Objective
Improve the competitiveness of European industry and 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. ICT is at the very core of the knowledge-based society. Activities will strengthen Europe’s scientific and technology base and ensure its global leadership in ICT, help drive and stimulate product, service and process innovation and creativity through ICT use and ensure that ICT progress is rapidly transformed into benefits for Europe’s citizens, businesses, industry and governments. These activities will also help reducing the digital divide and social exclusion.

Rationale
Information and Communication Technologies are critical to Europe’s future and underpin the realisation of the Lisbon agenda. They have a catalytic impact in three key areas: productivity and innovation, modernisation of public services and advances in science and technology. 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, in particular for people with special needs including the ageing population, and to modernise services in domains of public interest such as education, cultural heritage, security, energy, transport and the environment and to promote accessibility and transparency of governance and policy development processes. ICT plays an important role in RTD management and communication and is catalytic in the advance of other fields of science and technology as it transforms the way researchers conduct their research, cooperate and innovate.

The escalating economic and societal demands, together with the continued mainstreaming of ICT and the need to push further the technology limits as well as to develop innovative high-value ICT-based products and services 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 functional, 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 focussing on miniaturisation, mastering the convergence of computing, communications and media technologies, including further interoperability between systems and the convergence with other relevant sciences and disciplines, and on building 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 and the humanities.

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. ICT research activity based on the ‘open source’ development model is proving its utility as a source of innovation and increasing collaboration. The results of ICT research can take various exploitation paths and lead to various business models.

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, microsystems, embedded systems, mobile and wireless communications, electronic media, photonics, robotics and software, services and Grids, including Free, Libre and Open Source Software (FLOSS). Sustainability issues will also be taken into account, particularly in the field of electronics.

Activities
The role of research into Future and Emerging Technologies is particularly relevant under this theme 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, including the exploitation of quantum effects, system integration and smart systems.

**ICT Technology Pillars:**

Nano-electronics, photonics and integrated micro/nano-systems: pushing the limits of miniaturisation, integration, variety, storage 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, reliable and efficient computing, storage and communication systems and products that are embedded in objects and physical infrastructures and that can sense, control and adapt to their environment; interoperability of discrete and continuous systems.

Software, Grids, security and dependability: dynamic, adaptive, dependable and trusted software and services, platforms for software and services, complex systems and new processing architectures, including their provision as a utility.

Knowledge, cognitive and learning systems: semantic 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 convivial 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 mathematics and physics, biotechnologies, materials- and life-sciences, for miniaturisation of ICT devices to sizes compatible and interacting with living organisms, to increase performance and user-friendliness 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 and cooperation; miniaturisation, humanoid technologies.

Intelligent infrastructures: tools making infrastructures that are critical to everyday life more efficient and user-friendly, easier to adapt and maintain, more robust to usage and resistant to failures.

**Applications Research:**

ICT meeting societal challenges: New systems, novel materials, structures, technologies and services in areas of public interest improving quality, efficiency, access and inclusiveness, including accessibility for the disabled; user friendly applications, integration of new technologies and initiatives such as ambient assisted living.

for health, improving disease prevention and health care provisions, early diagnosis, treatment and personalisation; autonomy, safety, monitoring and mobility of patients; health information space for knowledge discovery and management.

to improve inclusion and equal participation and prevent digital divides; assistive technology for elderly and for disabled people; design-for-all.

for mobility; intelligent ICT-based transportation systems, vehicles and intelligent service solutions for tourism enabling people and goods to move safely, ecologically, comfortably and efficiently.

in support of the environment, risk management and sustainable development, to prevent or reduce vulnerability and to mitigate the consequences of natural disasters, industrial accidents and human activities related to economic development.
for governments at all levels: efficiency, openness and accountability, for a world-class public administration and links to citizens and businesses, supporting democracy, allowing access to information to all.

– **ICT for content, creativity and personal development:**

new media paradigms and new forms of content, including entertainment; creation of and access to interactive digital content; enriched user experiences; cost-effective content delivery; digital rights management; hybrid media.

technology-enhanced learning; adaptive and contextualised learning solutions; active learning.

ICT-based systems to support accessibility and use over time of digital cultural and scientific resources and assets, in a multilingual/multicultural environment.

– **ICT supporting businesses and industry:**

new forms of dynamic networked co-operative business processes, digital eco-systems including for empowering small and medium-sized organisations and communities; optimised work organisation and collaborative work environments such as knowledge sharing and interactive services (e.g. for tourism).

Manufacturing, including traditional industries: rapid and adaptive design, production and delivery of highly customised goods; digital and virtual production; modelling, simulation, optimisation 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.