regulators, experts on ethics, patients and society at large will be necessary.

(ii) *Combating major diseases*

Application-oriented genomic approaches to medical knowledge and technologies

The strategic objective of this line is to develop improved strategies for the prevention and management — using also advanced technologies for health — of human disease and for living and ageing healthily. It will concentrate exclusively on integrating genomic approaches through all relevant organisms into more established medical approaches for investigating disease and health determinants. The emphasis will be put on translational research aimed at bringing basic knowledge through to clinical application. Research actions will focus on the following:

— Combating cardiovascular diseases, diabetes, and rare diseases: The objectives are to improve the prevention and management of important causes of mortality and ill health in Europe and to pool Europe's research resources for tackling rare diseases.

Research will focus on: integrating clinical expertise and resources with relevant model systems and advanced tools in functional genomics to generate breakthroughs in the prevention and management of these diseases.

— Combating resistance to antibiotics and other drugs: The objectives are to confront the major threat to public health caused by drug resistant pathogens.

Research will focus on: exploitation of the knowledge of microbial genomes and on host-pathogen interactions for the development of vaccines and alternative therapeutic strategies to circumvent the problem of antimicrobial and other drug resistance; development of strategies for optimal usage of antimicrobials; support to the European Community network for epidemiological surveillance and control of communicable diseases.

— Studying the brain and combating diseases of the nervous system: The objectives are to use genome information to understand better the functioning and dysfunctioning of the brain, in order to gain new insight into mental processes, to combat neurological disorders and diseases, and to improve brain repair.

Research will focus on: understanding the molecular and cellular bases of brain function, damage, plasticity and repair, learning, memory and cognition; developing strategies for prevention and management of neurological and mental disorders and diseases (such as Alzheimer's disease, Parkinson's disease and new variant Creutzfeldt-Jakob's disease), including those relating to drug dependance.

— Studying human development and the ageing process: The objective is to better understand human development, with special emphasis on the ageing process, in order to develop the evidence base for improving public health strategies to promote healthy living and healthy ageing.

Research will focus on: understanding human development from conception to adolescence; exploring the molecular and cellular determinants of healthy ageing including their interactions with environmental, behavioural and gender factors.

Combating cancer

The objective is to combat cancer by developing improved patient-oriented strategies, from prevention to more effective and earlier diagnosis and better treatment with minimal side effects. The research will therefore concentrate on translating the knowledge being created by genomics and other fields of basic research into applications that improve clinical practice and public health.

The patient-oriented approach will include four interlinked components. Research will focus on:

— Establishing facilities and developing initiatives for the exploitation of research on cancer in Europe; encouraging the development of evidence-based guidelines for good clinical practice and improved public health strategies by accelerating the translation of existing research results into applications.

— Supporting clinical research, particularly clinical trials, aimed at validating new and improved interventions.

— Supporting translational research aimed at bringing basic knowledge through to applications in clinical practice and public health.

— Other issues related to cancer, such as ageing and cancer, regional differences, psycho-social aspects, palliative care and guidance to support groups.

Confronting the major communicable diseases linked to poverty

The strategic objective of this line is to confront the global emergency caused by the three major communicable diseases — HIV/AIDS, malaria and tuberculosis — through the development of effective disease interventions, particularly for use in developing countries. It is envisaged that developing countries will be significant partners in the implementation of this line and, as appropriate, participate directly in specific activities within it, in particular through the clinical trials programme.

Research will focus on: developing promising candidate interventions (vaccines, therapies and HIV microbicides) against the target diseases by sponsoring research over the full spectrum from basic molecular research, taking advantage of microbial genomics, through to pre-clinical testing and proof-of-principle; establishing a clinical trials programme to unite and support Europe's clinical trial activities specifically targeted at interventions for use in developing countries; establishing an AIDS Therapy Trials Network in Europe to improve the coherence and complementarity of clinical trials of AIDS therapies for European use.

The research activities carried out within this thematic priority area will include exploratory research at the leading edge of knowledge on subjects closely related to one or more topics within it. Two complementary approaches will be utilised: one receptive and open — the other proactive.

1.1.2. **Information society technologies**

Information society technologies (IST) are transforming the economy and society. Not only are they creating new ways of working and new types of business, but provide solutions to major societal challenges such as healthcare, environment, safety, mobility and employment, and have far reaching implications on our everyday life. The IST sector is now one the most important of the economy, with an annual turnover of EUR 2 000 billion, providing employment for more than 12 million people in Europe.

The IST thematic priority will contribute directly to realising European policies for the knowledge society as agreed at the Lisbon European Council of 2000, the Stockholm European Council of 2001, and reflected in the e-Europe Action Plan. It will ensure European leadership in the generic and applied technologies at the heart of the knowledge economy. It aims to increase innovation and competitiveness in European businesses and industry and to contribute to greater benefits for all European citizens.

Successes, like those achieved in Europe in mobile and wireless communications or consumer electronics, will not be repeated unless a real effort is made to achieve critical mass in key domains of IST research. The actions will therefore mobilise the community of researchers around medium to long term objectives, facilitating the integration of public and private effort on a European scale, to build essential competencies and strengthen innovation. They will involve high-risk and long term RTD such as the development of the next generation of mobile and wireless systems beyond 3G.

Although substantial advances have been achieved, we are still far from taking full advantage of the potential of knowledge-based services in real life. Products and services are still hard to use and out of reach for many people, and the 'digital divide' is widening within Europe and across the world. Research will focus on the future generation of technologies in which computers and networks will be integrated into the everyday environment, rendering accessible a multitude of services and applications through easy-to-use human interfaces. This vision of 'ambient intelligence' places the user, the individual, at the centre of future developments for an inclusive knowledge-based society for all.

The IST priority in support of the eEurope action plan, will help build an information and knowledge based society across Europe, encouraging the participation of least developed regions. It will also include activities linking the EU effort to the international context. The aim is to achieve thematic area global consensus when appropriate, e.g. through the Intelligent Manufacturing Systems (IMS) initiative or the dialogue on dependability issues, to integrate further the research of the Newly Associated States within the EU effort and to facilitate cooperation with developing countries.

In addition to the above, the priority thematic area will support research to investigate and experiment with future visions and emerging technologies at the frontier of knowledge in the IST field.

Within the context of the priorities identified below, the priority thematic area will also include activities relating to the further development of Géant and GRIDs.

Research priorities

(i) *Applied IST research addressing major societal and economic challenges*

The objective is to extend the scope and efficiency of IST-based solutions addressing major societal and economic challenges, and to make them accessible in the most trusted and natural way, anywhere and anytime to citizens, businesses and organisations.

— Technologies for trust and security: The objective is to develop technologies for key security challenges posed by the 'all-digital' world and by the need to secure the rights of individuals and communities.

  Research will focus on basic security mechanisms and their interoperability, dynamic security processes, advanced cryptography, privacy enhancing technologies, technologies to handle digital assets and technologies for dependability to support business and organisational functions in dynamic and mobile systems.

— Research addressing societal challenges: The focus is on 'ambient intelligence' for a broader inclusion of citizens in the Information Society, for more effective health, security, mobility and environment management and support systems, and for the preservation of cultural heritage, integration of multiple functionalities across these different domains will be also supported.

  Research activities on 'e-inclusion' will concentrate on systems enabling access for all, on barrier-free technologies for full participation in the information society and on assistive systems that will restore functions or compensate for disabilities thereby enabling a higher quality of life for citizens with special needs and their carers. In the area of health, the work will focus on intelligent systems aimed at supporting health professionals, at providing patients with personalised healthcare and information, and at stimulating health promotion and disease prevention in the general population. Research will also address intelligent systems to enhance the protection of people and property and for securing and safeguarding civil infrastructures.

In the area of mobility, research will focus on vehicle infrastructure and portable systems to provide integrated safety, comfort and efficiency and allow for the provision of advanced logistics info-mobility and location based services. Research in the area of environment will focus on knowledge-based systems for natural resource management and for risk prevention and crisis management including humanitarian mine clearance. In the area of leisure, research will focus on intelligent and mobile systems and applications for entertainment. In the area of tourism, research will address knowledge sharing and interactive services. For cultural heritage, the effort will focus on intelligent systems for dynamic access to and preservation of tangible and intangible cultural and scientific resources.

— Research addressing work and business challenges: The objective is to provide businesses, individuals, public administrations, and other organisations with the means to fully contribute to, and benefit from, the development of a trusted knowledge-based economy, whilst at the same time improving the quality of work and working life and support life-long continuous learning to improve work skills. Research will also aim at a better understanding of the socio-economic drivers and impact of IST development.

Research in e-business and e-government will focus on providing European organisations, private and public, and especially SMEs, with interoperable systems and services to enhance innovation capacities, value creation and competitive performance in the knowledge economy and on supporting new business environments ('business ecosystems'). Research in organisational knowledge management will aim at supporting organisational innovation and responsiveness through elicitation, sharing, trading, and delivery of knowledge. Work on electronic and mobile commerce will target interoperable, multimodal applications and services across heterogeneous networks. It will include anytime-anywhere trading, collaboration, workflow, and electronic services covering the whole value creation cycle of extended products and services.

Research into eWork systems will focus on new workplace designs incorporating innovative technologies to facilitate creativity and collaboration, on increasing resource-use efficiency and on extending work opportunities to all in local communities. Work on eLearning will focus on personalised access to, and delivery of, learning as well as on advanced learning environments at school, university, in the workplace and in lifelong learning in general, taking advantage of the development of ambient intelligence.

— Complex problem solving in science, engineering, businesses and for society: The objective is to develop technologies for harnessing computing and storage resources which are distributed in geographically dispersed locations, and for making them accessible, in a seamless way, for complex problem solving in science, industry, business and society. Application fields include environment, energy, health, transport, industrial engineering, finance and new media.

Research will focus on new computational models, including computing and information GRIDs, peer-to-peer technologies and the associated middleware to make use of large scale highly distributed computing and storage resources and to develop scalable, dependable and secure platforms. It will include novel collaborative tools and programming methods supporting interoperability of applications and new generations of simulation, visualisation and datamining tools.

(ii) *Communication, computing and software technologies*

The objectives are to consolidate and further develop European strengths in areas such as mobile communications, consumer electronics and embedded software and systems, and to improve the performance, reliability, cost-efficiency, functionality and adaptive capabilities of communications and computing technologies so as to meet the growing needs of applications. Work will also lead to the next generation Internet (including Internet Protocol, version 6).

— Communication and network technologies: The objective is to develop the new generations of mobile and wireless systems and networks that allow optimal service connection anywhere as well as all-optical networks to increase network transparency and capacity, solutions to improve network interoperation and adaptability, and technologies for personalised access to networked audio-visual systems.

Work on terrestrial and satellite [1] based, mobile and wireless systems and networks beyond 3G will focus on the next generation of technologies, ensuring cooperation and seamless inter-working at service and control planes of multiple wireless technologies over a common IP (Internet Protocol) platform as well as novel spectral efficient protocols, tools and technologies, to build wireless re-configurable IP enabled devices, systems and networks.

Research in all optical networks will focus on the management of optical wavelength channels enabling flexibility and speed in service deployment and provisioning and solutions for fibre to the LAN. Research on interoperable network solutions, including end-to-end network management will support generic services provision and interworking, and interoperation between heterogeneous networks and platforms. It will include programmable networks to provide adaptive and real-time allocation of network resources and enhanced service management capabilities by customers.

Research will also address the enabling technologies for personalised access to networked audio-visual systems and applications as well as cross-media service platforms and networks, trusted digital TV architectures and appliances able to process, encode, store, sense and display hybrid 3D multimedia signals and objects.

— Software technologies, embedded systems and distributed systems: The objective is to develop new software technologies, multifunctional service creation environments as well as tools for the control of complex distributed systems for the realisation of an ambient intelligence landscape and for coping with the expected growth and spread of applications and services.

Research will focus on new technologies for software and systems, that address composability, scalability, reliability and robustness as well as autonomous self-adaptation. It will include middleware for the management, control and use of fully distributed resources. Work on multifunctional service creation environments and new component frameworks will aim at the development of service functionality, including meta-information, semantics and taxonomy of the building blocks.

New strategies, algorithms, and tools for systematic and accurate design, prototyping and control of complex distributed systems will be addressed. Work will include networked embedded systems, distributed sensing, computing, storage resources and related intercommunication. Dynamic resources allocation will be a key feature as well as cognitive techniques for generic object and events recognition.

(iii) *Components and microsystems*

— Micro-, nano- and opto-electronics: The objective is to reduce the cost, increase the performance and improve reconfigurability, scalability, adaptability and self-adjusting capabilities of micro-, nano- and opto-electronic components and systems-on-a-chip. The environmental impact of IST systems will be taken into account.

Research will focus on pushing the limits of CMOS process and equipment technologies and enhancing device functionality, performance and integration of functions. It will address alternative process technologies, device types, materials and architectures to meet demands of communication and computing. Particular emphasis will be put on RF, mixed-signal and low power design. Work on optical, opto-electronic, and photonic functional components, will address devices and systems for information processing, communication, switching, storage, sensing and imaging. Research on electronic nano-devices, as well as on molecular electronics devices and technologies, will target those that promise broad functionality and have integration- and mass fabrication potential.

— Micro- and nano- technologies, micro-systems, displays: The objective is to improve the cost-efficiency, performance and functionality of subsystems and micro-systems and to increase the level of integration and miniaturisation allowing for improved interfacing with their surrounding and with networked services and systems.

Research will focus on new applications and functions that take advantage of multi-disciplinary interactions (electronics, mechanics, chemistry, biology, etc.) combined with the use of micro and nano-structures and new materials. The aim is to develop innovative, cost-effective and reliable micro-systems and reconfigurable, miniaturised subsystem modules. Work will also include low cost, information-rich and higher resolution displays as well as advanced sensors including low cost vision and bio-metric sensors, and haptic devices. Work on nano-devices and nano-systems will address the exploitation of basic phenomena, processes and structures that promise novel or improved sensing or actuating functionality as well as their integration and fabrication.

[1] The activity on satellite communications is done in coordination with the activities in priority 4 'Aeronautics and space'.

(iv) *Knowledge and interface technologies*

The objective is to improve usability of IST applications and services and access to the knowledge they embody in order to encourage their wider adoption and faster deployment. Integration issues related to multimedia research technologies will also be addressed.

— Knowledge technologies and digital content: The objective is to provide automated solutions for creating and organising virtual knowledge spaces (e.g. collective memories, digital libraries) so as to stimulate radically new content and media services and applications.

  Work will focus on technologies to support the process of acquiring and modelling, navigating and retrieving, representing and visualising, interpreting and sharing knowledge. These functions will be integrated in new semantic-based and context-aware systems including cognitive and agent-based tools. Work will address extensible knowledge resources and ontologies so as to facilitate service interoperabilitiy and enable next-generation Semantic-web applications. Research will also address technologies to support the design, creation, management and publishing of multimedia content, across fixed and mobile networks and devices, with the ability to self-adapt to user expectations. The aim is to stimulate the creation of rich interactive content for personalised broadcasting and advanced trusted media and entertainment applications.

— Intelligent interfaces and surfaces: The objective is to provide more effective ways of accessing ubiquitous information and easier and natural interaction modes with intelligence that surrounds us.

  Research will focus on interfaces and interactive surfaces that are natural, adaptive and multi-sensorial, for an ambient landscape that is aware of our presence, personality and needs, and which is capable of responding intelligently to speech, gesture or other senses. The aim is to hide the complexity of technology by supporting a seamless interaction between humans, between humans and devices, virtual and physical objects and the knowledge embedded in everyday environments. This includes research on virtual and augmented reality.

  Work will also address technologies for multilingual and multicultural access and communication that support timely and cost effective provisions of interactive information-rich services meeting the personal, professional and business requirements of all members of linguistically and culturally diverse communities.

(v) *IST future and emerging technologies*

The objective is to help new IST-related science and technology fields and communities to emerge, some of which will become strategic for economic and social development in the future and will feed into the mainstream IST activities in the future. To ensure openness to unforeseeable ideas, critical mass of research where strategic focus is needed, and seamless coverage of the IST frontier, two complementary approaches will be utilised: one receptive and open — the other proactive.

1.1.3. **Nano-technologies and nano-sciences, knowledge-based multifunctional materials and new production processes and devices**

The twofold transition toward a knowledge-based society and of sustainable development demands new paradigms of production and new concepts of product-services. European production industry as a whole needs to move from resource-based towards knowledge-based, more environment-friendly approaches, from quantity to quality, from mass produced single-use products to manufactured-on-demand multi-use, upgradable product-services; from 'material and tangible' to 'intangible' value-added products, processes and services.

These changes are associated with radical shifts in industrial structures, involving a stronger presence of innovative enterprises, with capabilities in networks and mastering new hybrid technologies combining nanotechnologies, material sciences, engineering, information technologies, bio and environmental sciences. Such an evolution implies a strong collaboration across traditional scientific frontiers. Leading edge industrial developments involve also a strong synergy between technology and organisation, the performance of both being highly dependent on new skills.

Successful technological solutions have to be sought more and more upstream in the design and production processes; new materials and nano-technologies have a crucial role to play in this respect, as drivers of innovation. This requires changes of emphasis in Community research activities from short to longer term and in innovation which must move from incremental to breakthrough strategies. Community research will benefit greatly from an international dimension.

Research priorities

(i) *Nano-technologies and nano-sciences*

Nano-technologies and nano-sciences represent a new approach to materials science and engineering. Europe enjoys a strong position in the nano-sciences, that needs to be translated into a real competitive advantage for European industry. The objective is twofold: to promote the creation of an RTD-intensive European nano-technology related industry, and to promote the uptake of nano-technologies in existing industrial sectors. Research may be long-term and high risk, but will be oriented towards industrial application. An active policy of encouraging industrial companies and SMEs, including start-ups, will be pursued, amongst others through the promotion of strong industry/research interactions in consortia undertaking projects with substantial critical mass.

— Long-term interdisciplinary research into understanding phenomena, mastering processes and developing research tools: The objectives are to expand the generic underlying knowledge base of application oriented nano-science and nanotechnology, and to develop leading edge research tools and techniques.

  Research will focus on: molecular and mesoscopic scale phenomena; self-assembling materials and structures; molecular and bio-molecular mechanisms and engines; multi-disciplinary and new approaches to integrate developments in inorganic, organic and biological materials and processes.

— Nano-biotechnologies: The objective is to support research into the integration of biological and non-biological entities, opening new horizons in many applications, such as for processing and for medical and environmental analysis systems.

  Research will focus on: lab-on-chip, interfaces to biological entities, surface modified nano-particles, advanced drug delivery and other areas of integrating nano-systems or nano-electronics with biological entities (such as targeted delivery of biologically active entities); processing, manipulation and detection of biological molecules or complexes, electronic detection of biological entities, micro-fluidics, promotion and control of growth of cells on substrates.

— Nano-metre-scale engineering techniques to create materials and components: The objective is to develop novel functional and structural materials of superior performance, by controlling their nano-structure. This will include technologies for their production and processing.

  Research will focus on: nano-structured alloys and composites, advanced functional polymeric materials, nano-structured functional materials and the embedding of ordered molecular systems or nano-particles in suitable substrates.

— Development of handling and control devices and instruments: The objective is to develop a new generation of instrumentation for analysis and manufacture at the nano-scale. A guiding target will be a feature size or resolution of the order of 10 nm.

  Research will focus on: a variety of advanced techniques for nano-scale manufacture (lithography or microscopy based techniques); breakthrough technologies, methodologies or instruments exploiting the self-assembling properties of matter and developing nano-scale machines.

— Applications in areas such as health and medical systems, chemistry, energy, optics, food and the environment: The objective is to foster the potential of nano-technologies in breakthrough applications through the integration of research developments in materials and technological devices in an industrial context.

  Research will focus on: computational modelling, advanced production technologies; development of innovative materials with improved characteristics.

(ii) *Knowledge-based multifunctional materials*

New, high knowledge-content materials, providing new functionalities and improved performance, will be critical drivers of innovation in technologies, devices and systems, benefiting sustainable development and competitiveness in sectors such as transport, energy, medicine, electronics, photonics and construction. To assure Europe's strong positions in emerging technology markets, which are expected to grow by one or two orders of magnitude within the next decade, the various actors need to be mobilised through leading edge RTD partnerships, including high risk research and through integration between research on materials and industrial applications.

— Development of fundamental knowledge: The objective is to understand complex physico-chemical and biological phenomena relevant to the mastering and processing of intelligent materials with the help of experimental, theoretical and modelling tools. This will provide the basis for synthesising larger complex or self-assembling structures with defined physical, chemical or biological characteristics.

  Research will focus on: long-term, trans-disciplinary and high industrial risk activities to design and develop new structures with defined characteristics; development of supra-molecular and macromolecular engineering, focusing on the synthesis, exploitation and potential use of novel highly complex molecules and their compounds.

— Technologies associated with the production, transformation and processing of knowledge-based multifunctional materials, and biomaterials: The objective is the development and sustainable production of new 'smart' materials with special functionalities and for building up macro-structures. These novel materials, serving multisectorial applications should possess characteristics to be exploited under predetermined circumstances as well as enhanced bulk properties or barrier and surface characteristics for higher performance.

  Research will focus on: new materials; engineered and self-repairing materials; crosscutting technologies including surface science and engineering (including catalytic materials).

— Engineering support for materials development: The objective is to bridge the gap from 'knowledge production' to 'knowledge use', thus overcoming the EU industry's weaknesses in the integration of materials and manufacturing. This will be achieved by the development of new tools enabling the production of new materials in a context of sustainable competitiveness.

  Research will focus on: inherent aspects of optimising materials design, processing and tools; testing, validation and up-scaling; incorporation of life-cycle approaches, obsolescence, bio-compatibility and eco-efficiency; support to materials for extreme conditions.

(iii) *New production processes and devices*

New production concepts which are more flexible, integrated, safe and clean will depend on breakthrough organisational and technological developments, supporting new products, processes and services, and at the same time decreasing (internal and external) costs. The objective is to provide the industrial systems of the future with the necessary tools for efficient life-cycle design, production, use and recovery as well as appropriate organisational models and improved knowledge management.

— Development of new processes and flexible and intelligent manufacturing systems: The objective is to encourage industry's transition towards more knowledge-based production and systems organisation and to considering production from a more holistic perspective, encompassing not only hardware and software, but also people and the way in which they learn and share knowledge.

  Research will focus on: innovative, reliable, smart and cost-effective manufacturing processes, and systems, and their incorporation into the factory of the future: integrating hybrid technologies based on new materials and their processing, micro-systems and automation (including simulations), high-precision production equipment, as well as integration of ICT, sensing and control technologies, and innovative robotics.

— Systems research and hazard control: The objective is to contribute to an improved sustainability of industrial systems and a substantial and measurable reduction in environmental and health impact, that serves to remedy environmental change, through new industrial approaches, as well as enhancement of resource efficiency and reduction in consumption of primary resources.

  Research will focus on: development of new devices and systems for clean, and safe production; non-polluting, sustainable waste management and hazard reduction in production and manufacturing, including bio-processes; enhancing company responsibility on products, resource consumption and industrial waste management; studying 'production-use-consumption' interactions, as well as socio-economic implications.

— Optimising the life-cycle of industrial systems, products and services. Products and production should become increasingly life-cycle and service oriented, in addition to the requirements of intelligence, cost-effectiveness, safety and cleanliness. The key challenge is therefore new industrial concepts based on life-cycle approaches and eco-efficiency, which must allow new products, organisational innovation and the efficient management of information and its transformation into useable knowledge within the value chain.

  Research will focus on: innovative product-services systems that optimise the 'design-production-service-end-of-life' value chain through of hybrid technologies and new organisational structures.

The research activities carried out within this thematic priority area will include exploratory research at the leading edge of knowledge on subjects closely related to one or more topics within it. Two complementary approaches will be utilised: one receptive and open—the other proactive.

1.1.4. **Aeronautics and space**

Over the last decades, Europe's outstanding technological and industrial capabilities in aeronautics and the exploitation of space have made many and various contributions to the standard of living of its citizens, the development and growth of its economies, as well as to those outside Europe, and have also contributed to more basic scientific knowledge. The economic benefits they bring can be seen in highly skilled employment and the balance of trade surplus, and they can have a strong leverage effect in upgrading the competitiveness of other related economic sectors.

Although aeronautics and space are distinct domains, they share common features, being extremely R&D intensive, with long development lead-times and very large investment requirements. Fierce competition, strategic significance, and increasingly severe environmental constraints combine to make it necessary to strive continually towards higher levels of technological excellence by consolidating and concentrating RTD efforts, with the ultimate aim of better serving society.

Aeronautics research will be planned against a Strategic Research Agenda (SRA) agreed by all stakeholders at European level in the context of the new Advisory Council for Aeronautics Research in Europe, which will also be the planning base for national programmes. The result will be a greater level of complementarity and cooperation between the national and Community efforts in the field. The European Strategy for Space will serve as a reference in planning space research, with the objective of gathering key players on projects of common interest and close liaison will be ensured with RTD activities carried out by other actors, such as space agencies, Eurocontrol and industry. Furthermore, the application of relevant Treaty articles will be explored to support, as appropriate, these initiatives.

Research priorities

(i) *Aeronautics*

In their report 'Vision 2020', leaders of the sector in Europe have highlighted the need to optimise the Community and national research efforts around a common vision and a strategic research agenda. Consistent with this, research will concentrate on the following 4 main strands. The scope of the research action will be commercial transport aircraft (including regional and business aeroplanes and helicopters) including their systems and components, as well as the on-board and ground-based elements of air-traffic management systems.

— Strengthening competitiveness: The objective is to enable the 3 sectors of the manufacturing industry: airframe, engines and equipment, to increase their competitiveness, by reducing, in the short and long term, respectively, aircraft development costs by 20 % and 50 %, and aircraft direct operating cost by 20 % and 50 %, and improving passenger comfort.

  Research will focus on: integrated design systems and processes for the realisation of the extended multi-site enterprise concept, as well as for more intelligent production technologies; new aircraft configurations, advanced aerodynamics, materials and structures, engine technologies; mechanical, electrical and hydraulic systems; improved cabin-environmental conditions and utilisation of multimedia services to improve passenger comfort.

— Improving environmental impact with regard to emissions and noise. Concerning emissions, the objectives are to meet Kyoto goals and to compensate for the increase in future air traffic, by reducing fuel consumption and emissions of CO_2 by 50 % in the long term and of NO_x by 20 % and 80 %, in the short and long term, respectively. Concerning noise, to limit the noise nuisance outside the airport boundary, the target is to reduce noise levels by 4-5 dB in the short term and 10 dB in the long term.

Concerning emissions, research will focus on: low-emission combustion and propulsion concepts, engine technologies and related control systems, low-drag aerodynamic concepts, low-weight airframe structures and high temperature materials, as well as improved flight operational procedures. Research on noise will focus on: engine and power-plant technologies, aeroacoustics for airframe noise reduction, advanced noise-control systems as well as novel flight operational procedures in the vicinity of airports.

— Improving aircraft safety: The objective is to obtain a two-fold reduction in accident rates in the short-term and a five-fold reduction in the long term, in order to compensate for the growth in air transport movements.

Concerning preventive safety, research will focus on: investigation of systemic safety models, improved fault-tolerant systems and human-centred cockpit design enabling a controllable situation awareness for the crew. Research on accident mitigation will focus on improved materials and structures as well as advanced safety systems.

— Increasing operational capacity and safety of the air transport system: The objective is to optimise airspace and airport utilisation, and consequently reduce flight delays, through a seamlessly integrated European air traffic management system, which would facilitate the achievement of the 'Single European Sky' initiative.

Research will focus on on-board and ground automation aids, communication, navigation and surveillance systems as well as flight operation procedures that will enable the introduction of new concepts including the free-flight concept in the future European ATM system.

(ii) *Space*

The aim is to contribute to the implementation of the European Strategy for Space, notably by targeting and focusing efforts with ESA and Member States on a small number of joint actions of common interest. Emphasis will be put on activities complementing those of space agencies (integration of terrestrial and space systems/services and demonstration of end-to-end services). This will include the following areas of activity:

— Galileo: the European Satellite Navigation system GALILEO, developed by the Joint Undertaking in close cooperation with the European Space Agency, will be fully operational by 2008. The use of the services provided by this infrastructure will span over wide ranges of activities of European society. The availability of precise navigation and timing services will have profound impacts in many domains.

It is important to build the necessary expertise and knowledge in Europe in order to exploit this emerging technology in the most efficient way.

Research will focus on: development of multisectorial concepts, systems and tools, user equipment including receivers, which will rely on precise navigation and timing service provision; spreading of high level, coherent and seamless quality services in all environments (cities, indoors and outdoors, land, sea, air, etc.), in synergy with other service provision (telecommunication, surveillance, observation, etc.).

— GMES: The objective is to stimulate the evolution of satellite-based information services, by development of technologies to bridge the gap between supply and demand, and to build up a European capability in the field of monitoring for environment and security, in particular in the context of sustainable development and taking into account users' needs and requirements as indicated in the GMES EC Action Plan for the initial period (2001-2003).

Research will focus on: sensors, data, and information models, developed in Europe or elsewhere, as well as developing prototypes of operational services responding to specific types of demand (for example global environment, land-use, desertification, disaster management). Research, including on data acquisition, assembly and qualification of models combining spatial and terrestrial data in an integrated operational information system, would use existing satellite data, for example provided by Envisat, future EarthWatch projects and other systems.

— Satellite telecommunications: Satellite communications should be integrated with the wider area of telecommunications systems, notably terrestrial systems [1].

[1] Considering the tight links between communications satellites and terrestrial technologies, the related work is presented in the context of the relevant actions of the 'Information society technologies' thematic priority area.

The research activities carried out within this thematic priority area will include exploratory research at the leading edge of knowledge on subjects closely related to one or more topics within it. Two complementary approaches will be utilised: one receptive and open—the other proactive.

1.1.5. **Food quality and safety**

This priority area is aimed at assuring the health and well-being of European citizens through a better understanding of the influence of food intake and environmental factors on human health and to provide them with safer, high-quality and health-promoting foods, including seafoods, relying on fully controlled and integrated production systems originating in agriculture, aquaculture and fisheries. By re-addressing the classical approach 'from farm to fork', this thematic priority area aims at ensuring that consumer protection is the main driver for developing new and safer food and feed production chains, i.e. 'from fork to farm', relying in particular on biotechnology tools taking into account the latest results of genomics research.

This end-user driven approach is reflected in the seven specific research objectives. Priority will be given to integrated research approaches crossing several specific objectives. Given that small enterprises constitute a major part of the food sector, the success of activities undertaken will rely on the adaptation of knowledge and processes to the specific characteristics of these enterprises.

Research priorities

— Epidemiology of food-related diseases, and allergies: The objective is to examine the complex interactions between food intake and metabolism, immune system, genetic background and environmental factors to identify key risk factors and develop common European databases.

  Research will focus on: epidemiological studies of the effect of diet, food composition and lifestyle factors, on the health of consumers and specific population groups such as children, and the prevention or development of specific diseases, allergies and disorders; methodologies for measuring and analysing food composition and dietary intake, risk assessment, epidemiological and intervention models; influences of genetic variability using advances in functional genomics.

— Impact of food on health: The objective is to provide the scientific basis for improving health through diet, and the development of new health-promoting foods, considering for instance new products, products resulting from organic farming, functional foods, products containing genetically modified organisms, and those arising from recent biotechnology developments, by means of an improved understanding of food metabolism and by harnessing the opportunities now available from proteomics and biotechnology.

  Research will focus on: overall relationship between diet and health; health promoting and disease prevention properties of foods; effects of food components, pathogens, chemical contaminants and new agents of prion type on health; nutrient requirements and health promoting intervention strategies; determinants of consumer attitudes towards food products and production; methodologies for risk/benefit assessment of nutrients and of bioactive compounds; specificities of different population groups, particularly the elderly and children.

— 'Traceability' processes all along the production chain: The objective is to strengthen the scientific and technological basis for ensuring complete traceability for instance of genetically modified organisms, including those based on recent biotechnology developments from raw material origin to purchased food products, and thereby increase consumer confidence in the food supply.

  Research will focus on: development, validation and harmonisation of technologies and methodologies to ensure complete traceability throughout the food chain; scale-up, implementation and validation of methods in whole food chains; assurance of authenticity; validity of labelling; application of HACCP to the whole food chain.

— Methods of analysis, detection and control: The objective is to contribute to the development, improvement, validation and harmonisation of reliable and cost-effective sampling and measurement strategies for chemical contaminants and existing or emerging pathogenic micro-organisms (such as viruses, bacteria, yeasts, fungi, parasites, and new agents of the prion type including development of ante mortem diagnostic tests for BSE and scrapie) so as to controll the safety of the food and feed supply and ensure accurate data for risk analysis.

Research will focus on: methods and standards for analysing and detecting food-borne pathogens and chemical contaminants, including pre-normative aspects; modelling and approaches to improve existing prevention and control strategies; detection tests and geographical mapping of prions; transfer and longevity of prions.

— Safer and environmentally friendly production methods and technologies and healthier foodstuffs: The objective is to develop lower input farming systems (agriculture and aquaculture) based on systems such as integrated production, lower-input methods including organic agriculture and the use of plant and animal sciences and biotechnologies and improved transformation processes aimed at producing safer healthier nutritious, functional and varied foodstuffs, and animal feed, responding to consumer expectations, and improving the quality of food and feed through innovative technologies.

Research will focus on: development of improved integrated production systems, lower-input farming, organic farming and GMO-based production as well as processing and distribution methods and innovative technologies for safer, nutritious and higher quality food and feed; individual and comparative assessment of safety, quality, environmental impact and competitiveness aspects of different production methods and foodstuffs; improvement of animal husbandry, waste-management and animal welfare from housing to slaughter; application of plant and animal sciences and biotechnologies, including the application of genomics, for the development of higher quality food raw materials and nutritious foods.

— Impact of animal feed, on human health: The objective is to improve understanding of the role of animal feed, including products containing genetically modified organisms and the use of sub-products of different origins for that feed, in food safety, to reduce the use of undesirable raw materials and to develop alternative new animal feed sources.

Research will focus on: epidemiological studies of animal-feed induced food-borne diseases; influence of raw materials, including waste and by-products of different origins, processing methods, additives and veterinary drugs used in animal feed on animal and human health; improved waste management, to ensure exclusion of specified high-risk and condemned materials from the feed chain; novel protein, fat and energy sources other than meat and bone meal for optimal animal growth, reproductive potential and food product quality.

— Environmental health risks: The objectives are to identify the environmental factors that are detrimental to health, understand the mechanisms involved and determine how to prevent or minimise these effects and risks.

(a) Risks linked to the food-chain (chemical, biological and physical).

(b) Combined exposures of authorised substances, including impact of local environmental disasters and pollution on the safety of foodstuffs, with emphasis being placed on cumulative risks and health impacts of environmental pollutants, transmission routes to human beings, long-term effects and exposure to small doses, prevention strategies, as well as the impact on particularly sensitive groups, and especially children.

Research will focus on: identification of causal agents including contaminants, and physiological mechanisms, of environmental, and food-linked environmental hazards; understanding of exposure pathways, estimation of cumulative, low dose and combined exposures; long-term effects; definition and protection of susceptible sub-groups; environmental causes and mechanisms responsible for the increase in allergies; impact of endocrine disrupters; chronic chemical pollution and combined environmental exposures, transmission of illnesses linked to water (parasites, viruses, bacteria, etc.).

The research activities carried out within this thematic priority area will include exploratory research at the leading edge of knowledge on subjects closely related to one or more topics within it. Two complementary approaches will be utilised: one receptive and open — the other proactive.

1.1.6. **Sustainable development, global change and ecosystems**

The Treaty confirms sustainable development as a central objective of the European Community. This was emphasised by the European Council in Göteborg and is reflected in the Union strategy for sustainable development, including the Sixth Environment Action Programme. In this context, global change, energy security, sustainable transport, sustainable management of Europe's natural resources, and their interaction with human activities motivate this research priority theme. The activities carried out within this priority aim at strengthening the scientific and technological capacities needed for Europe to be able to implement a sustainable development model in the short and in the long term, integrating its social, economic and environmental dimensions, and make a significant contribution to the international efforts to mitigate or even to reverse current adverse trends, to understand and control global change and preserve the equilibrium of ecosystems.

1.1.6.1. ***Sustainable energy systems***

Strategic objectives address the reduction of greenhouse gases and pollutant emissions, the security of energy supply, the increased use of renewable energy as well as to achieve an enhanced competitiveness of European industry. Achieving these objectives in the short term requires a large-scale research effort to encourage the deployment of technologies already under development and to help promote changes in energy demand patterns and consumption behaviour by improving energy efficiency and integrating renewable energy into the energy system. The longer term implementation of sustainable development requires also an important RTD effort to assure the economically attractive availability of energy, and overcome the potential barriers to adoption of renewable energy sources and new carriers and technologies such as hydrogen and fuel cells that are intrinsically clean.

Research priorities

(i) *Research activities having an impact in the short and medium term*

Community RTD activity is one of the main instruments which can serve to support the implementation of new legislative instruments in the field of energy and to change significantly current unsustainable patterns of development, which are characterised by growing dependence on imported fossil fuels, continually rising energy demand, increasing congestion of the transport systems, and growing CO_2 emissions, by offering new technological solution which could positively influence consumer/user behaviour, especially in the urban environment.

The goal is to bring innovative and cost competitive technological solutions to the market as quickly as possible through demonstration and other research actions aiming at the market, which involve consumers/users in pilot environments, and which address not only technical but also organisational, institutional, financial and social issues.

— Clean energy, in particular renewable energy sources and their integration in the energy system, including storage, distribution and use.

  The aim is to bring to the market improved renewable energy technologies and to integrate renewable energy into networks and supply chains, for example by supporting stakeholders who are committed to establishing 'Sustainable Communities' employing a high percentage of renewable energy supplies. Such actions will adopt innovative or improved technical and/or socio-economic approaches to 'green electricity', heat, or biofuels and their integration into energy distribution networks or supply chains, including combinations with conventional large scale energy distribution.

  Research will focus on: increased cost effectiveness, performance and reliability of the main new and renewable energy sources; integration of renewable energy and effective combination of decentralised sources, cleaner conventional large-scale generation; validation of new concepts for energy storage, distribution and use.

— Energy savings and energy efficiency, including those to be achieved through the use of renewable raw materials.

  The overall Community objective is to reduce the demand for energy by 18 % by the year 2010 in order to contribute to meeting the EU's commitments to combat climate change and to improve the security of energy supply. Research activities will focus in particular on Eco-Buildings to generate energy savings and improve environmental quality as well as quality of life for occupants. 'Polygeneration' activities will contribute to the Community target of doubling the share of co-generation (CHP) in EU electricity generation from 9 % to 18 % by 2010, and improve the efficiency of combined production of electricity, heating and cooling services, by using new technologies such as fuel cells and integrate renewable energy sources.

Research will focus on: improving savings and efficiency mainly in the urban context, in particular in buildings, through the optimisation and validation of new concepts and technologies, including combined heat and power and district heating/cooling systems; opportunities offered by on-site production and use of renewable energy to improve energy efficiency in buildings.

— Alternative motor fuels

The Commission has set an ambitious target of 20 % substitution of diesel and gasoline fuels by alternative fuels in the road transport sector by the year 2020. The aim is to improve the security of energy supply through reduced dependence on imported liquid hydrocarbons and to address the problem of greenhouse gas emissions from transport. In line with the Communication on alternative fuels for road transportation, short term RTD will concentrate on three types of alternative motor fuels that potentially could reach a significant market share: biofuels, natural gas and hydrogen.

Research will focus on: the integration of alternative motor fuels into the transport system, particularly into clean urban transport; the cost-effective and safe production, storage, and distribution (including fuelling infrastructure) of alternative motor fuels; the optimal utilisation of alternative fuels in new concepts of energy efficient vehicles; strategies and tools to manage the market transformation process for alternative motor fuels.

(ii) *Research activities having an impact in the medium and longer term*

In the medium and longer term the objective is to develop new and renewable energy sources, and new carriers such as hydrogen which are both affordable and clean and which can be well integrated in a long term sustainable energy supply and demand context both for stationary and for transport applications. Furthermore the continuing use of fossil fuels in the foreseeable future requires cost-effective solutions to the disposal of CO_2. The goal is to bring about further reduction in greenhouse gas emissions beyond the Kyoto deadline of 2010. The future large-scale development of these technologies will depend on significant improvement in their cost and other aspects of competitiveness against conventional energy sources, within the overall socio-economic and institutional context in which they are deployed.

— Fuel cells, including their applications: these represent an emerging technology which is expected, in the longer term, to replace a large part of the current combustion systems in industry, buildings and road transport, as they have a higher efficiency, lower pollution levels and a potential for lower cost. The long term cost target is 50 euro/kW for road transport and 300 euro/kW for high-durability stationary applications and fuel cell/electrolysers.

Research will focus on: cost reduction in fuel cell production and in applications for buildings, transport and decentralised electricity production; advanced materials related to low and high temperature fuel cells for the above applications.

— New technologies for energy carriers/transport and storage, in particular hydrogen: The aim is to develop new concepts for long term sustainable energy supply where hydrogen and clean electricity are seen as major energy carriers. For H_2, the means must be developed aiming at ensuring its safe use at an equivalent cost to that of conventional fuels. For electricity, decentralised new and in particular renewable energy resources, must be optimally integrated, within inter-connected European, regional and local distribution networks to provide secure and reliable high quality supply.

Research will focus on: Clean cost-effective production of hydrogen; hydrogen infrastructure including transport, distribution, storage and utilisation; for electricity the focus will be on new concepts, for analysis, planning, control and supervision of electricity supply and distribution and on enabling technologies, for storage, interactive transmission and distribution networks.

— New and advanced concepts in renewable energy technologies: Renewable energy technologies have, in the long term, the potential to make a large contribution to the world and EU energy supply. The focus will be on technologies with a significant future energy potential and requiring long-term research, by means of actions with high European added value in particular to overcome the major bottleneck of high investment costs, and to make these technologies competitive with conventional fuels.

Research will focus on: for photovoltaics: the whole production chain from basic material to the PV system, as well as on the integration of PV in habitat and large scale MW-size PV systems for production of electricity. For biomass, barriers in the biomass supply-use chain will be addressed in the following areas: production, combustion technologies, gasification technologies for electricity and H_2/syngas production and biofuels for transport. For other areas of new and advanced concepts in renewable technologies, the effort will be focused on integrating at European level specific aspects of RTD activities which require long term research.

— Capture and sequestration of CO_2, associated with cleaner fossil fuel plants: Cost effective capture and sequestration of CO_2 is essential to include the use of fossil fuels in a sustainable energy supply scenario, reducing costs to the order of EUR 30 in the medium term and EUR 20 or less in the longer term per tonne of CO_2 for capture rates above 90 %.

Research will focus on: developing holistic approaches to near zero emission fossil fuel based energy conversion systems, low cost CO_2 separation systems, both pre-combustion and post-combustion as well as oxyfuel and novel concepts; development of safe, cost efficient and environmentally compatible CO_2 disposal options, in particular geological storage, and exploratory actions for assessing the potential of chemical storage and innovative uses of CO_2 as a resource.

1.1.6.2. ***Sustainable surface transport*** [1]

The White Paper: 'European transport policy for 2010: time to decide' forecasts a transport demand growth by 2010 in the European Union of 38 % for freight and 24 % for passenger transport (base-year 1998). The already congested transport networks will have to absorb the additional traffic, and the trend suggests that the proportion absorbed by the less sustainable modes is likely to grow. The objective is consequently both to fight against congestion and to decelerate or even reverse these trends regarding the modal split by better integrating and rebalancing the different transport modes, improving their safety, performance and efficiency, minimising their impact on the environment and ensuring the development of a genuinely sustainable European transport system, while supporting European industry's competitiveness in the production and operation of transport means and systems.

Research priorities

(i) Developing environmentally friendly and competitive transport systems and means of transport. The objective is to reduce the contribution of surface transport (rail, road, waterborne) to CO_2 emissions and other environmentally hazardous emissions including noise, while increasing safety, comfort, quality, cost-effectiveness and energy-efficiency of vehicles and vessels. Emphasis will be given to clean urban transport and rational use of the car in the city.

— New technologies and concepts for all surface transport modes (road, rail and waterborne).

Research will focus on: high efficiency propulsion systems and their components, based on alternative and renewable fuels, taking into account the fuelling infrastructure; development of zero or near zero emission propulsion systems and components, in particular those integrating fuel cells, hydrogen combustion and their fuelling infrastructure into the transport system; integrated concepts for clean urban transport and rational use of the car in urban locations.

— Advanced design and production techniques.

Research will focus on: 'transport-specific' advanced design and production techniques, in particular for one-of-a-kind production environments, leading to improved competitiveness through quality, safety, recycling, comfort and cost-effectiveness of environmentally friendly vehicles (cars and trains) and vessels.

(ii) Making rail and maritime transport safer, more effective and more competitive. The objectives are to assure transport of passengers and freight, taking into account transport demand and the need for rebalancing transport modes, while increasing transport safety in line with the 2010 objectives for European transport policy (eg for road transport the objective would be to halve the number of fatalities).

— Rebalancing and integrating different transport modes.

Research will focus on: interoperable transport systems, to enable the inter-connectivity of the transport networks, in particular enabling a competitive European railway system and the integration of a European vessel traffic information system; intermodal transport services, technologies (e.g. harmonisation of unit loads) and systems, and advanced mobility management and transport logistics;

[1] 'Surface transport' is understood to cover road, rail and waterborne transport; waterborne transport covers maritime and inland waterway transport.

— Increasing road, rail and waterborne safety and avoiding traffic congestion.

Research will focus on: strategies and technologies to increase road safety and to improve maritime safety; concepts and systems for advanced human-vehicle, vehicle-vehicle and vehicle-infrastructure interaction; large-scale integration and validation platforms for intelligent transport systems (e.g. transport pricing, transport and traffic management and transport information), including satellite navigation applications, new vehicle types and operational procedures to increase capacity and safety, while respecting the environment (in particular in urban and sensitive areas).

1.1.6.3. ***Global change and ecosystems***

Global change encompasses the complex dynamic changes over different time-scales in the physical, chemical and biological components of the Earth system (i.e. atmosphere, oceans and land) in particular those influenced by human activities. The objectives of this priority area are:

(i) to strengthen the capacity to understand, detect and predict global change and develop strategies for prevention, mitigation and adaptation, in close liaison with the relevant international research programmes and in the context of relevant conventions such as the Kyoto Protocol and the Montreal Protocol;

(ii) to preserve the ecosystems and protect biodiversity which would also contribute to the sustainable use of land and marine resources. Concerning global change, strategies for integrated, sustainable management of agricultural and forest ecosystems are of particular importance for the preservation of these ecosystems and will contribute substantially to the sustainable development of Europe. These objectives will be best achieved through activities aiming at the development of common and integrated approaches necessary to implement sustainable development, taking into account its environmental, economic and social aspects, as well as the impact of global change on all countries and regions of the world. It will foster the convergence of European and national research efforts for common definitions of thresholds of sustainability and estimation methods, and encourage international cooperation in order to achieve common strategies to respond to global change issues.

Research priorities

— Impact and mechanisms of greenhouse gas emissions and atmospheric pollutants on climate, ozone depletion and carbon sinks (oceans and inland waters, forests and soil). The objective is to detect and describe global change processes, associated with greenhouse gas emissions and atmospheric pollutants from all sources, including those resulting from energy supplies, transport and agriculture, to improve prediction and assessment of their global and regional impacts, evaluate mitigation options and improve the access of European researchers to facilities and platforms for global change research.

Research will focus on: understanding and quantification of changes in the carbon and nitrogen cycles; the role of all sources of greenhouse gases and atmospheric pollutants and their sinks in the biosphere; their effects on climate dynamics and variability, ocean and atmospheric chemistry, and their interactions; future stratospheric ozone levels and ultraviolet radiation; prediction of global climatic change and impacts; associated phenomena (e.g. the North Atlantic oscillation, El Niño and changes in sea level and ocean circulation); and mitigation and adaptation strategies.

— Water cycle, including soil-related aspects: the objective is to understand the mechanisms and assess the impact of global change and in particular climate change on the water cycle, water quality and availability, as well as soil functions and quality to provide the bases for management tools for water systems to mitigate the impacts.

Research will focus on: impact of climate change on the components of the hydrological cycle — land/ocean/atmosphere interactions, groundwater/surface water distribution, freshwater and wetland ecosystems, soil functioning and water quality; assessment of vulnerability of water/soil systems to global change; management strategies, their impacts and mitigation technologies; scenarios of water demand and availability.

— Biodiversity and ecosystems: the objectives are to develop a better understanding of marine and terrestrial biodiversity and of ecosystem functioning, understand and minimise the negative impacts of human activities on them and ensure sustainable management of natural resources and terrestrial and marine ecosystems (including fresh water systems) as well as the protection of genetic resources.

Research will focus on: assessing and forecasting changes in biodiversity, structure, function and dynamics of ecosystems and their services, with emphasis on marine ecosystems' functioning; relationships between society, economy, biodiversity and habitats; integrated assessment of drivers affecting ecosystems' functioning and biodiversity, and mitigation options; risk assessment, management, conservation and rehabilitation options in relation to terrestrial and marine ecosystems.

— Mechanisms of desertification and natural disasters: the objective is to understand the mechanisms of desertification and natural disasters (such as those caused by seismic and volcanic activity), including their links with climatic change so as to improve risk and impact assessment and forecasting, and decision support methodologies.

Research will focus on: large scale integrated assessment of land/soil degradation and desertification in Europe and related prevention and mitigation strategies; long term forecasting of hydro-geological hazards; natural hazard monitoring, mapping and management strategies; improved disaster preparedness and mitigation.

— Strategies for sustainable land management, including coastal zones, agricultural land and forests: The objective is to contribute to the development of strategies and tools for sustainable use of land, with emphasis on the coastal zones, agricultural lands and forests, including integrated concepts for the multipurpose utilisation of agricultural and forest resources, and the integrated forestry/wood chain in order to ensure sustainable development at economic, social, and at environmental levels; qualitative and quantitative aspects of multifunctionality of agriculture and forestry will be addressed.

Research will focus on: development of the necessary tools for integrated management of coastal zones (ICZM); evaluation of positive and negative externalities under different production systems for agriculture and forestry; development of strategies for sustainable forest management considering regional specificity; strategies/concepts for sustainable management and multipurpose utilisation of forest and agriculture resources; cost-efficiency of new environmental-friendly processes and recycling technologies within the integrated forestry/wood chain.

— Operational forecasting and modelling, including global climate change observation systems: the objective is to make systematic observations of atmospheric, terrestrial and oceanic parameters including those of climate so as to improve forecasting of the marine, terrestrial and atmospheric environment, consolidate long-term observations for the modelling and in particular prediction, establish common European data bases and contribute to international programmes.

Research will focus on: observations of basic marine, terrestrial and atmospheric parameters necessary for global change research and management strategies, and of extreme events; large observing/monitoring/surveying/operational forecasting/modelling networks (taking into account the developments of GMES and providing the European dimension to G3OS [1].

— Complementary research will focus on: development of advanced methodologies for risk assessment of processes, technologies, measures and policies, appraisal of environmental quality, including reliable indicators of population health and environmental conditions and risk evaluation in relation to outdoor and indoor exposure. Relevant prenormative research on measurements and testing for these purposes will also be necessary.

The research activities carried out within this thematic priority area will include exploratory research at the leading edge of knowledge on subjects closely related to one or more topics within it. Two complementary approaches will be utilised: one receptive and open — the other proactive.

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[1] Global Observing Systems (3: Global Climate Observing System (GCOS), Global Ocean Observing System (GOOS), Global Terrestrial Observing System (GTOS)).

1.1.7. **Citizens and governance in a knowledge-based society**

The Lisbon European Council recognised that the transition towards a European knowledge-based society will affect every aspect of people's lives. The overall objective is to provide a sound knowledge base for the management of this transition, which will be conditioned by national, regional and local policies, programmes and actions, as well as informed decision making by individual citizens, families and other societal units.

Given the complexity, breadth and interdependence of these challenges and the issues involved, the research approach adopted must be based on greatly enhanced research integration, multi and transdisciplinary cooperation, and on the mobilisation of the social sciences and humanities research communities in Europe in addressing them. Activities will also facilitate the identification of medium to long term societal challenges arising from research in social sciences and humanities and will ensure the active participation of key societal stakeholders and the targeted dissemination of the work carried out. In order to support the development of comparative transnational and interdisciplinary research, while at the same time preserving the diversity of research methodologies throughout Europe, the collection and analysis of better and more genuinely comparable data and the coordinated development of statistics and qualitative and quantitative indicators in particular in the context of the emerging knowledge society at the European level is essential.

Appropriate coordination of socio-economic research and foresight elements across the specific programmes will be assured.

Research priorities

(i) *Knowledge-based society and social cohesion*

The building of a European knowledge society is a clear political objective for the European Community. The research aims to provide the basis of understanding needed to ensure this takes place in a manner which accords with specific European conditions and aspirations.

— Improving the generation, distribution and use of knowledge and its impact on economic and social development. The objective is to improve significantly understanding of the characteristics of knowledge and its functioning as a public and private good, and to provide the bases for policy formulation and decision making.

  Research will focus on: characteristics of knowledge and its functioning in relation to the economy and society, as well as for innovation and for entrepreneurial activities; and the transformation of economic and social institutions; the dynamics of knowledge production, distribution and use, role of knowledge codification and impact of ICTs; the importance of territorial structures and social networks in these processes.

— Options and choices for the development of a knowledge-based society. The objective is to develop an integrated understanding of how a knowledge-based society can promote the societal objectives of the EU set at the Lisbon summit and subsequent European Councils of sustainable development, social and territorial cohesion and improved quality of life, with due consideration to the variety of social models in Europe and taking into account aspects relating to the ageing of the population.

  Research will focus on: features of a knowledge based society in line with European social models and the need to improve the quality of life; social and territorial cohesion, gender and intergenerational relations and social networks; implications of changes to work and employment, and the labour market; access to education and training, and life-long learning.

— The variety of paths towards a knowledge society. The objective is to provide comparative perspectives across Europe and thus provide an improved basis for the formulation and implementation of transition strategies towards a knowledge society at the national and regional levels.

  Research will focus on: globalisation in relation to pressures for convergence; the implications for regional variation; challenges to European societies from a diversity of cultures and increased sources of knowledge; the role of the media in this context.

(ii) *Citizenship, democracy and new forms of governance*

The work will identify the main factors influencing changes in governance and citizenship, in particular in the context of increased integration and globalisation and from the perspectives of history and cultural heritage as well as the impacts of these changes and the possible options to enhance democratic governance, resolve conflicts, protect human rights and take account of cultural diversity and multiple identities.

— The implications of European integration and enlargement for governance and the citizen. The objective is to clarify the key interactions between European integration and enlargement, and issues of democracy, institutional arrangements and citizens' well-being.

  Research will focus on: relationships between integration, enlargement and institutional change within the context of their historical evolution and with a comparative perspective; the implications of a changing global context and the role of Europe; the consequences of an enlarged European Union for the well-being of its citizens.

— Articulation of areas of responsibility and new forms of governance. The objective are to support the development of forms of multi-level governance which are accountable, legitimate, and sufficiently robust and flexible to address societal change including integration and enlargement, and to assure the effectiveness and legitimacy of policy making.

  Research will focus on: the articulation of responsibilities between various territorial levels and between public and private sectors; democratic governance, representative institutions and roles of civil society organisations; privatisation, the public interest, new regulatory approaches, corporate governance; implications for legal systems.

— Issues connected with the resolution of conflicts and restoration of peace and justice. The objectives are to support the development of institutional and social capacity in the field of conflict resolution, identify factors leading to success or failure in preventing conflict, and develop improved options for conflict mediation.

  Research will focus on: early identification of factors leading to conflict within and between countries; comparative analysis of procedures for prevention and mediation of conflicts and achievement of justice in different fields, including the safeguarding of fundamental rights; Europe's role in regional and international arenas in these respects.

— New forms of citizenship and cultural identities. The objectives are to promote citizens' involvement and participation in European policy making, to understand perceptions and impacts of citizenship and human rights provisions in Europe and to identify factors that allow mobility and coexistence of multiple identities.

  Research will focus on: relations between new forms of citizenship including rights of non-citizens; tolerance, human rights, racism and xenophobia; the role of the media in the development of a European public sphere; evolution of citizenship and identities in a context of cultural, and other diversities in Europe, taking into account population flows; social and cultural dialogue among the peoples in Europe and with other world regions; implications for the development of a European knowledge based society.

The research activities carried out within this thematic priority area will include exploratory research at the leading edge of knowledge on subjects closely related to one or more topics within it. Two complementary approaches will be utilised: one receptive and open — the other proactive.

1.2. SPECIFIC ACTIVITIES COVERING A WIDER FIELD OF RESEARCH

Activities under this heading will complement research within the thematic priority areas and comprise the following:

— Policy support and anticipating the EU's scientific and technological needs;

— Specific research activities for SMEs;

— Specific international cooperation activities.

1.2.1. **Policy support and anticipating scientific and technological needs**

These activities have a distinct role within the overall architecture of the Framework Programme 2002-2006. They involve common implementation arrangements, and the necessary critical mass, to assure efficient and flexible conduct of research which is essential to the fundamental objectives of Community research and which covers a wide range of needs that cannot be satisfied within the thematic priorities. They will have the following specific objectives:

— To underpin the formulation and implementation of Community policies, bearing on the interests of possible future members of the Union as well as the existing member states, and monitor their effects;

— To explore new and emerging scientific and technological problems and opportunities, including in particular interdisciplinary and multidisciplinary research areas, where European action is appropriate in view of the potential to develop strategic positions at the leading edge of knowledge and in new markets, or to anticipate major issues facing European society.

A feature common to these activities is that they will be implemented within a multi-annual perspective which takes direct account of the needs and viewpoints of the main associated actors (as appropriate: policymakers, industrial user groups, leading edge research groups, etc.) They will be implemented in conjunction with flexible programming mechanism to be implemented during the course of the programme, by which specific priorities, corresponding to identified needs and falling within the objectives indicated above, will be determined.

Priorities thus determined will then be inscribed in the workprogramme for the specific programme, alongside the priorities deriving from objectives in other parts of the programme, and updated regularly. This will result in a progressive allocation of the budget relating to these activities to the specific priorities identified, throughout the period of execution.

The programming will be carried out by the Commission, and will be based on suggestions received in response to a wide-ranging consultation of interested circles in the EU and the countries associated with the Framework Programme, regarding the topics to be included.

A first allocation of EUR 340 million will be made to the research activities specified below, which have been determined on the basis of needs which can be identified now; the remaining EUR 215 million will be allocated during the course of implementation of the specific programme, in which due consideration will be given to the need for maintaining the necessary flexibility for dealing with 'policy support and anticipating scientific and technological needs'.

(i) *Policy-oriented research*

The activities under this heading will provide, in particular, support for:

— the common agricultural policy (CAP), and the common fisheries policy (CFP);

— sustainable development, in particular the Community policy objectives relating to environment including those set out in the 6th Environment Action Programme; energy (the Green Paper 'Towards a European strategy for the security of energy supply'); and transport (the White Paper on European transport policy);

— other Community policies, namely health (in particular public health), regional development, trade, development aid, internal market and competitiveness, social policy and employment, education training and culture, gender equality, consumer protection, the creation of an area of freedom, security and justice, external relations including those policies in support of enlargement, and including the requisite statistical methods and tools;

— Community policy objectives deriving from the political orientations given by the European Council, with regard to, for instance, economic policy, the Information Society, as well as e-Europe, and enterprise.

They may include pre-normative research and measurement and testing where necessary for the needs of Community policies. Links between the different policy areas will be taken into account.

Multi-annual programming

The multi-annual programming of these activities will take into account the opinions of the relevant Scientific Committees associated with the policies concerned. The programming will be conducted with the help of a User Group composed of different Commission Services, who will also have recourse, where appropriate, to an independent consultation structure composed of high-level scientific and industrial experts. The User Group will assess suggestions put forward regarding the topics to be included on the basis of the following criteria:

— their contribution to policy formulation and development (e.g. links with legislative proposals in preparation or with major deadlines in the area);

— their potential contribution to the EU's competitiveness, the strengthening of its scientific and technological bases and the achievement of the European Research Area, including the effective integration of the candidate countries;

— European added value, taking account in particular of research carried out in the Member States in the relevant fields;

— the scientific relevance and feasibility of the research themes and approaches proposed;

— assurance of an appropriate division of tasks, and synergy, between these activities and the Direct Actions of the Joint Research Centre in support of Community policies.

The programming may be altered by means of an emergency procedure based on the same evaluation criteria in the event of a crisis giving rise to urgent and unforeseen research needs.

Initial research priorities

Policy-orientated research priorities responding to immediate needs are based on suggestions for topics made by the Commission's policy services, drawing on the advice, as appropriate, of the relevant Scientific Committees, as well as the broader objectives of the Union as set out in successive conclusions of the meetings of the European Council.

They have been grouped within the following lines of action, in a structure which optimises synergies between different policy requirements and scientific inputs, and which cuts across and complements the thematic priorities:

— Sustainable management of Europe's natural resources. Research under this heading responds to policy requirements relating, in particular, to the modernisation and sustainability of the common agriculture and fisheries policies and the promotion of rural development, including forestry. It will focus on:

  the modernisation and sustainability of agriculture and forestry, including their multifunctional role in order to ensure the sustainable development and promotion of rural areas;

  tools and assessment methods for sustainable agriculture and forestry management;

  the modernisation and sustainability of fisheries policy, including aquaculture-based production systems;

  new and more environment friendly production methods to improve animal health and welfare including research on animal diseases such as foot and mouth disease, swine fever and development of marker vaccines;

  environmental assessment (soil, water, air, noise, including the effects of chemical substances);

  assessment of environmental technologies for support of policy decisions, in particular concerning effective but low-cost technologies in the context of fulfilling environmental legislation.

— Providing health, security and opportunity to the people of Europe. Research in this category responds to policy requirements relating, in particular, to the implementation of the European Social Agenda including future social policy issues, public health and consumer protection and the creation of an Area of Freedom, Security and Justice. It will focus on:

  health determinants and the provision of high quality and sustainable health care services and pension systems (in particular in the context of ageing and demographic change);

  public health issues, including epidemiology contributing to disease prevention and responses to emerging rare and communicable diseases, allergies, procedures for secure blood and organ donations, non-animal test methods;

  the impact of environmental issues on health (including safety at work and methods for risk assessment and the mitigation of risks of natural disasters to people);

  quality of life issues relating to handicapped/disabled people (including equal access facilities);

  comparative research of factors underlying migration and refugee flows, including illegal immigration and trafficking in human beings;

improved means to anticipate crime trends and causes, and to assess the effectiveness of crime prevention policies; assessment of new challenges related to illicit drug use;

issues related to civil protection (including biosecurity and protection against risks arising from terrorist attacks), and crisis management.

— Underpinning the economic potential and cohesion of a larger and more integrated European Union. Research in this category responds, in particular, to the needs of a series of policies concerned with the competitiveness, dynamism and integration of the European economy, in the context of enlargement, globalisation and Europe's commercial relations with the rest of the world. It will focus on:

underpinning European integration, sustainable development, competitiveness and trade policies (including improved means to assess economic development and cohesion);

the development of tools, indicators and operational parameters for assessing sustainable transport and energy systems performance (economic, environmental and social);

global security analysis and validation systems for transport and research relating to accident risks and safety in mobility systems;

forecasting and developing innovative policies for sustainability in the medium and long term;

Information Society issues (such as management and protection of digital assets, and inclusive access to the information society);

the protection of cultural heritage and associated conservation strategies;

improved quality, accessibility and dissemination of European statistics.

A coordinated approach will be ensured when addressing research questions that are common to different policy areas, in particular with respect to the measurement and impact assessment of demographic changes and more broadly in the development of policy-relevant statistics and indicators. Policy makers should also have appropriate and timely information on the results of policy-oriented research.

(ii) *Research to explore new and emerging scientific and technological problems and opportunities*

Research under this heading will respond to needs in new areas which fall within the legitimate scope of Community research and which cut across or lie outside the thematic priority areas, in particular because they are highly interdisciplinary and/or multidisciplinary. The research will also respond to unexpected major developments. By bringing together resources from across the EU, it will aim to put European research in a leading position, opening the way or creating new scientific and technological developments. It will stimulate the flow of ideas between academia and industry, and allow Europe better to exploit its research assets in the drive towards a dynamic knowledge-based society.

The following areas of activity will be supported initially:

— Research to assess rapidly new discoveries, or newly-observed phenomena, which may indicate emerging risks or problems of high importance to European society, and identify appropriate responses to them.

— Research in emerging areas of knowledge and on future technologies, in particular in transdisciplinary fields, which is highly innovative and involves correspondingly high (technical) risks. It will be open to any new idea that has significant potential for major industrial and/or social impact, or for the development of Europe's research capabilities in the longer term.

Proposals will be evaluated on the basis of research excellence, potential for future impact, and, in the first of these areas particularly, innovativeness.

Multi-annual programming

Specific topics within the above categories on which research will be focused during the implementation of the programme will be selected by means of the multi-annual programming on the basis of their urgency or potential for future societal, industrial, or economic relevance, taking account of the ongoing research activities under this heading. The assessment of topics will be carried out with the support of an independent consultation structure composed of high-level scientific and industrial experts and will also incorporate the following criteria:

— the potential contribution of the research topics proposed for innovation and the EU's competitiveness, the strengthening of its scientific and technological bases and the achievement of the European Research Area, including the effective integration of the candidate countries;

— the scientific relevance and timeliness of the research themes and approaches proposed.

The programming may be altered by means of an emergency procedure based on the same evaluation criteria in the event of a crisis giving rise to urgent and unforeseen research needs. Foresight studies could also make a contribution to informing the priority setting process.

(iii) *Implementation*

The activities programmed will be carried out by means of calls for proposals, preceded, where appropriate, by a call for expressions of interest, in particular in the area of exploring new and emerging scientific technological areas. They will essentially take the form of:

— specific targeted research projects generally of a limited scale, carried out by means of partnerships of a size adapted to the needs to be covered;

— coordination actions, and the networking of research activities carried out at national level where the objectives can be achieved by mobilising capacities existing in the Member States, candidate countries and other associated states.

In certain duly justified cases, where the objectives pursued can be better attained in this way, limited use may be made of networks of excellence and integrated projects.

The proposals will be selected by the Commission following evaluation by independent experts.

Specific support actions may also be used to implement these activities.

1.2.2. **Horizontal research activities involving SMEs**

Objectives

Small and medium-sized enterprises (SMEs) play a crucial role in European competitiveness and job creation, not only because they represent the overwhelming majority of enterprises in Europe, but also because they are the source of dynamism and change in new markets, particularly those at the leading edge of technology. Although a heterogeneous community, they are all confronted by increased competition resulting from the completion of the European internal market and the need to innovate constantly and accommodate advances in technology. Besides this, an increasing number of SMEs both need and want to internationalise in search of new markets and business opportunities.

SMEs will participate, for the most part, in the activities implemented under the priority thematic areas of research within networks of excellence, integrated projects and specific targeted research projects. In addition, specific schemes for SMEs in the form of actions on collective and cooperative research will be set up. These will be addressing primarily the large community of SMEs with a capacity to innovate but with limited research capability. However, the cooperative research scheme will also allow innovative SMEs to cooperate with universities and research centres.

Overall, in addition to the horizontal activities for SMEs, at least 15 % of the budget relating to the seven thematic priorities under this programme will be allocated to SMEs.

(i) *Collective research*

Collective research is a form of research undertaken by RTD performers on behalf of industrial associations or industry groupings in order to expand the knowledge base of large communities of SMEs and thus improve their general standard of competitiveness. Conducted on a European basis, through substantial projects of several years duration, this is an efficient way of addressing technological needs of significant sections of the industrial community.

Based on schemes existing in many member states, this measure aims at allowing industrial groupings to identify and express research needs that are common to large numbers of SMEs at European level. It should allow to improve the overall European technological basis of whole industrial sectors. By inter-linking industrial groupings in different countries and in financing larger projects with an increased responsibility for project co-ordinators, it will contribute to structuring the landscape of collective research in line with the objectives of the European Research Area.

Collective research projects could cover, for example:

— research aimed at addressing common problems/challenges (e.g. to meet regulatory requirements, environmental performance);

— pre-normative research (research to provide a scientific base for European norms and standards);

— research aimed at reinforcing the technological basis of particular sector(s);

— development of 'technological tools' (e.g. diagnosis, safety equipment).

Projects will be managed, on the basis of well-defined guidelines, by industrial associations or other groupings established at European level, or by at least two national industrial associations/groupings established in different European countries. European Economic Interest Groups representing the interests of SMEs are also eligible. A 'core group' of SMEs associated to each project will monitor progress from the definition phase of the research to the dissemination of the results obtained.

A two-step approach is envisaged in identifying topics and selecting proposals (call for outline proposals and, after those selected in a first round evaluation have been developed into complete proposal(s), evaluation and selection from amongst these). The level of funding and contractual arrangements of Collective research projects will depend on their objectives:

— projects aimed at strengthening the competitiveness of a specific industrial sector would benefit from a maximum Community contribution of 50 % of the total eligible costs. In such cases the contracting party (the industrial groupings) would own the results;

— projects having a strong legislative or 'public well-being' content (e.g. environmental protection, enhancement of public health), could obtain a higher funding. In such cases, the main emphasis will be on a Europe-wide dissemination of the research results.

In all cases, dissemination of the results amongst the SMEs would be foreseen through, for example, special training and demonstration ('take-up') actions.

(ii) *Cooperative research*

Cooperative research is a scheme whereby a limited number of SMEs from different countries having specific problems or needs, outsource the required research to an RTD performer, while retaining ownership of the results. Projects are relatively short term and may address any research topic or field, being based on the specific needs and problems of the SMEs concerned. Other (non-SME) enterprises and end-users will be able to participate in co-operative research projects, under conditions ensuring they do not assume a dominant role, and have restricted access to the results.

These activities may also be carried out by innovative and high-tech SMEs in cooperation with research centres and universities.

Cooperative research will be implemented via an open call for proposals.

Information and advice about the possibilities of SME involvement will be ensured via entry points set up by the Commission, and by making use of the national contact point scheme. This activity will also be responsible for the coordination of a dedicated network of SME National Contact Points in the Member States and Associated States, providing SMEs at regional and national level with information and assistance on their participation in the Framework Programme, including in networks of excellence and integrated projects. Close coordination with the Economic and Technological Intelligence Actions and with the innovation support services, implemented under the heading 'Research and Innovation', will ensure that SMEs benefit from all the foreseen instruments and activities.

1.2.3. **Specific measures in support of international cooperation**

The general objective of the international cooperation activities carried out under the Framework Programme is to help open up the European Research Area to the rest of the world. These activities represent the particular contribution of the Framework Programme to this opening-up process, which will require a joint effort by the Community and the Member States.

Under this heading, the activities in question have the following particular objectives:

— To help European researchers, businesses and research organisations in the EU and the countries associated with the Framework Programme to have access to knowledge and expertise existing elsewhere in the world.

— To help ensure Europe's strong and coherent participation in the research initiatives conducted at international level in order to push back the boundaries of knowledge or help to resolve the major global issues, for example as regards health and environment.

— To lend support, in the scientific and technological field, to the implementation of the Community's foreign policy and development aid policy.

Apart from opening up the activities of the seven thematic priorities to participation by third-country researchers and institutions, international cooperation activities will take the form of specific activities.

Carried out in support of the Community's foreign policy and development aid policy, these specific activities will concern three groups of countries: the Mediterranean third countries including the Western Balkans, Russia and other NIS countries, and the developing countries.

They will be carried out in such a way as to complement the participation of researchers and entities in those countries in the networks of excellence and integrated projects which are open to them and in which they will participate in a variable way depending on the themes and countries.

The research priorities in this category of activities are defined on the basis of the interests and objectives of the Community's political partnership with the different groups of countries, as well as their particular economic and social needs.

They could therefore cover more particularly:

— in the case of the developing countries, the problems of health and public health, food security, and the rational exploitation of resources.

— in the case of the Mediterranean third countries, in support of the development of the Euro-Mediterranean partnership, issues relating to environment, health and water issues, as well as protection of the cultural heritage. Aspects of sustainable rural development will be duly taken into account, where appropriate. In addition, in the case of the Western Balkans, in support of stability of the region, issues relating to the making good of the consequences of war on the environment, health and agricultural and industrial facilities.

— in the case of Russia and other NIS countries, stabilisation of R&D potential, issues relating to changes in the industrial production system, environment and health protection and related safety aspects.

These activities will be carried out by means of research, technological development and demonstration projects of a limited scale, actions to coordinate national efforts and, where necessary, specific support measures.

Cooperation activities with Russia and other NIS countries will be carried out in particular through the INTAS structure set up jointly by the Community and the Member States.

In all three cases, one of the major objectives is to help strengthen, stabilise, develop or adapt the local research systems.

Accordingly, the Framework Programme activities will endeavour to strengthen coordination and complementarity with activities carried out by means of financial instruments such as, in the case of the Mediterranean third countries, the MEDA Programme, in the case of Russia and other NIS countries the Tacis Programme and in the case of the developing countries the EDF (European Development Fund) and the ALA (Latin America/Asia) Fund. These activities can help to promote the development in those countries of human resources for research, research infrastructures and capabilities relating to innovation and exploitation of results.

2. **STRENGTHENING THE FOUNDATIONS OF THE EUROPEAN RESEARCH AREA**

The establishment of the European Research Area depends on improving the coherence and coordination of research and innovation activities and policies conducted at national, regional and European level.

The objectives of Community action in this field are to stimulate and support programme coordination and joint actions conducted at national or regional level as well as among European organisations and thus help to develop the common knowledge base necessary for the coherent development of policies. The activities may be implemented in any scientific and technological area, including in the thematic priority domains.

2.1. SUPPORT FOR THE COORDINATION OF ACTIVITIES

Coordination of national activities

The objective is to encourage and support initiatives undertaken by several countries, in areas of common strategic interest, to develop synergy between their existing activities through coordination of their implementation, mutual opening and mutual access to research results, as well as to define and implement joint activities.

The activities concerned must be understood as programmes or parts of programmes, instruments, plans or other initiatives undertaken at national or regional levels and involving public funding to support RTD work, the development of research capabilities, and the promotion of innovation. The activities may be undertaken directly by public authorities or research agencies at national or regional levels or through European cooperation frameworks, in particular the EUROCORES collaborative scheme of the European Science Foundation.

Efforts to encourage coordination activities, using a bottom-up approach, will be carried out in the whole field of science and technology, including across domains and disciplines, in areas such as:

— health: health of key population groups; major diseases and disorders (e.g. cancer, diabetes and diabetes-related diseases, degenerative diseases of the nervous system, psychiatric diseases, cardiovascular diseases, hepatitis, allergies, visual impairment, infectious diseases), rare diseases; alternative or non-conventional medicine; and major diseases linked to poverty in developing countries; palliative care; activities involved will be implemented, for instance, through coordination of research and comparative studies, development of European databases and interdisciplinary networks, exchange of clinical practice and coordination of clinical trials.

— biotechnology: non-health and non-food applications.

— environment: urban environment (including sustainable urban development and cultural heritage, including, for example, ecosite concepts); marine environment and land/soil management; seismic risk.

— energy: new generation power plants ('near-zero-emission'), energy storage, transport and distribution.

The Community will encourage and support initiatives aimed at networking national and regional activities and programmes, by supporting:

— the coordination of independent activities including their mutual opening;

— the preparation and the management of joint activities.

For this purpose, the Community will:

— Support proposals selected following their submission in response to an open call for proposals (2 evaluations per year). Where appropriate, calls for expressions of interest, followed by targeted calls may be published.

  Proposals may cover for instance strategic studies and planning, consultation of the research and innovation community, joint calls for proposals and peer review panels, exchange and dissemination of information and results, programme monitoring and evaluation, exchange of personnel.

  Proposals will be evaluated taking into account in particular the following aspects: the scope of the resources mobilised, the scientific and technological relevance and impact, the expected improvement in the use of research resources at European level and where appropriate their contribution to promoting innovation.

— Develop an integrated information system, which will be easily accessible, user-friendly and updated regularly, to provide relevant information to:

  — policy makers and programme managers: information on national and regional research programmes, instruments, research activities undertaken and planned to help identify opportunities for coordination, networking or joint initiatives;

  — the research community: information on national, regional or joint programmes in which they can participate.

Coordination at European level

The objective is to enhance the complementarity and synergy between Community actions undertaken under the Framework Programme and those of other European scientific cooperation organisations as well as among these organisations themselves. Through increased coordination and collaboration the various European cooperation frameworks will contribute more effectively to the overall coherence of European research efforts and the establishment of a European Research Area. Community participation in international activities can be supported in duly justified cases.

— Scientific and technological cooperation activities carried out in other European cooperation frameworks

  COST is a long-standing bottom-up mechanism that facilitates coordination and exchanges between nationally funded scientists and research teams in a variety of areas. In order for COST to continue to fulfil its intergovernmental role and to ensure a cost-effective contribution to research coordination within the European research area, its management arrangements must be adapted to the new context. This will entail the establishment by COST member states of an appropriate organisation to which financial support may then be granted under this programme.

  Reinforced coordination among the activities of the European Science Foundation, COST and the Framework Programme will also be sought in areas of common interest.

  Coordination with EUREKA will be strengthened to improve strategic coherence and complementarity of funding, in particular in the thematic priority areas. Joint information and communication actions will also be organised where appropriate.

— Collaboration and joint initiatives of specialised European scientific cooperation organisations

  With regard to thematic European organisations, such as CERN, ESA, ESO, ENO, EMBL, ESRF, ILL [1], the Community will encourage and support specific initiatives aiming at strengthening the coherence and synergies between their activities and between them and Community actions, in particular through the development of joint approaches and actions on issues of common interest.

2.2. COHERENT DEVELOPMENT OF RESEARCH AND INNOVATION POLICIES

The objective of the activities to be carried out in this area is to encourage the coherent development of research and innovation policies in Europe thanks to the early identification of challenges and areas of common interest as well as by providing national, regional and Community policymakers with knowledge and decision-aiding tools that can help them formulate policy.

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[1] CERN: European Organisation for Nuclear Research; ESA: European Space Agency; ESO: European Southern Observatory; ENO: European Northern Observatory; EMBL: European Molecular Biology Laboratory; ESRF: European Synchroton Radiation Facility; ILL: Laue-Langevin Institute.

The activities to be carried out to this end will take place in the following areas:

— Analyses and studies; work relating to foresight, statistics and science and technology indicators

These activities will include studies, analyses and foresight activities relating to scientific and technological activities and research and innovation policies in the context of the implementation of the European Research Area.

The activities relating to foresight will include in particular the development of thematic dialogue platforms and a knowledge base for users and producers of prospective analyses, the exploitation of good practices with regard to methodology, as well as the preparation of medium and long term scenarios for science and technology in Europe.

Work on indicators will involve the further development of relevant and harmonised indicators, taking into account the different dimensions of research and innovation and their impact on economy and society, for example for comparing the scientific and technological performance of the Member States and regions.

— Benchmarking of research and innovation policies at national, regional and European level

The first exercise to benchmark national RTD policies, which began in 2000, will be completed by mid 2002. In the light of this exercise, the methodology of the next benchmarking cycles, including the indicators, will be adapted and the exercises will be enlarged geographically by opening them up to the countries in the process of acceding to the EU and the associated countries, and will be extended to include other themes. Special attention will be paid to the dissemination and monitoring of the application of best practices in close collaboration with the Member States and the research actors.

The benchmarking work in progress in the field of innovation (gathering of information about innovation policies in Europe, development of the 'innovation scoreboard' and organisation of 'peer reviews' of innovation policies by 'thematic clubs' of policymakers) will be extended so as to open them up geographically, in social terms as a result of involving the innovation stakeholders, and in regional terms.

— Mapping scientific and technological excellence in Europe

The activities on mapping excellence will be expanded according to two guidelines, increasing the number of themes covered and regularly updating the results.

Special attention will be paid to the very broad dissemination of the information available as well as to the coordination of mapping with the activities aimed at promoting the integration of research efforts in Europe.

— Improving the regulatory and administrative environment for research and innovation in Europe

The objective here is to examine and analyse regulatory and administrative obstacles, to identify and disseminate good management practices and to help formulate new approaches. The following are some of the areas that will be concerned: intellectual and industrial property; public-private relations with regard to research and innovation; the exploitation and dissemination of knowledge; the rules governing access to new products or services on the market; mechanisms for funding research and innovation and encouraging investment, in particular by the private sector.

ANNEX II

INDICATIVE BREAKDOWN OF THE AMOUNT

Types of activities	Amount (EUR million)
FOCUSING AND INTEGRATING COMMUNITY RESEARCH (1)	12 585
Priority thematic areas of research (2)	11 285
Life sciences, genomics and biotechnology for health (3)	2 255
— Advanced genomics and its applications for health	1 100
— Combating major diseases	1 155
Information society technologies (4)	3 625
Nano-technologies and nano-sciences, knowledge-based multifunctional materials, and new production processes and devices	1 300
Aeronautics and space	1 075
Food quality and safety	685
Sustainable development, global change and ecosystems	2 120
— Sustainable energy systems	810
— Sustainable surface transport	610
— Global change and ecosystems	700
Citizens and governance in a knowledge-based society	225
Specific activities covering a wider field of research	1 300
Policy support and anticipating scientific and technological needs	555
Horizontal research activities involving SMEs	430
Specific measures in support of international cooperation (5) (6)	315
STRENGTHENING THE FOUNDATIONS OF THE EUROPEAN RESEARCH AREA	320
Support for the coordination of activities (7)	270
Support for the coherent development of policies	50
Total	**12 905**

(1) Including any amounts provided for under decisions of the European Parliament and Council pursuant to Article 169 of the Treaty.
(2) Of which at least 15 % to SMEs.
(3) Including up to EUR 400 million for cancer-related research.
(4) Including up to EUR 100 million for the further development of Géant and GRID.
(5) This amount of EUR 315 million will fund specific measures in support of international cooperation involving developing countries, Mediterranean countries, the Western Balkans, and Russia and the Newly Independent States (NIS). Another EUR 285 million is earmarked to finance the participation of third country organisations in the 'Thematic Priorities' and in the 'Specific activities covering a wider field of research', thus bringing the total amount devoted to international cooperation to EUR 600 million.
(6) Of which EUR 70 million for INTAS.
(7) Of which at least EUR 50 million and up to EUR 80 million for COST.

ANNEX III

MEANS FOR IMPLEMENTING THE PROGRAMME

In order to implement the specific programme, and in accordance with the Decisions of the European Parliament and of the Council concerning the multiannual Framework Programme 2002–2006 of the European Community for research, technological development and demonstration activities aimed at contributing towards the creation of the European Research Area (No 1513/2002/EC) and with the Regulation (EC) No .../2002 on rules for the participation of undertakings, research centres and universities and for the dissemination of research results, the Commission will use various instruments.

As regards the thematic priority areas, the importance of the new instruments (integrated projects and networks of excellence) is recognised as being an overall priority means to attain the objectives of critical mass, management simplification and European added value contributed by Community research in relation to what is already undertaken at national level, and of the integration of the research capacities.

However, the size of projects is not a criterion for exclusion, and access to new instruments is ensured for SMEs and other small entities.

The new instruments will be used from the start of the Sixth Framework Programme in each theme and, where deemed appropriate, as a priority means, while maintaining the use of specific targeted projects and coordination actions.

The Commission will evaluate the proposals in accordance with the evaluation criteria set out in the abovementioned legal instruments.

The Community contribution will be granted in accordance with the above mentioned legal instruments and in compliance with the Community framework for state aid for research.

In certain cases, when a project receives the maximum level of co-financing authorised under the framework programme or an overall grant, an additional contribution from the Structural Funds, pursuant to Council Regulation (EC) No 260/99 ([1]), could be granted.

In the case of participation of entities from the associated candidate countries, an additional contribution from the pre-accession financial instruments could be granted under similar conditions. In the case of participation of organisations from Mediterranean or developing countries, a contribution of the MEDA programme and of the financial instruments of the Community's aid to development could be envisaged.

In carrying out the programme, the Commission may have recourse to technical assistance. In 2004 an evaluation will be undertaken by independent experts of the efficiency of each of these three types of instruments in the execution of the Sixth Framework Programme.

Actions under Articles 169 and 171 of the Treaty which contribute to the scientific and technological objectives set out in Annex I may be supported financially by the specific programme, in accordance with the relevant decisions under Article 172 of the Treaty.

A. NEW INSTRUMENTS

A.1. **Networks of excellence**

Networks of excellence are implemented in the seven priority thematic areas of the Framework Programme and, in duly justified cases, in research areas supporting policies and anticipating scientific and technological needs.

([1]) OJ L 161, 26.6.1999.

The purpose of networks of excellence is to strengthen and develop Community scientific and technological excellence by means of the integration, at European level, of research capacities currently existing or emerging at both national and regional level. Each network will also aim at advancing knowledge in a particular area by assembling a critical mass of expertise. They will foster cooperation between capacities of excellence in universities, research centres, enterprises, including SMEs, and science and technology organisations. The activities concerned will be generally targeted towards long-term, multidisciplinary objectives, rather than predefined results in terms of products, processes or services.

A network of excellence will be implemented by a joint programme of activities involving some or, where appropriate, all of the research capacities and activities of the participants in the relevant area to attain a critical mass of expertise and European added value. A joint programme of activities could aim at the creation of a self-standing virtual centre of excellence that may result in developing the necessary means for achieving a durable integration of the research capacities. A joint programme of activities will necessarily include those aimed at integration, as well as activities related to the spreading of excellence and dissemination of results outside the network.

In pursuing its objectives, the network will therefore carry out:

— research activities integrated by its participants,

— integration activities which will comprise in particular:

  — adaptation of the participants' research activities in order to strengthen their complementarity,

  — development and utilisation of electronic information and communication means, and development of virtual and interactive working methods,

  — short-, medium- and long-term exchanges of personnel, the opening of positions to researchers from other members of the network, or their training,

  — development and use of joint research infrastructures, and adaptation of the existing facilities with a view to a shared use,

  — joint management and exploitation of the knowledge generated, and actions to promote innovation,

— activities of spreading of excellence which will comprise, as appropriate:

  — training of researchers,

  — communication concerning the achievements of the network and the dissemination of knowledge,

  — services in support of technological innovation in SMEs, aimed in particular at the take-up of new technologies,

  — analyses of science/society issues related to the research carried out by the network.

In carrying out some of its activities (such as training of researchers), the network will endeavour to ensure publicity by publishing calls for applications.

The size of the network may vary according to the areas and subjects involved. As an indication, the number of participants should not be less than half a dozen. On average, in financial terms, the Community contribution to a network of excellence may represent several million euros per year.

The network proposals should comprise the following elements:

— a general outline of the joint programme of activities, and its content for the first period, broken down into research activities, integration activities, and activities for spreading excellence,

— the role of the participants, identifying the activities and resources that they will integrate,

— the operation of the network (coordination and management of activities),

— the plan for the dissemination of knowledge and the perspectives as regards exploitation of the results.

The partnership may evolve when necessary, within the limit of the initial Community contribution, by replacing participants or adding new ones. In most cases, this will be done through publication of a competitive call.

The programme of activities would be updated yearly and would entail a reorientation of certain activities or launching of new ones not initially foreseen, which could involve new participants. The Commission may launch calls for proposals with a view to the allocation of additional contribution in order to cover, for example, an extension of the integrated activities of the existing network or the integration of new participants.

The Community's financial contribution will take the form of a grant for integration, the amount of which is determined in relation to the value of the capacities and resources which all the participants propose to integrate. It will complement the resources deployed by the participants in order to carry out the joint programme of activities. It should be sufficient to act as an incentive for integration, but without creating a financial dependence that might jeopardise the lasting association of the network.

A.2. **Integrated projects**

Integrated projects will be implemented in the seven priority thematic areas of the Framework Programme and, in duly justified cases, in research areas supporting policies and anticipating scientific and technological needs.

Integrated projects are designed to give increased impetus to the Community's competitiveness or to address major societal needs by mobilising a critical mass of research and technological development resources and competence. Each integrated project will be assigned clearly defined scientific and technological objectives and should be directed at obtaining specific results applicable in terms of, for instance, products, processes or services. Under these objectives they may include more long-term or 'risky' research.

Integrated projects will comprise a coherent set of component actions which may vary in size and structure according to the tasks to be carried out, each dealing with different aspects of the research needed to achieve common overall objectives, and forming a coherent whole and implemented in close coordination.

They will be carried out on the basis of overall financing plans preferably involving significant mobilisation of public and private sector funding, including funding from EIB and collaboration schemes such as Eureka.

All the activities carried out in the context of an integrated project will be defined in the general framework of an 'implementation plan' comprising activities relating to:

— research, and as appropriate technological development and/or demonstration,

— management, dissemination and transfer of knowledge with a view to promoting innovation,

— analysis and assessment of the technologies concerned, as well as the factors relating to their exploitation.

In pursuit of its objectives, it may also comprise activities relating to:

— training researchers, students, engineers and industrial executives, in particular for SMEs,

— support for the take-up of new technologies, in particular by SMEs,

— information and communication, and dialogue with the public concerning the science/society aspects of the research carried out within the project.

The combined activities of an integrated project may represent a financial size ranging from several million euros to several tens of millions of euros. However, the size of projects is not a criterion for exclusion, and access to new instruments is ensured for SMEs and other small entities.

Integrated project proposals should comprise the following elements:

— the scientific and technological objectives of the project,

— the main lines and timetable of the execution plan, highlighting the articulation of the various components,

— the stages of implementation and the results expected in each one of them,

— the role of the participants within the consortium and the specific skills of each of them,

— the organisation and management of the project,

— the plan for the dissemination of knowledge and the exploitation of results,

— the global budget estimate and the budget for the different activities, including a financial plan identifying the various contributions and their origin.

The partnership may evolve when necessary, within the limits of the initial Community contribution, by replacing participants or adding new ones. In most cases, this will be done through publication of a competitive call.

The implementation plan will be updated yearly. This updating may entail the reorientation of certain activities and the launching of new ones. In the latter case, and where an additional Community contribution is needed, the Commission will identify these activities and the participants who will carry them out, by means of a call for proposals.

The Community contribution will take the form of a grant to the budget, calculated as a percentage of the budget allocated by the participants to carry out the project, adapted according to the type of activity.

B. OTHER INSTRUMENTS

B.1. **Specific targeted research projects**

Specific targeted research projects will aim at improving European competitiveness. They will be sharply focused and will take either of the following two forms, or a combination of the two:

(a) a research and technological development project designed to gain new knowledge either to improve considerably or to develop new products, processes or services or to meet other needs of society and Community policies;

(b) a demonstration project designed to prove the viability of new technologies offering potential economic advantage but which cannot be commercialised directly.

B.2. **Collective research projects for SMEs**

Implemented across the whole field of science and technology, these projects will be carried out by research entities for the benefit of industrial associations or groupings, in areas and on subjects of interest to a large number of SMEs confronted with common problems.

B.3. **Cooperative research projects for SMEs**

Implemented across the whole field of science and technology, these projects will be undertaken for the benefit of a number of SMEs on themes of common interest.

B.4. **Coordination actions**

Coordination actions are intended to promote and support the coordinated initiatives of a range of research and innovation operators aiming at improved integration. They will cover activities such as the organisation of conferences, meetings, the performance of studies, exchanges of personnel, the exchange and dissemination of good practices, setting up information systems and expert groups, and may, if necessary, include support for the definition, organisation and management of joint or common initiatives.

B.5. **Specific support actions**

Specific support actions will complement the implementation of the Framework Programme and may be used to help in preparations for future Community research and technological development policy activities including monitoring and assessment activities. In particular, they will involve conferences, seminars, studies and analyses, high level scientific awards and competitions, working groups and expert groups, operational support and dissemination, information and communication activities, or a combination of these, as appropriate in each case.

Specific support actions will also be implemented to stimulate, encourage and facilitate the participation of SMEs, small research teams, newly developed and remote research centres, as well as those organisations from the candidate countries in the activities of the priority thematic areas, in particular via the networks of excellence and the integrated projects. The implementation of these actions will rely on the specific information and assistance structures, including the network of national contact points, established by the Member States and the associated countries at local, regional and national level and will aim at ensuring a smooth transition from the Fifth to the Sixth Framework Programme.