



Synthèse de la 1^{ère} Proposition de la Commission Européenne pour le 7^{ème} PCRD 2007-2013

Construire l'Europe de la Connaissance

La présente synthèse est extraite d'une proposition émanant de la Commission Européenne (CE) à destination du Parlement Européen et du Conseil. La proposition de la CE, qui s'inscrit dans le cadre de la préparation du 7^{ème} PCRD, est un document de travail provisoire soumis au débat et ne peut en aucun cas être considéré comme définitif.

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I – Principes Généraux

I-1: Connaissance pour la croissance

Le préambule de la proposition de la CE rappelle que, conformément à «*l'agenda de Lisbonne*», la société de la connaissance est la priorité politique de l'Union Européenne. La recherche scientifique et l'innovation technologique sont les principales sources de nouvelles connaissances à l'origine de nouveaux enjeux sociaux, économiques et industriels.

I-2: Accroître le financement de la recherche

La réalisation d'une société de la connaissance repose à la fois sur les efforts de chacun des Etats-Membres mais aussi sur le soutien et les financements que la CE se doit d'y apporter. Les précédentes communications de la CE (26/02/2004 et 14/07/2004) sur les perspectives financières pour 2007-2013 vont dans ce sens en proposant un doublement du budget de la recherche pour ainsi impulser la réalisation d'une économie et d'une société de la connaissance.

I-3: Le triangle de la connaissance

L'accroissement de l'effort européen en matière de recherche permettra de stimuler les différentes composantes du triangle de la connaissance que sont la Recherche, la Formation, et l'Innovation.

L'objectif est d'avoir un PCRD renforcé et étroitement lié à 3 catégories d'initiatives qui couvriraient la même période 2007-2013.

- une nouvelle génération de programmes d'éducation et de formation avec une série de sujets d'intérêt général comme «*le futur des Universités*», «*les sciences de l'éducation*», «*la formation et la carrière des chercheurs*».
- la recherche et développement, et l'innovation au service de l'Economie de la connaissance par le biais des 3 objectifs des nouveaux fonds structurels:
 - la convergence
 - la compétitivité régionale
 - la coopération territoriale européenne
- un Programme-Cadre «*Compétitivité et Innovation*» strictement complémentaire du Programme-Cadre Recherche et Développement.

I-4: Renforcer et simplifier le Programme-Cadre

Le développement croissant des actions en faveur de la recherche européenne impose des simplifications et une rationalisation du PCRD dans tous ses aspects et dimensions.

- Réduction des lourdeurs administratives, des règles financières, des procédures en réduisant le volume d'informations demandées aux participants.
- Rationaliser les instruments
- Améliorer les règles financières et les modalités de financement en mettant en place un système simplifié de calcul de la contribution financière, et de contrôle de l'utilisation des fonds.
- Améliorer et simplifier la présentation et le vocabulaire utilisés dans tous les documents relatifs au PCRD (décisions, annexes techniques, programmes de travail, appels à propositions, contrats, etc...)

I-5: Continuité thématique

entre le FP6 et le FP7 avec des thèmes correspondant aux principaux champs d'avancement des connaissances susceptibles de générer d'importantes retombées scientifiques et technologiques, et d'avoir un impact social, économique et industriel. L'objectif est d'offrir à la Communauté scientifique, à l'Industrie, et à la Société Européenne en général, une «*Boîte à outils*» indispensable pour renforcer et mieux exploiter les potentialités, les performances, et les résultats de la recherche européenne; de la recherche académique au transfert technologique et industriel, et du chercheur individuel à la coordination à grande échelle des programmes nationaux de recherche.

I-60: Une organisation en 4 programmes

- **Recherche Collaborative**, qui comprend toutes les activités de recherche en coopération, des petits projets de R&D aux actions de coordination des programmes nationaux, en passant par les réseaux, etc... l'objectif est de créer des Pôles d'excellence européens dans les principaux champs d'avancement des connaissances.

Dans ce programme, l'effort sera concentré sur 10 priorités thématiques considérées comme les plus porteuses pour à la fois l'avancée des connaissances et les progrès technologiques, et répondant le mieux aux objectifs sociaux, économiques et industriels de l'Union Européenne.

- Santé
- Alimentation, Agriculture et Biotechnologies
- Technologies de l'Information et de la Communication
- Nanosciences et Nanotechnologies, matériaux, et nouvelles méthodes de production
- Energie
- Environnement et changement climatique
- Transport
- Sciences socio-économiques et sciences humaines
- Espace
- Sécurité

Au sein des priorités thématiques, les partenariats européens de recherche et de développement technologique se feront au sein de 4 types d'outils et de catégories d'activité :

Les projets et réseaux collaboratifs : L'objectif des projets et réseaux collaboratifs est d'établir des pôles d'excellence à même d'attirer des chercheurs et des investisseurs du monde entier. La constitution de ces pôles sera encouragée au travers des instruments suivants : REX, PI, STREP, CA, SSA.

Les Initiatives Technologiques Conjointes (ITC). Les ITC seront essentiellement créées sur la base des travaux entrepris par les plateformes technologiques européennes (ETP).

La coordination des programmes nationaux de recherche (ERA-NET)

La coopération Internationale

Enfin, et afin de renforcer le potentiel et l'exploitation des résultats de la recherche en Europe, la diffusion des connaissances et le transfert des résultats seront soutenus au sein de chacune des priorités thématiques au travers de financements et d'initiatives (réseaux, séminaires, manifestations).

- **Recherche Visionnaire (Frontier Research)**

L'objectif de cette nouvelle action est d'améliorer et d'accroître le dynamisme, la créativité et l'excellence de la Recherche Européenne et de stimuler son progrès aux frontières de la connaissance. Cette action encouragera des projets de recherche amont qui concerneront toutes les thématiques, de l'ingénierie aux sciences humaines et économiques. Les projets seront financés sur la base de propositions faites par des chercheurs et/ou équipes sur des sujets de leur choix.

Cette action sera supervisée par un **Conseil Européen de la Recherche (ERC)**, structure indépendante qui sera créée par la Commission Européenne, et composée de personnalités scientifiques de tous les domaines, nommés par la CE selon une procédure indépendante. Ce Conseil aura en charge la supervision du programme dans les aspects tant scientifiques que financiers et administratifs, et procédera à l'évaluation des propositions. Pour ce faire, il se reposera sur une « executive agency » qui aura en charge tous les aspects relatifs à l'exécution du programme, au processus d'évaluation des propositions sur la base des recommandations de l'ERC, à la gestion financière des bourses de formation. Cette agence fournira également un soutien administratif à l'ERC.

- **Potentiel Humain**

Basées sur l'expérience passée, les actions Marie-Curie évoluent pour mieux intégrer les aspects clés des compétences et du développement de carrière, tout en renforçant et en structurant l'effort avec les systèmes nationaux. Les actions Marie Curie au sein du FP6 étaient organisées en 12 lignes d'action. Il est proposé de les organiser en 5 domaines dans le FP7.

- Formation initiale pour les chercheurs, dont l'objectif est d'améliorer les perspectives de carrière des chercheurs, à la fois dans le public et dans le privé, mais aussi de relancer l'attrait des carrières scientifiques auprès des jeunes chercheurs. Cela sera mis en œuvre au

travers de réseaux qui intégreront des programmes de formation à destination des jeunes chercheurs en début de carrière.

- Formation tout au long de la vie et développement de carrière, qui concernent les chercheurs expérimentés et qui sera soutenue à la fois par le biais de bourses individuelles attribuées par la CE, et par le biais de co-financements régionaux et/ou nationaux
- Partenariats public/privé, afin d'encourager la participation des industriels, et notamment des PME-PMI, dans les actions Marie Curie, afin d'accroître le partage des connaissances dans le cadre de programmes conjoints de recherche.
- Dimension Internationale, reprenant les principes des bourses entrantes et sortantes
- Actions Spécifiques, notamment en vue de favoriser la création d'un véritable marché européen du travail dans le domaine de la recherche.

• Capacité de recherche

- soutien aux infrastructures de recherche, qu'elles soient existantes ou en création.
- soutien à la recherche pour et par les PME et les associations de PME. L'objectif est de renforcer la capacité d'innovation des PME européennes et de favoriser leur contribution au développement de nouvelles technologies (orientées produits et marchés). La réalisation de cet objectif passe par un soutien à l'externalisation de travaux de R&D, à l'augmentation des efforts de recherche, à l'extension des réseaux, et à une meilleure exploitation des résultats de la recherche et à l'acquisition d'un savoir-faire technologique.
Les actions spécifiques à destination des PME seront par conséquent renforcées, qu'il s'agisse de PME seules ou d'associations de PME.
- développement de « clusters » régionaux de recherche associant étroitement universités, centres de recherche et entreprises
- développement du potentiel de recherche et d'excellence existant dans les convergences régionales de l'UE
- réflexions, débats, et actions autour du thème « Science et Société »
- activités spécifiques de coopération internationale de coordination de programmes nationaux.

FP7 : 4 programmes spécifiques

Recherche Collaborative

- 4 types d'outils et d'activité :
 - Projets et réseaux (IP, NOE, STREP, CCA, CA)
 - ITC
 - Coordination programmes nationaux
 - Coopération Internationale
- 10 priorités thématiques

Recherche Visionnaire

- Frontières de la connaissance
- Tous les domaines scientifiques
- Conseil Européen de la Science
- Executive agencies

Potentiel Humain

- Formation initiale pour les chercheurs
- Formation tout au long de la vie
- Partenariats et passerelles public/privé
- Dimension internationale
- Actions spécifiques (marché de l'emploi)

Capacité de Recherche

- Infrastructures de recherche
- Recherche pour et par les PME-PMI
- Pôles Régionaux
- Science et société
- Potentiel de Recherche

I-70: Gouvernance

Une partie des financements du FP7, et notamment dans les 3 nouvelles catégories d'action précitées (initiatives technologiques conjointes, coordination à grande échelle des programmes nationaux de recherche, et soutien à la création de nouvelles infrastructures), sera directement gérée par des organisations nationales, des Etats-Membres, des entreprises étroitement liées à la Commission.

En complément, la gestion de nombreuses autres activités sera assurée par des structures externes (appelées executive agencies). A côté du Conseil Européen de la Recherche, une structure similaire sera créée pour l'administration et la gestion des actions Marie Curie, des actions pour les PME-PMI,...

I-80: Calendrier

Proposition de la Commission

6 Avril 2005

Proposition de programmes spécifiques et des règles de participation

Automne 2005

Adoption par le Conseil/Parlement

Eté 2006

Programme de travail

Fin 2006

Lancement premier appel

Début 2007

I-90: Contact

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II – Recherche Collaborative: les 10 priorités thématiques

II-1: Health

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

RATIONALE : The sequencing of the human genome and the recent advances in post-genomics have revolutionised research into human health and diseases. Integrating vast amounts of data and understanding underlying biological processes requires bringing together critical masses of various expertises and resources that are not available at a national level. Significant advances in translational health research, which is essential to ensure that biomedical research provides practical benefits, also requires multidisciplinary and pan-European approaches involving different stakeholders. Such approaches allow Europe to contribute more effectively to international efforts to combat diseases of global importance. Clinical research on many diseases (cancer, cardiovascular diseases, neurological diseases, in particular those linked with ageing, such as Alzheimer and Parkinson diseases) relies on international multi-centre trials since the required number of patients cannot often be recruited in a single country in a short time-frame. Epidemiological research requires a large diversity of populations and international networks to achieve significant conclusions. Developing new diagnostics and treatments for rare disorders require multi-country approaches to increase the number of patients for each study. And performing health policy driven research at the European level offers a possibility to compare the models, systems, data, and patient material held in national databases and biobanks.

A strong EU-based biomedical research will help strengthen the competitiveness of the European healthcare biotechnology, medical technology and pharmaceutical industries. Research-based SMEs are the main economic drivers of the healthcare biotechnology and medical technology industries. Although Europe now has more Biotechnology companies than US, most of them are small and less mature than their competitors. Public-private research efforts at the EU level will facilitate their development. EU research will also contribute to the development of new norms and standards to set up an appropriate legislative framework for new medical technologies (e.g. regenerative medicine). The themes and activities that will be addressed, which also include research essential to policy requirements, are set out below. To complement these and respond to new policy needs, additional actions may be supported for example in the areas health policy issues and occupational health and safety.

THEMES AND ACTIVITIES:

- **Tools and biotechnology for health.**

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

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

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

- *Tools and technologies for innovative therapeutic approaches and intervention.* To ensure further development of tools essential for the success of innovative therapeutic approaches with potential application in many diseases and disorders.

- **Translating research for human health**

- *Integrating biological data and processes: Large-scale data gathering, Systems biology.* To generate and analyse the massive amount of data needed to better understand the complex regulatory networks of thousands of genes and gene products controlling important biological processes.

- *Research on the brain and related diseases, human development and ageing.* To explore the process of healthy ageing and the way brain activity interacts with genes and environment, under normal conditions as well as in brain diseases.

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

- *Translational research in major diseases: cancer, cardiovascular disease, diabetes/obesity; rare diseases; and other chronic diseases (e.g. osteoarthritis).* To develop patient-oriented strategies from prevention to diagnosis and treatment including clinical research.

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

- *Translating clinical outcome into clinical practice.* To understand clinical decision-making and how to translate outcomes of clinical research into clinical practice and especially addressing the specificities of children, women and elderly population.

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

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

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

II-20: Food, agriculture and biotechnology

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

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

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

Several Technology Platforms have contributed in setting the priorities of this area, in the fields of: plant genomics and biotechnology, forestry, global animal health, farm animal breeding, food and industrial biotechnology. This will ensure integration of all relevant stakeholders within EU research actions, in particular biotechnology, food and feed industries and researchers, but also farmers, forestry managers, energy, and chemical industries, retailers and consumers. In addition, the relevant policy, regulatory and standardisation issues will be addressed, (Common Agricultural Policy and Common Fisheries Policy; agriculture and trade issues ; food safety regulations; animal health and welfare standards), including by responding flexibly to new policy needs that arise.

THEMES AND ACTIVITIES :

- **Sustainable production and management of biological resources from land, forest, and aquatic environments** : Enabling research, including 'omics' technologies, such as genomics, proteomics, metabolomics, systems biology and converging technologies for micro-organisms, plants and animals, including exploitation of their biodiversity ; improved crops; sustainable, competitive and multifunctional agriculture, including rural development and forestry; animal welfare, breeding and production, including aquaculture and fishery management; infectious diseases in animals, including zoonoses.
- **“Fork to farm”: Food, health and well being** : Consumer, societal and health aspects of food and feed, including behavioural and cognitive sciences; nutrition and diet related diseases, including obesity; innovative food and feed processing technologies (including functional foods); improved quality and safety, both chemical and microbiological, of food, beverage and feed; integrity of the food chain; environmental impacts on food chains and of food chains; total food chain concept including traceability.
- **Life sciences and biotechnology for sustainable non-food products and processes** : Improved crops, feed-stocks and biomass for energy, environment, materials and chemicals, including novel farming systems, bio-processes and bio-refinery concepts; bio-catalysis; forestry and forestry related products and processes; environmental remediation and cleaner processing.

II-3□: Information and communication technologies

OBJECTIVE: Enabling Europe to master and shape the future developments of Information and Communication Technologies (ICT) so that the demands of society and the economy are met; driving and stimulating innovation through ICT use and ensuring that ICT is rapidly transformed into socio-economic benefits for Europe's citizens, businesses and governments; strengthening the underlying ICT pillars where there is a strong potential for new technology breakthroughs and radical innovation; and integrating multi-technology sets that underlie new functionalities, services and applications and research to support the development of ICT applications.

RATIONALE : Europe is still lagging behind its major competitors in terms of investment in ICT research. This is undermining its economic growth, its capacity to address the upcoming challenges and its position in all other major science and technology fields. Europe's industrial and academic research base has demonstrated its strengths. More however needs to be done to ensure that the research base is extended and that our economy meets the challenges of the global markets. Current levels of investment are far below competing regions. Investment in ICT research in the EU is one third of the US level and around 70 % of Japan's level. In addition, partnering at European level is essential to provide the strategic direction, to pool the necessary interdisciplinary resources and to pursue common goals. Furthermore, half of the productivity gains in our economies are explained by the impact of ICT on products, services, work methods and improvements in overall organisation, and ICT is the leading factor in mastering change and innovation in industrial value chains. ICT is also essential to meet the rise in demand for health and social care and to modernise services in domains of public interest such as education and learning, energy and the environment. At the same time, ICT is catalytic in the advance of other sciences and technologies as new ICT tools and infrastructures change the way researchers communicate, co-operate and innovate. As competition on a global scale is increasing and as countries and regions are engaged in a relentless world-wide race to attract private investment, including in research, Europe has no other choice but to intensify its ICT research effort. This should be done in the public sector at national and European level and in the private sector. The themes and activities that will be addressed are set out below in terms of the underpinning technology pillars, environments where ICT is to be integrated and areas of application. In addition, support may be provided to respond to new policy needs, for example relating to: privacy, security and trust of ICT; ethical issues of ICT developments; and ICT-related legal, regulatory and governance frameworks.

THEMES AND ACTIVITIES

• **Technology Pillars**

- *Nano-electronics, photonics and integrated micro/nano-systems.* To push the limits of miniaturisation, integration, variety and density of nano components and systems with the aim of increasing performance at lower prices and to facilitate the incorporation of ICT in a wider range of products and services.
- *Ubiquitous and unlimited capacity communication networks.* To offer ubiquitous access over heterogeneous networks - fixed, mobile and broadcasting networks spanning from the personal area to the regional and global area - allowing the seamless delivery of ever higher volumes of data and services anywhere, anytime.
- *Embedded systems, computing and control.* To strengthen capabilities to design and build computing and communication systems that are embedded in objects and artefacts and that can control and adapt to the constraints imposed by their physical environments.
- *Software, Grids, trust and dependability.* To strengthen capabilities to develop and manage dynamic, adaptive and trusted knowledge-intensive software and services and their provision as a utility.
- *Knowledge, learning and cognitive systems.* To capture knowledge embedded in web and multimedia content, making information understandable to people and machines and to develop artificial systems that perceive, understand, learn and evolve, and act toward achieving goals.
- *Interaction, visualisation, simulation and mixed realities.* To foster creativity and innovation in products, services and interactive and rich digital content, and to develop natural ways to interact with technology, machines, devices, and other artefacts.

• **Multi-technology, Multi-disciplinary Integration**

- *Personal environments.* To provide people with the means to use applications and services in the most seamless and effortless way, anytime, anyplace and on any device.
- *Home environments.* To bring new services and new forms of interactive digital content to the home.
- *Robotic systems.* To build the robotic systems that drive innovation in service, entertainment, security and industrial engineering applications, as well as in environmental surveillance and medical treatment.
- *Intelligent infrastructures.* To embed intelligence in the infrastructures that are critical to everyday life spanning from energy, transport and water supply to financial service systems.

• **Application Poles**

- *ICT for health.* To improve quality, access and efficacy of health care delivery systems and to contribute to autonomy and increased mobility of patients, including bringing health knowledge discovery into clinical practice.
- *ICT for inclusion.* To promote digital opportunities and prevent digital divides due to age, disability, gender, literacy, culture and others.
- *ICT for mobility.* To develop intelligent ICT-based systems for transportation and vehicles enabling people and goods to move safely, comfortably and efficiently.
- *ICT for the environment.* To support sustainable development and to reduce vulnerability and mitigate consequences of natural disasters and industrial accidents.
- *ICT for organisations and work.* To support new forms of dynamic networked co-operative business processes, and to enhance efficiency, openness and accountability of public services.
- *ICT for manufacturing.* To support manufacturing of miniature ICT products, and to assist in the rapid and adaptive production of highly customised goods.
- *ICT for media, culture and entertainment.* To enable enriched user experiences, including for access to cultural resources, and to deliver content in flexible and yet cost effective ways.
- *ICT for learning.* To improving significantly people's abilities to become active learners.

II-4□: Nanosciences, Nanotechnologies, Materials and new Production Technologies

OBJECTIVE: Ensure the transformation of European industry from a resource-intensive to a knowledge-intensive industry, by generating and exploiting breakthroughs in nanosciences, nanotechnologies and advanced materials; and by developing innovating production processes, products and services, relying on the convergence of information and communication technologies, biotechnologies and other new technologies.

RATIONALE : The decline in industrial activities appears no longer to be limited to traditional sectors with a high labour density, but is beginning to be observed in intermediate sectors – which constitute the established strengths of European industry – and even in some hightechnology sectors. This trend can and must be reversed by building, in Europe, a strong knowledge-based, knowledge intensive industry. This will include the modernisation of the existing SME base and on the creation of new knowledge-driven SMEs, thanks to the dissemination of knowledge and expertise through collaborative programmes. EU recognized leadership in nanotechnologies, materials and knowledge intensive sectors has to be reinforced in order to secure and increase the EU position in a highly competitive global context. World-class European-scale multidisciplinary poles of excellence attracting and retaining the best scientists must be developed. This requires a critical mass of interdisciplinary resources easier to gather at European level. An important number of European Technology Platforms have been set up in this area, in fields such as, for instance, nanoelectronics, manufacturing, nanomedicine, steel, chemistry, construction, industrial safety and textiles, which have and will further help establish common research priorities and targets. Step changes in production, manufacturing and hence productivity will result from these common approaches. In addition to industry relevant priorities which are set out in the themes and activities below, the relevant policy, regulatory and standardisation issues will be addressed, including by responding flexibly to new policy needs that arise.

THEMES AND ACTIVITIES :

• **Nanosciences, Nanotechnologies**

- Expanding our knowledge of size, dimension and geometry dependent phenomena and interface phenomena;
- Extending the limits of control at the nano-scale to realise new micro- and macro-applications, e.g. in nanosystems, biotechnologies, medicine, energy and environmental technologies;
- Developing instruments, methods and tools for characterisation and manipulation at nano dimensions;
- Impact of nanoscale entities on human health and the environment; Metrology, nomenclature and standards;
- Nanoelectronics, including molecular electronics, quantum computing and spintronics, possibly subject of a Technology Initiative.

• **Materials**

- Knowledge-based materials with tailored properties and the ability to process them; more direct molecular-level control of their properties;
- More reliable design and simulation – enhancing the concept of “materials engineering”; recyclability and environmental compatibility; higher complexity of materials;
- Integration of nano-molecular-macro levels in the chemical and materials processing industries;
- New nano-materials, bio-materials and hybrid materials.

• **New Production**

- New concepts for design, production and delivery of high added-value products and services. Development and validation of new industrial paradigms;
- Adaptive production adopting agility and adaptability for flexible, small or single batch oriented production. Resource efficient, sustainable production processes.
- Affordable intelligent sensor technologies and control of processes. Customer orientation and co-operation in product development ;
- Digital and virtual production, modelling, simulation and presentation tools. New generation of planning tools, software and ICT to integrate new technologies ;
- Networked production based on dynamic, co-operative and value-adding operations for global production capability.
- Knowledge-intensive products and processes, exploiting the convergence of nano, bio, info and cognitive technologies.

II-50: Energy

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

RATIONALE : Energy systems are confronted with major challenges. The urgency to develop adequate and timely solutions is justified by the alarming trends in global energy demand (predicted to rise by 60% in the next 30 years), the need to curb dramatically emissions of greenhouse gases to mitigate the devastating consequences of climate change, the damaging volatility of oil prices and geopolitical instability. Research is needed to develop the most environmentally and cost-effective technologies and measures enabling the EU to meet its targets under the Kyoto Protocol and beyond, in line with EU policy on sustainable development. Europe has developed world leadership in a number of energy technologies. It is the pioneer in modern renewable energy technologies, such as bio-energy and wind energy. The EU is also a global competitor in power generation and distribution technologies and has a strong research capability in the area of carbon capture and sequestration. These positions, however, are under severe threat from competition (in particular from the US and Japan). Radically transforming the energy system requires new technologies with risks that are too high and the benefits too uncertain for private firms to provide all the investment needed for research, development and deployment. Public support should therefore play a key role in mobilising private investment and European efforts and resources should be combined in a coherent and more effective manner, to compete with economies that are investing heavily and consistently in similar technologies. The themes and activities to meet the objective are set out below. A specific theme on knowledge for energy policy making is included which may also provide support to new policy needs that emerge, for example relating to the role of European energy policy in the developments of international climate change actions, and instabilities or disruptions in energy supply and price.

THEMES AND ACTIVITIES:

- **Hydrogen and fuel cells**

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

- **Renewable electricity generation**

Development, validation and demonstration of advanced and innovative technologies. To contribute to lowering EU dependence on imports and to limit CO₂ emissions by increasing overall conversion efficiency, driving down the cost of electricity production from indigenous renewable energy sources, and developing technologies suited to different regional conditions (eg, through achieving the full potential of photovoltaics, and further developing wind energy).

- **Renewable fuel production**

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

- **Near zero emission power generation**

Research, development, validation and demonstration of advanced and clean conversion technologies. To create highly efficient power plants with near-zero emissions by paying attention to technologies which drastically reduce the adverse environmental impact of fossil fuels, especially those allowing the clean use of coal in coming decades (CO₂ capture and storage will be a major element).

- **Smart energy networks**

Research, development and demonstration of technologies and systems. To increase the efficiency and security of the European electricity and gas transport and distribution system e.g. by transforming the current electricity grids into an interactive (customers/operators) service network and to remove obstacles to the large-scale deployment and effective integration of distributed and renewable energy sources.

- **Energy savings and energy efficiency**

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

- **Knowledge for Energy policy making**

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

II-6□: Environment and Climate Change

OBJECTIVE : Advancing our knowledge on the interactions between the biosphere, ecosystems and human activities, and developing new technologies, tools and services, in order to address in integrated way global environmental issues and support sustainable development. Emphasis will be put on improved understanding and prediction of climate, earth and ocean systems changes; on tools for monitoring, prevention and mitigation of environmental pressures and risks, as well as for the management and conservation of natural resources.

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

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

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

THEMES AND ACTIVITIES :

- **Pressures on environment and climate, impacts and feedback:** Functioning of climate and the earth system; adaptation and mitigation measures; pollution in air, soil and water; changes in atmospheric composition and water cycle; interactions between climate and the ocean; and impacts on biodiversity and ecosystems.
- **Environment and health** : Interaction of environmental stressors with human health including identification of sources, impact and emerging risk factors; integrated risk assessment approaches for effective prevention strategies; quantification and cost-benefit analysis of environmental health risks and indicators.
- **Conservation and sustainable management of natural resources:** Conservation and sustainable management of ecosystems; water resources management; waste management; protection and management of biodiversity, soil protection, approaches against desertification and land degradation; data management and information services; assessment and foresight relating to natural processes.
- **Evolution of marine environments:** Impacts of human activities on the marine environment; pollution and eutrophication in regional seas and coastal areas; deep sea ecosystems; assessment of marine biodiversity trends, of ecosystem processes and of ocean circulation; seabed geology.
- **Environmental Technologies:** Technologies for observation, prevention, mitigation, adaptation, and restoration, related to: water, climate, marine, urban environment, soil, waste treatment, recycling, clean production processes, protection of cultural heritage. environmental technology and life cycle assessment, verification and testing.
- **Natural hazards: understanding and prevention:** Improve prediction and integrated hazards- vulnerability - and risks assessments for disasters related to geological hazards (such as earthquakes, volcanoes, tsunamis) and climate (such as storms); develop early warning systems and improve prevention strategies.
- **Forecasting methods and assessment tools:** modelling economy/environment, externalities, thresholds and sustainability impact assessment on key issues such as land use and urban management.
- **Earth observation:** Contribute to the development of space and ground observation systems for environmental and sustainability issues; interoperability between systems and use of information for understanding, modelling and predicating environmental phenomena.

II-70: Transport

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

RATIONALE: Transport is one of Europe’s strengths - the air transport sector contributes to 2.6% of the EU GDP (with 3.1 million jobs) and the surface transport field generates 11% of the EU GDP (employing some 16 million persons). However, transport is responsible for 25% of all the EU emissions of CO₂, hence the absolute need for a “greening” of the system to ensure more sustainable transport patterns and compatibility with growth rates. The enlargement of the EU (increasing land surface by 25% and population by 20%) presented new challenges for transporting people and goods efficiently, cost-effectively and in a sustainable manner. Transport also has direct relevance on other major policies such as trade, competition, employment, cohesion, energy, security and the internal market. Investment in RTD in EU transport industries is a prerequisite to ensure technological competitive advantage in global markets. The research agendas developed by Technology platforms support the need to take a new “transport systems” perspective that is considering the interactions of vehicles and transport networks, which can only be developed at European level. RTD costs in all these fields are rising substantially, and collaborative activity at EU-level is essential to enable a “critical mass” of diverse RTD providers to address the scale and multi-disciplinary challenges in a cost-effective way, as well as meeting the technological and socio-economic challenges on issues such as interconnectivity, intermodality, affordability, safety, capacity, security and environmental impacts in an enlarged Union. Activities at European level will also stimulate the restructuring of the industry, including the integration of the supply chain and in particular SMEs. As well as the strong industry relevance of the themes and activities set out below, the needs of policy makers will be addressed. In addition, support will be provided to respond to new policy needs that arise, for example relating to developments in maritime policy and the implications for transport policy of trends in global warming and changes in the demographics, lifestyles and expectations of society.

THEMES AND ACTIVITIES :

• **Aeronautics and air transport**

- *The greening of air transport:* reduction of CO₂ and NO_x emissions and noise disturbance, incorporating work on engines and fuel, structures and new aircraft designs, airport operations and traffic management.
- *Increasing time efficiency:* improvement of the efficiency of operating schedules focusing on innovative air traffic management systems which integrate air, ground and space components, including traffic flow and more aircraft autonomy.
- *Ensuring customer satisfaction and safety:* improvement of passenger comfort, innovative in-flight services and more efficient passenger handling; safe separation of aircraft, prevention of hazards, human performance and control aspects; wider choice of aircraft ranging from wide body to small size general aviation vehicles.
- *Improving cost efficiency:* reduction of product development and operating costs focusing on zero maintenance aircraft, check in procedures, cheaper manufacturing costs, increased use of automation and simulation.
- *Ensuring security:* absolute prevention measures such as improved data and identification methods, securing the aircraft against attack, auto recovery and improved security design of aircraft.

Actions in areas such as of “*air traffic management*” - in line with the Single Sky policy and the SESAME initiative, and “(*new generation*) *greener aircraft*” could be implemented through a Joint Technology Initiative scheme.

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

- *Ensuring mobility:* development of intermodal transport, innovative urban transport, inter-connection between regional and national transport networks, new and regenerated transport infrastructures, intelligent systems and information exchange between vehicle and transport infrastructure.
- *The greening of surface transport:* solutions for the “greening” of products and operations with focus on: atmospheric pollution, marine pollution and biodiversity, noise pollution and recycling, clean engines and the use of alternative fuels(including the use of hydrogen and the integration of fuel cells technologies into vehicles) for transport applications.
- *Improving safety and security:* improvement of safety and security in operations for passengers, crew and pedestrians, in particular integrated passive, active and preventive safety, human factor related aspects, security of terminals, vehicles, vessels and critical infrastructure.
- *Strengthening competitiveness:* production by design, development of cost-effective, high quality products and systems, efficient production; maximisation of infrastructure capacity, cost-effective infrastructure construction; advanced engine and vehicle production, innovative production and delivery organisations; end of life strategies for vehicles.

II-8□: Socio-Economic Sciences and the Humanities

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

RATIONALE : Europe has a strong and high quality research base in socio-economic sciences and the humanities fields. The diversity of approaches within the EU in the economic, social, political and cultural domains provides a highly fertile ground for research in these fields at EU-level. There is a high European added value in collaborative research addressing European socio-economic issues in the areas mentioned. First, the issues and challenges concerned are of high priority at the EU level and are addressed by EU policies. Second, comparative research across several or all EU countries offers a particularly effective tool as well as important learning opportunities across countries and regions. Third, EU-level research has particular advantages in being able to develop Europe-wide data collection and to employ the multiple perspectives needed to understand complex issues. Finally, the development of a genuinely European socio-economic knowledge base on these key challenges will make an essential contribution to promoting their shared understanding across the European Union and, most significantly, on the part of the European citizens. The themes and activities to be supported are listed below and are expected to contribute significantly to improve the formulation, implementation and impacts of policy in a wide range of areas such as economic, social, education and training, external relations and justice and home affairs policies. In addition, opportunities will be provided to address emerging socio-economic issues challenges as well as to undertake research on new or unforeseen policy needs.

THEMES AND ACTIVITIES :

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

II-90: Space

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

RATIONALE : The GALILEO experience has demonstrated that EU participation can be fundamental in the definition and implementation of important space applications bringing innovative solutions to Europe's indispensable requirements. The EU can contribute to the better definition of common objectives based on user requirements and policy objectives; to the coordination of activities, so as to avoid duplications; and to the definition of standards. Public authorities and decision-makers represent important potential users and the European industry will also benefit from a well defined European Space policy. European level actions are also needed to support EU policy objectives, for example in the fields of transport, agriculture, fisheries, telecommunications, security, as well as ensuring that Europe is a respected partner in regional and international cooperation. In the last 40 years, Europe has built up excellent technological competence and a competitive space industry with an impressive series of successful space missions. The European space industry is a key actor in the world-wide commercial market of satellite manufacturing, launch services, and satellite operators. Sustaining a competitive industry (including manufacturers, service providers and operators) requires new research and technologies. Space applications bring important benefits to the citizens (e.g. radio navigation, communication by satellite, earth observation for monitoring in case of natural disasters or humanitarian aid). The public policy benefits of the below themes and activities will also be maximised, included additional support for new policy needs that may arise, for example: space based solutions in support of developing countries; and use of space-observation tools and methods to support developments in Community policies.

THEMES AND ACTIVITIES :

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

- 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.
- GMES: satellite-based monitoring systems relating to the management of the environment and security; use and delivering of GMES data and enhanced monitoring techniques.
- Innovative satellite communication services for citizens and enterprises in application sectors encompassing civil protection, e-government, telemedicine, tele-education and generic users.
- EU space based security capability and the development of technologies for reducing the vulnerability of space-based systems.

• RDT for strengthening space foundations

- Space transportation technology: research to preserve the independence and the competitiveness of the European space transportation sector.
- Space sciences: structure of the universe, life in space, improved understanding of Planet Earth; new technology developments and applications.
- Space exploration activities and related technology.

II-10 Security Research

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

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. With enlargement, new external sea borders have increased by about 5000 km and new land borders by 4000 km. Furthermore, security-related research is an important building block in realising an EU-wide area of freedom, security and justice, as endorsed by The Hague programme. It also supports the Common Foreign and Security Policy. Existing security-related research activities in Europe however clearly prove the fragmentation of efforts, the lack of critical mass of scale and scope and the lack of connections and interoperability. Security research at EU level will therefore reinforce the competitiveness of European civil and defence industry. Security research will also contribute to developing technologies in support of the EU policies in areas such as transport, civil protection, energy and environment. In addition, Europe needs to improve the coherence of its efforts and overcome the dividing line between defence and civil research. European security research will therefore maximise the benefit of the multi-purpose aspects of technologies and will, in addition, complement other priorities of the Framework Programme. The themes and activities are set out below. It is also important to be able to respond to new security threats and related policy needs that may arise, and support may be provided for this purpose, for example concerning the analysis and vulnerabilities assessment of such threats and the management of possible consequences and impact assessment.

THEME AND ACTIVITIES:

- **Border security:** Research will focus on technologies and capabilities to enhance surveillance of Europe's land and coastal borders.
- **Security of individuals:** Research will aim at delivering technology solutions for threat detection, prevention, identification, protection and neutralisation as well as containment of terrorist attacks and organised crime.
- **Security of infrastructures and utilities:** Research will aim at analysing and securing existing and future critical infrastructure systems and services and will focus on activities related to established and future networked systems.
- **Restoring security in case of crisis:** Research will focus on technologies and tools in support of diverse emergency management operations (such as civil protection, humanitarian and rescue tasks, support to CFSP), and on issues such as interorganisational co-ordination and communication, distributed architectures and human factors.
- **Security Systems Integration and interoperability:** Research will focus on technologies and tools to enhance the interoperability of equipment, processes and services (e.g. in the field of information exchange and international law enforcement communication systems), as well as on the dependability, organisational aspects, protection of confidentiality and integrity of information.
- **Security and society:** Research will focus on socio-economic analyses, scenarios building and other activities related to the citizen perception of the security, ethics, protection of privacy and societal foresight, and on technologies that better enable safeguarding privacy and liberties.
- **Security Research Co-ordination and structuring:** Research will focus on coordination of European and international security research efforts and ensure synergies between civil, security and defence research, improve legal conditions, provide efficient institutional arrangements and encourage the optimal use of existing infrastructures.