

THEMES

1. Health

Objective

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

Rationale

The sequencing of the human genome and the recent advances in post-genomics have revolutionised research into human health and diseases. Integrating the vast amounts of data and understanding underlying biological processes requires bringing together critical masses of various expertises and resources that are not available at a national level. Significant advances in translational health research, which is essential to ensure that biomedical research provides practical benefits, also requires multidisciplinary and pan-European approaches involving different stakeholders. Such approaches allow Europe to contribute more effectively to international efforts to combat diseases of global importance.

Clinical research on many diseases (e.g. cancer, cardiovascular diseases, mental and neurological diseases, in particular those linked with ageing, such as Alzheimer and Parkinson diseases) relies on international multi-centre trials to achieve the required number of patients in a short time-frame. Epidemiological research requires a large diversity of populations and international networks to achieve significant conclusions. Developing new diagnostics and treatments for rare disorders also require multi-country approaches to increase the number of patients for each study. And performing health policy-driven research at the European level enables comparisons of the models, systems, data, and patient material held in national databases and biobanks.

A strong EU-based biomedical research will help strengthen the competitiveness of the European healthcare biotechnology, medical technology and pharmaceutical industries. The EU also has to play an active role in creating an environment conducive to innovation in the pharmaceutical sector, in particular to maximise the success of clinical research. Research-based SMEs are the main economic drivers of the healthcare biotechnology and medical technology industries. Although Europe now has more Biotechnology companies than US, most of them are small and less mature than their competitors. Public-private research efforts at the EU level will facilitate their development. EU research will also contribute to the development of new norms and standards to set up an appropriate legislative framework for new medical technologies (e.g. regenerative medicine).

The activities that will be addressed, which include research essential to policy requirements, are set out below. Two strategic issues, child health and the health of the ageing population will be addressed across activities. Research agendas established by European Technology Platforms, such as the one on innovative medicines, will be supported where relevant. To complement these and respond to new policy needs, additional actions may be supported for example in the areas of health policy issues and occupational health and safety.

Activities

- **Biotechnology, generic tools and technologies for human health.**

- *High-throughput research.* To catalyse experimental progress in biomedical research by enhancing data generation, standardisation, acquisition and analysis.
- *Detection, diagnosis and monitoring.* With emphasis on non-invasive or minimally invasive approaches.
- *Predicting suitability, safety and efficacy of therapies.* To develop and validate biological markers, in vivo and in vitro methods and models, including simulation, pharmacogenomics, targeting approaches and alternatives to animal testing.
- *Innovative therapeutic approaches and intervention.* To consolidate and ensure further developments in advanced therapies and technologies with potential application in many diseases and disorders.

- **Translating research for human health**

- *Integrating biological data and processes: large-scale data gathering, systems biology.* To generate and analyse the vast amount of data needed to understand better the complex regulatory networks of thousands of genes and gene-products controlling important biological processes.
- *Research on the brain and related diseases, human development and ageing.* To explore the process of healthy ageing and the way genes and environment interact with brain activity, under normal conditions as well as in brain diseases.
- *Translational research in infectious diseases.* To address anti-microbial drug resistance, the global threats of HIV/AIDS, malaria and tuberculosis as well as emerging epidemics (e.g. SARS and highly pathogenic influenza).
- *Translational research in major diseases: cancer, cardiovascular disease, diabetes/obesity; rare diseases; and other chronic diseases (e.g. osteoarthritis).* To develop patient-oriented strategies from prevention to diagnosis and treatment including clinical research.

- **Optimising the delivery of health care to European citizens**

- *Translating clinical outcome into clinical practice.* To understand clinical decision-making and how to translate outcomes of clinical research into clinical practice and especially addressing the specificities of children, women and elderly population.
- *Quality, efficiency and solidarity of health systems including transitional health systems.* To translate effective interventions into management decisions, to ensure an adequate supply of human resources, to analyse factors influencing equity of access to high quality health care, including analyses of changes in population (e.g. ageing, mobility and migration, and the changing workplace).
- *Enhanced disease prevention and better use of medicines.* To develop efficient public health interventions addressing wider determinants of health (such as stress, diet or

environmental factors). To identify successful interventions in different health care settings for improving the prescription of medicines and improving their use by patients (including pharmacovigilance aspects).

- *Appropriate use of new health therapies and technologies.* Long term safety aspects and monitoring of large scale use of new medical technologies (including devices) and advanced therapies ensuring a high level of protection for public health.

2. Food, Agriculture and Biotechnology

Objective

Building a European Knowledge Based Bio-Economy¹² by bringing together science, industry and other stakeholders, to exploit new and emerging research opportunities that address social and economic challenges: the growing demand for safer, healthier and higher quality food and for sustainable use and production of renewable bio-resources; the increasing risk of epizootic and zoonotic diseases and food related disorders; threats to the sustainability and security of agricultural and fisheries production resulting in particular from climate change; and the increasing demand for high quality food, taking into account animal welfare and rural contexts.

Rationale

Innovations and advancement of knowledge in the sustainable management, production and use of biological resources (micro-organism, plants, animals), will provide the basis for new, sustainable, eco-efficient and competitive products for agriculture, fisheries, food, health, forest based and related industries. In line with the European strategy on life sciences and biotechnology¹³, this will help increase the competitiveness of European biotechnology and food companies, in particular high tech SMEs, while improving social welfare and well-being. Research into the safety of food and feed chains, diet related diseases, food choices and the impact of food and nutrition on health will help to fight food related disorders (e.g. obesity, allergies) and infectious diseases (e.g. transmissible spongiform encephalopathies, avian-flu), while making important contributions to the implementation of existing and the formulation of future policies and regulations in the area of public, animal and plant health and consumer protection.

The diversity of the European industries in these areas, while being one of its strengths and an opportunity, leads to fragmented approaches to similar problems. These are better addressed by increased collaboration and sharing of expertise, for example on new methodologies, processes and standards that result from changing EU legislation.

Several European Technology Platforms contribute in setting common research priorities, in fields such as plant genomics and biotechnology, forestry and forest based industries, global animal health, farm animal breeding, food and industrial biotechnology. The research will also provide the knowledge base needed to support¹⁴: the Common Agricultural Policy;

¹² The term “bio-economy” includes all industries and economic sectors that produce, manage and otherwise exploit biological resources (and related services, supply or consumer industries, such as agriculture, food, fisheries, forestry, etc.

¹³ “Life Sciences and biotechnology – A strategy for Europe”, COM(2002)27

¹⁴ Complementary research relating to the sustainable management and conservation of natural resources is addressed under the “Environment (including Climate Change)” theme.

agriculture and trade issues; food safety regulations; Community animal health, disease control and welfare standards; and the Common Fisheries Policy reform aiming to provide sustainable development of fishing and aquaculture. A flexible response to new policy needs is also foreseen, in particular with respect to new social or economic trends.

Activities

- **Sustainable production and management of biological resources from land, forest, and aquatic environments:** Enabling research, including 'omics' technologies, such as genomics, proteomics, metabolomics, systems biology and converging technologies for micro-organisms, plants and animals, including exploitation of their biodiversity; improved crops and production systems, including organic farming, quality production schemes and GMO impacts; sustainable, competitive and multifunctional agriculture, and forestry; rural development; animal welfare, breeding and production; plant health; sustainable and competitive fisheries and aquaculture; infectious diseases in animals, including zoonoses; safe disposal of animal waste; conservation, management and exploitation of living aquatic resources, developing the tools needed by policy makers and other actors in agriculture and rural development (landscape, land management practices etc.).
- **“Fork to farm”: Food, health and well being:** Consumer, societal, industrial and health aspects of food and feed, including behavioural and cognitive sciences; nutrition, diet related diseases and disorders, including obesity; innovative food and feed processing technologies (including packaging); improved quality and safety, both chemical and microbiological, of food, beverage and feed; integrity (and control) of the food chain; environmental impacts on and of food/feed chains; total food chain concept (including seafood); traceability.
- **Life sciences and biotechnology for sustainable non-food products and processes:** Improved crops, feed-stocks, marine products and biomass (including marine resources) for energy, environment, and high added value products such as materials and chemicals, including novel farming systems, bio-processes and bio-refinery concepts; bio-catalysis; forestry and forest based products and processes; environmental remediation and cleaner processing.

3. Information and Communication Technologies

Objective

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

Rationale

Information and Communication Technologies are critical to Europe’s future and underpin the realisation of the Lisbon agenda. Half of the productivity gains in our economies are explained by the impact of ICT on products, services and business processes. ICT is the leading factor in boosting innovation and creativity and in mastering change in value chains across industry and service sectors. ICT is essential to meet the rise in demand for health and

social care and to modernise services in domains of public interest such as education, learning, security, energy, transport and the environment. And ICT is catalytic in the advance of other fields of science and technology as it transforms the way researchers conduct their research, co-operate and innovate.

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

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

The ICT research activities will be closely articulated with policy actions for ICT deployment and with regulatory measures within a comprehensive and holistic strategy. Priorities have been set following extensive consultations including input from a series of European Technology Platforms and industrial initiatives in areas such as nano-electronics, embedded systems, mobile communications, electronic media, robotics and software, services and Grids.

Activities

- **ICT Technology Pillars:**

- *Nano-electronics, photonics and integrated micro/nano-systems*: pushing the limits of miniaturisation, integration, variety and density; increasing performance and manufacturability at lower cost; facilitating incorporation of ICT in range of applications; interfaces; upstream research requiring exploration of new concepts.
- *Ubiquitous and unlimited capacity communication networks*: ubiquitous access over heterogeneous networks - fixed, mobile, wireless and broadcasting networks spanning from the personal area to the regional and global area - allowing the seamless delivery of ever higher volumes of data and services anywhere, anytime.
- *Embedded systems, computing and control*: powerful, secure and distributed computing and communication systems that are embedded in objects and physical infrastructures and that can control and adapt to their environment.

- *Software, Grids, security and dependability*: dynamic, adaptive, dependable and trusted software and services, and new processing architectures, including their provision as a utility.
- *Knowledge, cognitive and learning systems*: capturing and exploiting knowledge embedded in web and multimedia content; bio-inspired artificial systems that perceive, understand, learn and evolve, and act autonomously; learning by machines and humans based on a better understanding of human cognition.
- *Simulation, visualisation, interaction and mixed realities*: tools for innovative design and creativity in products, services and digital media, and for natural, language-enabled and context-rich interaction and communication.

New perspectives in ICT drawing on other science and technology disciplines, including insights from physics, biotechnologies, materials- and life-sciences, for miniaturisation of ICT devices to sizes compatible and interacting with living organisms, to increase performance of systems engineering and information processing, and for modelling and simulation of the living world.

- **Integration of Technologies:**

- *Personal environments*: personal communication and computing devices, accessories, wearables, implants; their interfaces and interconnections to services and resources.
- *Home environments*: communication, monitoring, control, assistance; seamless interoperability and use of all devices; interactive digital content and services.
- *Robotic systems*: advanced autonomous systems; cognition, control, action skills, natural interaction; miniaturisation.
- *Intelligent infrastructures*: tools making infrastructures that are critical to everyday life more efficient, easier to adapt and maintain, more robust to usage and resistant to failures.

- **Applications Research:**

- *ICT meeting societal challenges*: New systems and services in areas of public interest improving quality, efficiency, access and inclusiveness; user friendly applications, integration of new technologies and initiatives such as ambient assisted living.
 - for *health*, improving disease prevention, early diagnosis and personalisation; autonomy, safety and mobility of patients; health information space for knowledge discovery.
 - to improve *inclusion* and equal participation and prevent digital divides; assistive technology; design-for-all.
 - for *mobility*; intelligent ICT-based transportation systems and vehicles enabling people and goods to move safely, comfortably and efficiently.
 - in support of *the environment* and sustainable development, to reduce vulnerability and to mitigate the consequences of natural disasters and industrial accidents.

- for *governments*; efficiency, openness and accountability, for a world-class public administration and links to citizens and businesses, supporting democracy.
- *ICT for content, creativity and personal development*:
 - new *media* paradigms and new forms of content; creation of interactive digital content; enriched user experiences; cost-effective content delivery.
 - technology-enhanced *learning*; adaptive and contextualised learning solutions; active learning.
 - ICT-based systems to support accessibility and use over time of digital *cultural* resources and assets, in a multilingual environment
- *ICT supporting businesses and industry*:
 - new forms of dynamic networked co-operative *business* processes, digital eco-systems; optimised *work* organisation and collaborative work environments.
 - *Manufacturing*: rapid and adaptive design, production and delivery of highly customised goods; digital and virtual production; modelling, simulation and presentation tools; miniature and integrated ICT products;
- *ICT for trust and confidence*: identity management; authentication and authorization; privacy enhancing technologies; rights and asset management; protection against cyber threats.
- **Future and Emerging Technologies**: to support research at the frontier of knowledge in core ICTs and in their combination with other relevant areas and disciplines; to nurture novel ideas and radically new uses and to explore new options in ICT research roadmaps.

4. Nanosciences, Nanotechnologies, Materials and new Production Technologies

Objective

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

Rationale

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

The EU has recognised leadership in fields such as in nanotechnologies, materials and production technologies which must be strengthened in order to secure and increase the EU position in a highly competitive global context.

European Technology Platforms in fields such as nanoelectronics, manufacturing, steel, chemistry, the transport industry, construction, industrial safety, textiles, pulp and paper help establish common research priorities and targets. In addition to industry relevant priorities and their integration for sectoral applications,, the relevant policy, regulatory and standardisation, and impact issues will be addressed, including by responding flexibly to new policy needs that arise.

Activities

- **Nanosciences, Nanotechnologies**

- Generating new knowledge on interface and size dependent phenomena; nano-scale control of material properties for new applications; integration of technologies at the nano-scale; self-assembling properties; nano-motors; nano-machines and nano-systems; methods and tools for characterisation and manipulation at nano dimensions; nano and high-precision technologies in chemistry; impact on human safety, health and the environment; metrology, nomenclature and standards; exploration of new concepts and approaches for sectoral applications, including the integration and convergence of emerging technologies.

- **Materials**

- Generating new knowledge on high-performance materials for new products and processes; knowledge-based materials with tailored properties; more reliable design and simulation; higher complexity; environmental compatibility; integration of nano-molecular-macro levels in the chemical technology and materials processing industries; new nano-materials, bio-materials and hybrid materials, including design and control of their processing.

- **New Production**

- Creating conditions and assets for knowledge-intensive production, including construction, development and validation of new paradigms responding to emerging industrial needs; development of generic production assets for adaptive, networked and knowledge-based production; development of new engineering concepts exploiting the convergence of technologies (eg, nano, bio, info, cognitive and their engineering requirements) for the next generation of high value-added products and services, and adaptation to the changing needs.

- **Integration of technologies for industrial applications**

- Integrating new knowledge and technologies on nano, materials and production in sectoral and cross sectoral applications such as: health, construction, transport, energy, chemistry, environment, textiles and clothing, pulp and paper, mechanical engineering.

5. Energy

Objective

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

Rationale

Energy systems are confronted with major challenges. The urgency to develop adequate and timely solutions is justified by the alarming trends in global energy demand (predicted to rise by 60% in the next 30 years), the need to curb dramatically emissions of greenhouse gases to mitigate the devastating consequences of climate change, the damaging volatility of oil prices (in particular for the transport sector which is heavily oil dependent) and geopolitical instability in supplier regions. Research and demonstration are needed to provide the most environmentally and cost-effective technologies and measures enabling the EU to meet its targets under the Kyoto Protocol and beyond and to implement its energy policy commitments, as described in the 2000 Green Paper on the security of energy supply¹⁵.

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

Radically transforming the energy system requires new technologies with risks that are too high and the benefits too uncertain for private firms to provide all the investment needed for research, development, demonstration and deployment. Public support should therefore play a key role in mobilising private investment and European efforts and resources should be combined in a coherent and more effective manner, to compete with economies that are investing heavily and consistently in similar technologies. European technology platforms play a vital role in this regard, by mobilising the necessary research effort in a coordinated manner. The activities to meet the objective are set out below. A specific activity on knowledge for energy policy making is included which may also provide support to new policy needs that emerge, for example relating to the role of European energy policy in the developments of international climate change actions, and instabilities or disruptions in energy supply and price.

Activities

- **Hydrogen and fuel cells**

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

- **Renewable electricity generation**

¹⁵ COM(2000)769

Technologies to increase overall conversion efficiency, driving down the cost of electricity production from indigenous renewable energy sources, and the development and the demonstration of technologies suited to different regional conditions.

- **Renewable fuel production**

Integrated conversion technologies: to develop and drive down the unit cost of solid, liquid and gaseous (including hydrogen) fuels produced from renewable energy sources, aiming at the cost-effective production and use of carbon-neutral fuels, in particular liquid biofuels for transport.

- **Renewables for heating and cooling**

Technologies to increase efficiencies and drive down the costs of heating and cooling from renewable energy sources, ensuring their use in different regional conditions.

- **CO2 capture and storage technologies for zero emission power generation**

To drastically reduce the environmental impact of fossil fuel use aiming at highly efficient power generation plants with near zero emissions, based on CO2 capture and storage technologies.

- **Clean coal technologies**

To substantially improve plant efficiency, reliability and cost through development and demonstration of clean coal conversion technologies.

- **Smart energy networks**

To increase the efficiency, safety and reliability of the European electricity and gas systems and networks e.g. by transforming the current electricity grids into an interactive (customers/operators) service network and to remove obstacles to the large-scale deployment and effective integration of distributed and renewable energy sources.

- **Energy efficiency and savings**

New concepts and technologies to improve energy efficiency and savings for buildings, services and industry. This includes the integration of strategies and technologies for energy efficiency, the use of new and renewable energy technologies and energy demand management.

- **Knowledge for energy policy making**

Development of tools, methods and models to assess the main economic and social issues related to energy technologies and to provide quantifiable targets and scenarios for medium and long term horizons.

6. Environment (including Climate Change)

Objective

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

Rationale

Environmental problems go beyond national frontiers and require a coordinated approach at a pan-European and often global level. Earth's natural resources and the man-made environment are under intense pressures from growing population, urbanisation, continuous expansion of the agriculture, transport and energy sectors, as well as climate variability and warming at local, regional and global scales. Europe needs to engage in a new sustainable relationship with the environment while improving competitiveness and strengthening European industry. EU-wide cooperation is needed to attain critical mass given the scale, scope and high level of complexity of environmental research. It facilitates common planning, the use of connected and inter-operable databases, and the development of coherent and large scale observation and forecasting systems.

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

The EU needs to strengthen its position in world markets for environmental technologies. Such technologies help deliver sustainable growth providing eco-efficient solutions to environmental problems at different scales and protecting our cultural heritage. Environmental requirements act as a stimulus for innovation and can provide business opportunities. European Technology Platforms on water supply and sanitation and on sustainable chemistry confirm the need for EU level action and their research agendas are taken into consideration in the activities below. Other Platforms (e.g. on Construction and on Forestry) partially deal with environmental technology issues and are taken into consideration as well.

A series of activities are listed below¹⁶ many of which are directly relevant to policy needs. However, additional support may be provided to new policy needs that emerge, for example relating to sustainability impact assessments of EU policies; the follow up of the post-Kyoto action on Climate Change; and new environmental policies such as in maritime policy, standards and regulations.

Activities

¹⁶ Complementary research relating to the production and use of biological resources is addressed under the "Food, Agriculture and Biotechnology" theme.

- **Climate change, pollution and risks**

- *Pressures on environment and climate:* Functioning of climate and the earth system; adaptation and mitigation measures; pollution in air, soil and water; changes in atmospheric composition and water cycle; interactions between climate, land surface and the ocean; and impacts on biodiversity and ecosystems.
- *Environment and health:* Interaction of environmental stressors with human health including identification of sources, links to indoor environment, and impact and emerging risk factors; integrated risk assessment methods for toxic substances including alternatives to animal testing; quantification and cost-benefit analysis of environmental health risks and indicators for prevention strategies.
- *Natural hazards:* Improve prediction and integrated hazards- vulnerability - and risks assessments for disasters related to geological hazards (such as earthquakes, volcanoes, tsunamis) and climate (such as storms and floods); develop early warning systems and improve prevention and mitigation strategies.

- **Sustainable Management of Resources**

- *Conservation and sustainable management of natural and man-made resources:* ecosystems; water resources management; waste management and prevention; protection and management of biodiversity, soil protection, seabed and coastal areas protection, approaches against desertification and land degradation; forest management; sustainable management and planning of urban environment, data management and information services; assessment and foresight relating to natural processes.
- *Evolution of marine environments:* Impacts of human activities on the marine environment and its resources; pollution and eutrophication in regional seas and coastal areas; deep sea ecosystems; assessment of marine biodiversity trends, of ecosystem processes and of ocean circulation; seabed geology.

- **Environmental Technologies**

- *Environmental technologies for observation, prevention, mitigation, adaptation, remediation and restoration of the natural and man-made environment:* related to water, climate, air, marine, urban and rural environment, soil, waste treatment, recycling, clean production processes, chemicals safety, protection of cultural heritage and of the built environment.
- *Technology assessment, verification and testing:* Methods and tools for environmental risk and lifecycle assessment of processes, technologies and products; support for sustainable chemistry, water supply and sanitation Platforms¹⁷; scientific and technological aspects of a future European environmental technologies verification and testing programme.

- **Earth observation and assessment tools**

¹⁷ The research agendas of these European Technology Platforms will be taken into account in the different activities.

- *Earth observation*: Contribute to the development and integration of observation systems for environmental and sustainability issues in the framework of GEOSS; interoperability between systems and optimisation of information for understanding, modelling and predicating environmental phenomena.
- *Forecasting methods and assessment tools*: modelling links between economy/environment/society including market based instruments, externalities, thresholds and developing the knowledge base and methodologies for sustainability impact assessment on key issues such as land use and marine issues; social and economic tensions related to climate change.

7. Transport (including Aeronautics)

Objective

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

Rationale

Transport is one of Europe’s strengths - the air transport sector contributes to 2.6% of the EU GDP (with 3.1 million jobs) and the surface transport field generates 11% of the EU GDP (employing some 16 million persons). However, transport is responsible for 25% of all the EU emissions of CO₂, hence the absolute need for a “greening” of the system to ensure more sustainable transport patterns and compatibility with growth rates, as developed in the White Paper on “European Transport Policy for 2010: time to decide”.¹⁸

The enlargement (increasing land surface by 25% and population by 20%) and economic development of the EU present new challenges for transporting people and goods efficiently, cost-effectively and in a sustainable manner. Transport also has direct relevance on other major policies such as trade, competition, employment, cohesion, energy, security and the internal market. Investment in RTD in EU transport industries is a prerequisite to ensure technological competitive advantage in global markets.¹⁹ Activities at European level will also stimulate the restructuring of the industry, including the integration of the supply chain and in particular SMEs.

The research agendas developed by European Technology platforms²⁰ support the need to take a new “transport systems” perspective that considers the interactions of vehicles, transport networks and the use of transport services, which can only be developed at European level. RTD costs in all these fields are rising substantially, and collaborative activity at EU-level is essential to enable a “critical mass” of diverse RTD providers to address the scale and

¹⁸ COM (2001) 370 final

¹⁹ The European aeronautics industry invests 14% of its turnover in research, the European car industry almost 5% of its turnover; and the EU shipbuilding industry competitive advantage relies exclusively on RTD.

²⁰ ACARE: Advisory Council for Aeronautics Research in Europe. Launched in 2001, it is the first operational example of a Technology Platform; ERRAC: European Rail Research Advisory Council; ERTRAC: European Road Transport Research Advisory Council; WATERBORNE Technology Platform.

multi-disciplinary challenges in a cost-effective way, as well as meeting the political, technological and socio-economic challenges on issues such as the “clean and safe vehicle” of the future, interoperability and intermodality with particular reference to rail transport, affordability, safety, capacity, security and environmental impacts in an enlarged Union. Also, developing technologies in support of the Galileo system and its applications will be essential in implementing European policies.

As well as the strong industry relevance of the themes and activities set out below, the needs of policy makers will be addressed in an integrated way covering economic, social and environmental aspects of transport policy. In addition, support will be provided to respond to existing as well as new policy needs, for example relating to developments in maritime policy.

Activities

- **Aeronautics and air transport**

- *The greening of air transport*: reduction of emissions and noise disturbance, incorporating work on engines and alternative fuels, structures and new aircraft designs, airport operations and traffic management.
- *Increasing time efficiency*: improvement of the efficiency of operating schedules focusing on innovative air traffic management systems in line with the effective implementation of Single Sky policy which integrate air, ground and space components, including traffic flow and more aircraft autonomy.
- *Ensuring customer satisfaction and safety*: improvement of passenger comfort, innovative in-flight services and more efficient passenger handling; improvement of all safety aspects of air transport; wider choice of aircraft ranging from wide body to small size vehicles.
- *Improving cost efficiency*: reduction of costs associated with product development, manufacturing and operating costs focusing on zero maintenance aircraft, increased use of automation and simulation.
- *Protection of aircraft and passengers*: enhancement of protection measures for the traveller, crew, aircraft and air transport system such as improved data and identification methods, protecting the aircraft against attack, auto recovery and improved security design of aircraft.
- *Pioneering the air transport of the future*: addressing the longer term challenges of aviation with more radical, environmentally efficient and innovative combinations of technologies which would lead to significant steps forward in air transport.

- **Surface transport (rail, road and waterborne)**

- *The greening of surface transport*: reduction of environmental and noise pollution;; development of clean and efficient engines, including hybrid technology and the use of alternative fuels for transport applications; end of life strategies for vehicles and vessels.
- *Encouraging modal shift and decongesting transport corridors*: development of innovative, intermodal and interoperable regional and national transport networks,

infrastructures and systems in Europe; cost internalisation; information exchange between vehicle/vessel and transport infrastructure; optimisation of infrastructure capacity.

- *Ensuring sustainable urban mobility*: innovative organisation schemes, including clean and safe vehicles and non-polluting means of transport, new public transportation modes and rationalisation of private transport, communication infrastructure, integrated town planning and transport.
- *Improving safety and security*: as inherent to the transport system, in transport operations for drivers, passengers, crew, cyclists and pedestrians, in the design of vehicles, vessels, and within the total transport system.
- *Strengthening competitiveness*: improvement of design processes; development of advanced power-train and vehicle technologies; innovative and cost-effective production systems and infrastructure construction; integrative architectures.
- **Support to the European global satellite navigation system (Galileo)**: precise navigation and timing services for use in a range of sectors; efficient use of satellite navigation and support to the definition of second generation technologies.

8. Socio-Economic Sciences and the Humanities

Objective

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

Rationale

Europe has a strong and high quality research base in socio-economic sciences and the humanities fields. The diversity of approaches within the EU in the economic, social, political and cultural domains provides a highly fertile ground for research in these fields at EU-level. There is a high European added value in collaborative research addressing European socio-economic issues in the areas mentioned. First, the issues and challenges concerned are of high priority at the EU level and are addressed by EU policies. Second, comparative research across several or all EU countries offers a particularly effective tool as well as important learning opportunities across countries and regions.

Third, EU-level research has particular advantages in being able to develop Europe-wide data collection and to employ the multiple perspectives needed to understand complex issues. Finally, the development of a genuinely European socio-economic knowledge base on these key challenges will make an essential contribution to promoting their shared understanding across the European Union and, most significantly, on the part of the European citizens.

The activities to be supported are listed below and are expected to contribute significantly to improve the formulation, implementation, impacts and assessments of policy in a wide range of areas such as economic, social, education and training, enterprise, international trade, consumer, external relations, justice and home affairs and official statistics policies. In

addition, opportunities will be provided to address emerging socio-economic challenges as well as to undertake research on new or unforeseen policy needs.

Activities

- **Growth, employment and competitiveness in a knowledge society:** developing and integrating research on the issues affecting growth, employment and competitiveness, ranging from innovation, education including life-long learning and the role of scientific and other knowledge, to national institutional contexts.
- **Combining economic, social and environmental objectives in a European perspective:** by addressing the two key and highly interrelated issues of continuing evolution of European socio-economic models and economic and social cohesion in an enlarged EU, taking into account the protection of the environment.
- **Major trends in society and their implications:** such as demographic change including ageing and migration; lifestyles, work, families, gender issues, health and quality of life; criminality; the role of business in society and population diversity, cultural interactions and issues related to protection of fundamental rights and the fight against racism and intolerance.
- **Europe in the world: understanding changing** interactions and interdependencies between world regions and their implications for the regions concerned, especially Europe; and addressing emerging threats and risks without undermining human rights, freedom and well-being.
- **The citizen in the European Union:** in the context of the future development of the EU, addressing the issues of achieving a sense of democratic “ownership” and active participation by the peoples of Europe; effective and democratic governance including economic governance; and building a shared understanding and respect for Europe’s diversities and commonalities in terms of culture, institutions, history, languages and values.
- **Socio-economic and scientific indicators:** their use in policy and its implementation and monitoring, the improvement of existing indicators and the development of new ones for this purpose and for the evaluation of research programmes, including indicators based on official statistics.
- **Foresight activities** on major science, technology and related socio-economic issues such as the future demographic trends and the globalization of knowledge and evolution of research systems, as well as of the future developments in and across major research domains and scientific disciplines.

9. Security and Space

Objective

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

technologies to the benefit of European security, and to stimulate the co-operation of providers and users for security solutions.

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

9.1 Security

Rationale

Security in Europe is a precondition of prosperity and freedom. The EU Security Strategy: ‘A Secure Europe in better World’, adopted by the European Council, addresses the need for a comprehensive security strategy encompassing both civil and defence-related security measures.

Security related research is an important building block in supporting the Common Foreign and Security Policy as well as for realising a high level of security within an EU-wide area of justice, freedom and security²¹ as underpinned by the Hague programme. It will also contribute to developing technologies and capabilities in support of other EU policies in areas such as transport, civil protection, energy and environment.

Existing security related research activities in Europe suffer from the fragmentation of efforts, the lack of critical mass of scale and scope and the lack of connections and interoperability. Europe needs to improve the coherence of its efforts by developing efficient institutional arrangements and by instigating the various national and international actors to co-operate and co-ordinate in order to avoid duplication and to explore synergies wherever possible. Security research at Community level will focus on activities of clear added value to the national level. As a consequence, security research at Community level will reinforce the competitiveness of the European security industry.

The activities set out below will complement and integrate the technology- and systems-oriented research relevant to security which is carried out in other themes. They will be mission-oriented, developing the technologies and capabilities as required by the specific security missions. They are by design flexible so as to accommodate as yet unknown future security threats and related policy needs that may arise, stimulating cross-fertilisation and the take-up of existing technologies for the civil security sector, European security research will also encourage the development of multi-purpose technologies in order to maximise the scope for their application.

Activities

- **Protection against terrorism and crime:** delivering technology solutions for threat (e.g. CBRN) awareness, detection, prevention, identification, protection, neutralisation and containment of effects of terrorist attacks and crime.

²¹ Prevention, Preparedness, and response to terrorist attacks, COM 698 (2004), COM 698, 700, 701, 702;; Solidarity/ CBRN programme.

- **Security of infrastructures and utilities:** analysing and securing existing and future public and private critical/networked infrastructure (e.g. in transport, energy, ICT), systems and services (including financial and administrative services).
- **Border security:** focusing on technologies and capabilities to enhance the effectiveness and efficiency of all systems, equipment, tools and processes required for improving the security of Europe's land and coastal borders, including border control and surveillance issues.
- **Restoring security in case of crisis:** focusing on technologies in support of diverse emergency management operations (such as civil protection, humanitarian and rescue tasks, support to CFSP), and on issues such as inter-organisational co-ordination and communication, distributed architectures and human factors.

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

- **Security Systems Integration and interoperability:** focusing on technologies to enhance the interoperability of systems, equipment, services and processes, including law enforcement information infrastructures, as well as on the reliability, organisational aspects, protection of confidentiality and integrity of information and traceability of all transactions and processing.
- **Security and society:** mission orientated research which will focus on socio-economic analyses, scenario building and activities related to: crime, the citizen's perception of security, ethics, protection of privacy and societal foresight. Research will also address technologies that better safeguard privacy and liberties, and will address vulnerabilities and new threats, as well as the management and impact assessment of possible consequences.
- **Security Research Co-ordination and structuring:** co-ordination of European and international security research efforts and development of synergies between civil, security and defence research, improvement of legal conditions, and encouragement to the optimal use of existing infrastructures.

9.2 Space

Rationale

The EU can contribute in this field to the better definition of common objectives based on user requirements and policy objectives; to the coordination of activities, to avoid duplications and maximise interoperability; and to the definition of standards. Public authorities and decision-makers represent important potential users and the European industry will also benefit from a well defined European Space policy implemented through a European Space Programme, supported in part by the proposed research and technological development actions. European level actions are also needed to support EU policy objectives, for example in the fields of agriculture, fisheries, environment, telecommunications, security, transport as well as ensuring that Europe is a respected partner in regional and international cooperation.

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

The activities set out below aim at: the exploitation of space assets for the implementation of applications, namely GMES (Global Monitoring for Environment and Security) and their contribution to law enforcement in EU policies; as well as space exploration, allowing international cooperation opportunities and dramatic technological breakthroughs; exploitation and exploration of space supported through enabling activities guaranteeing the strategic role of the European Union. These activities will be complemented by other actions included in the Competitiveness and Innovation Framework Programme and in the Education and Training Programme. The public policy benefits of the below activities will also be maximised, included additional support for new policy needs that may arise, for example: space based solutions in support of developing countries; and use of space-observation tools and methods to support developments in Community policies.

Activities

- **Space-based applications at the service of the European Society**

- GMES: development of satellite-based monitoring systems and techniques relating to the management of the environment and security and their integration with ground-based, ship-borne and airborne components; support to the use and delivery of GMES data and services.
- Innovative satellite communication services, seamlessly integrated in the global electronic communication networks, for citizens and enterprises in application sectors encompassing civil protection, e-government, telemedicine, tele-education and generic users.
- Development of technologies for reducing the vulnerability of space-based services and for contributing to the surveillance of space.

- **Exploration of space**

- Contribution to international space exploration initiatives.

- **RTD for strengthening space foundations**

- Space transportation technology: research to increase the competitiveness of the European space transportation sector.
- Space sciences including life in space.

II IDEAS

Objective

This programme will enhance the dynamism, creativity and excellence of European research at the frontier of knowledge. This will be done by supporting “investigator-driven” research projects carried out across all fields by individual teams in competition at the European level. Projects will be funded on the basis of proposals presented by researchers on subjects of their choice and evaluated on the sole criterion of excellence as judged by peer review.

Rationale