

Information Society Technologies Advisory Group
Orientations for EU ICT R&D & Innovation beyond 2013
10 Key Recommendations

Objectives, rationale and content

Introduction

The European knowledge society is entering a new phase of development where ICT is providing the key basic infrastructures for all vital social and economic processes and is the most influential key technology in most innovations across all industries. All private and public services are being provided through and shaped by these infrastructures. ICT is becoming indispensable to address key social challenges and continues to play a defining role in our economy, providing a critical infrastructure for the global economy. The ICT infrastructure thus becomes an issue of the highest social concern. Therefore, in this new phase social innovation will be a key driver for ICT development.

Social innovation refers to new strategies, concepts, ideas and organizations that meet social needs of all kinds. Technological innovation can inspire social innovation, for example e-health, distance learning and the use of texting on mobile phones, but technological innovation is also driven by our desire to build systems to meet social needs, for example the Google search engine was developed to enable people to find things on the Web. The two processes are becoming increasingly inter-connected.

The shift towards social innovation also implies that the dynamics of ICT-innovation has changed. Innovation has shifted downstream and is becoming increasingly distributed; new stakeholder groups are joining the party, and combinatorial innovation is becoming an important source for rapid growth and commercial success. Continuous learning, exploration, co-creation, experimentation, collaborative demand articulation, and user contexts are becoming critical sources of knowledge for all actors in R&D & Innovation.

The rapid deployment of the Internet as a global infrastructure available practically anywhere anytime has led to a new dimension of integration across time and distance. Never before in history could global distributed systems be connected like today. Thus, a new era for systems and service integration, where ICT will be functioning as a 'systems-of-systems', is about to take off in the next decade.

Recommendations

1. Strengthen Europe's competitiveness by investment in ICT as an enabling technology – keep ICT as a free standing area in the CSF with sufficient budget allocation

The last two decades have shown that ICT is THE key innovation enabler in almost any technology domain as well as has changed the social behaviour of most of the people in Europe. Europe must continue to focus on ICT as a key technology area by having a dedicated R&D&I programme for ICT with special emphasis on how to apply ICT inventions in mission critical application domains both in societal as well as in industry domains.

European investment in collaborative ICT research in the CSF must continue to ensure that research results, needed as the basis of the next generation of global technologies and services for ICT, are available on time. ICT must be kept as a free standing area of collaborative research efforts in the CSF, with sufficient budget allocation, to ensure that

future generations of technologies can be researched while, at the same time, the work of implementing new solutions to societal challenges can be undertaken using the latest available ICT products and services based on previous cycles of investment in research.

2. Aim at global leadership in Social Innovation and create a 'Balanced Progress' framework

In the next stage of our knowledge society the social dimension of technical innovation becomes increasingly visible and important, as the ICT infrastructure is now an issue of the highest societal concern. The key importance of ICT for society implies that ICT is not only a key enabler, but also a transformative force that redefines both challenges and solutions. Economic growth, social cohesion and the wellbeing and empowerment of European citizens will fully depend on the further development of ICT. This requires a continuous balancing of sometimes contradictory individual, social, societal, entrepreneurial, and ecological needs. Action is needed to embed technological innovation in social, cultural, political, material, and cognitive contexts. It also requires the development of multidisciplinary research contexts in which this balance is reflected. By focusing on social innovation, Europe can take leadership in developing solutions to worldwide challenges

Different stages of development in ICT also imply different systems of evaluation and impact assessment. In a product-centric phase, the technology developer community to a large extent defines what constitutes "progress". In a user-centric phase, consumption and market forces play a similar evaluative role. Users signal their preferences, which can be highly varied, but which are typically grounded in the underlying social practices and communities of practice. In the phase that we are entering now, progress is predominantly defined in *social* terms, which implies that intrinsically different and often conflicting interests need to be balanced. This also means that the definition of "progress" is fundamentally political and value driven.

In this stage, research areas such as Trustworthy Digital Societies or Smart Cities gain importance and European Innovation Partnerships aiming to join up research, innovation and policy are encouraged in these areas.

3. Enlarge the stakeholder community as new, non-conventional actors become increasingly important

The increasing importance of the social dimension of technical innovation also requires the involvement of new stakeholders. Policy needs to include new, non-traditional stakeholders who become increasingly important to articulate both technological opportunities and social concerns. As the collective interest in technology development and its usage becomes more crucial, political and ethical research gains importance for ICT research.

New institutional and regulatory approaches should be created that enables the participation of non-conventional actors, including individual persons, informal networks, and researchers from non-ICT disciplines.

Simplification of rules and procedures and streamlining of instruments is important to ease the participation in the EU programme in particular for new actors.

4. Focus on Europe's strategic strength to manage complex systems and environments

Priorities for ICT research in Europe should be placed in areas where ICT technological progress meets European research and industrial strengths. These intersection points, from components to the capability to manage large interconnected ICT systems, will be essential

technical enablers of new solutions to complex societal challenges, like green and safe transport, smart energy, smart communities, and affordable healthcare.

Europe by nature has to deal with a very complex environment. Furthermore, European industry leaders, including SME, are capable of building and managing the most complex ICT systems in the world. Internet, ICT and services are more and more connected and integrated in complex, distributed systems. Europe should make sure that it owns the key system technology and know-how in this development and takes leadership in developing a 'system of systems' approach'. The Internet of Things and Services mentioned in previous ISTAG reports (ref. http://cordis.europa.eu/fp7/ict/istag/reports_en.html) provides the profound sound base for what is called System-of-Systems, where e.g. car-to-car and car-to-infrastructure communication, cyber-physical systems, autonomous robots, and real time analysis & prediction will be among them.

5. Ensure the dependability of ICT with next generation of infrastructures

The dependence of European business, society, public sector and defence on ICT and large infrastructures – such as power grids, water supply, roads and railway systems, the Internet – poses a high risk and should be countered with sufficient and timely countermeasures.

These include the issuing of international, binding policies and the definition, implementation and enforcement of effective, preventive, responsive and forensic defence mechanisms against intentional (= attacks) and accidental (= faults and failures) impacts on all layers of the ICT infrastructure. This has implications on the next generation smart networks that shall be developed in order to face new challenges like scarcity of resources (both energy and spectrum) while at the same time face the growing demand for more bandwidth and services offered by the underlying infrastructure.

Means of implementation

Introduction

The CSF should build on the success of previous FP initiatives and the related activities of the CIP, EIT and e.g. the Eureka Programmes. The CSF can bring all of these activities together in a single framework supporting the transformation of both curiosity- and agenda-based research results into market and society oriented field trials and innovations, which will help to bridge the gaps between current initiatives.

In a world of Open Innovation it is imperative that European funding instruments facilitate effective cross-border collaboration. Open Innovation in Europe will often involve bringing the research results, obtained in one country, into the industrial sites located in another European country.

Recommendations

6. Unleash the potential of the full value chain in ICT R&D & Innovation by bridging the gap between pre-competitive R&D and products

Current focus of EU-funded ICT projects is mostly on research and development. Innovation and exploitation is often not pursued with the effort and focus required to deliver a sufficient or sustainable impact on market value and society. Often the overall ambition of initiatives and projects fails to connect world class ICT research with various industries and SMEs. The result can be an opportunity lost in leveraging the results by efficient knowledge transfer and turning invention into innovation, i.e. successfully bringing products and services to the market. The recently established "ICT Labs" Knowledge Innovation Community of the EIT is

an essential first step in addressing this question. Given the significance of ICT in Europe's wealth, initiatives like EIT "ICT Labs" must be provided with adequate resources and position within the CSF in order to achieve its goals.

What is needed is a comprehensive view of the value chain from basic research to industrial and applied research including support to market entrance going beyond current CIP-like measures and also including large-scale 'European Lighthouse Pilots'. Innovation actions should also comprise pilot lines for fabrication, innovative process technology, and user centred pilots to validate technology developments and new business models. Such actions (cf. Recommendations from the High Level Expert Group on Key Enabling Technologies (KET)) are very important to develop and prove technology and show feasibility in real life environments, to allow users to participate and co-create in the development of applications and services and to evaluate end-user value. In public markets these research and innovation activities should be followed by public procurement where procurers consider the life cycle cost of the product/service they will procure and use.

In order to fully unleash the potential of the full value chain in R&D & Innovation in ICT, an adequate regime for handling of the intellectual property generated by the projects needs to be developed. Finally, adequate instruments are needed for supporting start-ups and ventures exploiting project results.

7. Create open fast-track schemes for innovation detection, amplification, and acceleration

Innovation is rarely predictable. Many important uses of ICT have come as surprises to technology developers and policymakers. Yet, chance favours the prepared mind. We may not be able to predict innovation, but we can detect it when it emerges. When the locus of innovation continues to shift downstream, and will feed the rise of many more unexpected and disruptive innovations, the early detection of important new developments becomes very important. Innovation and growth are facilitated by systemic amplification of promising new lines of development. This requires agility, fast strategic sense-making, and instruments that can boost growth.

Open, rapid and light-weight explorations are often needed to check the viability and practical potential of new ideas that emerge during research. Such exploration can lead to a redefinition of the original project objectives. Successful ICT companies often have good plans, which they discard several times before finding the right formula for success. R&D&I projects need flexibility and openness to creative thinking and non conventional stakeholders and partners. R&D&I portfolios, in turn, need amplification and selection mechanisms that flexibly re-allocate resources to promising new opportunities.

Action is needed to create project extension and spin-out instruments and open fast-track project pipelines and processes for rapid exploitation, innovation and commercial exploitation. Such investments could be evolutions from current CIP instruments. Processes should include two-step project submission models (as today's FET-Open scheme), with a low-effort first proposal stage that focuses on detecting promising new lines of research. EU-level funding instruments should be developed to facilitate ICT breakthroughs also when they occur locally, at small scale, and before EU-level co-operation is established.

8. Continue and strengthen the Future and Emerging Technologies (FET) scheme with new initiatives

The Future and Emerging Technologies (FET) scheme should continue as a nursery for new ideas and for funding high-risk research promising major advances with the potential for societal and industrial impact. The FET Flagships initiative is welcomed as a new model for large-scale scientific partnerships. The level for the FET open programme should be

maintained at least at the current level. If the overall funding level for FET activities is increased, funding should be sought for a complementary FET Proactive scheme, running alongside the Flagships. Assuming that the FET Proactive scheme continues, the Commission should consider engaging the FET community on a more regular basis to identify potential themes with ground-breaking potential for societal and industrial impact and requiring concerted action and resources beyond the reach of individual organisations. The FET scheme should also have a stronger focus on the quick diffusion of its ideas to 'non-FET communities', societal stakeholders etc, in order to detect the potential for innovation in the FET work as soon as possible and to translate that into new ideas for more innovation-oriented research.

The mixing of people between academia, research institutes and industrial R&D should be encouraged and facilitated as promoted under the EIT. Researchers who wish to work in collaboration with a commercial partner to turn their research into an industrial application or get involved in the main part of the programme should be supported. Short-term industry-based fellowships should be set up for established researchers who have developed exploitable ideas through the FET scheme. An "industrial uncle" scheme should be established to ensure that projects have appropriate industrial or societal impact.

9. Develop common EU-wide services and platforms in cross-border, co-funded initiatives and partnerships, and re-think the set-up of schemes involving Member State funds

Future funding of cross-border, co-funded initiatives and partnerships should focus on areas and activities where EU-wide action, services and systems-of-systems are needed. This notably includes development and support to common platforms and reference architectures as binding sets of structures, processes, interfaces, and data exchange standards and documentation standards. It also includes formalisation of sets of best practices and support to ICT solutions to be implemented and tested in actual environments in the public sector.

For co-funding schemes that require matching funds from the Member States (like today's ENIAC and ARTEMIS Joint Technology Initiatives and the AAL joint programme) improvements in implementation must be found to create efficient cross-border collaboration, balancing EU-wide and Member State interests. When research in one Member State can strengthen product generation and manufacturing in another Member State, European funding should come in as the glue that enables this. Part of the EU budget should be reserved for true cross border cooperation, by supporting those partners that can contribute, but have not sufficient regional budgets to do so.

10. Embrace ambiguity and unpredictability and enable a dynamic agenda

The CSF should allow for changes in priorities of European organisations' for both curiosity- and agenda-based research. Enabling a dynamic agenda, including cross-sector programs, the CSF can support a continued leadership of European based organisations in key segments of the global ICT markets for the coming decade and beyond.

Conventional planning and management approaches have an inherent tendency to make complex realities manageable by clustering, consolidating and simplifying reality. Emergent domains of innovation, however, imply unclear focus, vague objectives and inherent managerial complexity. Conventional control-oriented management approaches and systems are common in bureaucratic contexts, but often dysfunctional for innovation management.

Action is needed to embrace ambiguity and unpredictability, instead of managing them away. Portfolio-approaches should be used to reduce risk and to manage uncertainty.