

Strengthening the Strategic Cooperation Between the EU and Western Balkan Region in the field of ICT Research

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Abstract	The Policy Paper presents the regional / common ICT Research & Development priorities of Albania, Bosnia-Herzegovina, the Former Yugoslav Republic of Macedonia and Serbia, with insights also for Montenegro and Croatia. The priorities were defined following a broad consultation process that involved more than 320 ICT stakeholders in the region. Moreover, the paper presents concrete recommendations on what the Western Balkan countries on the one hand and the EU on the other hand could further undertake in order to enhance the EU-Western Balkan R&D collaboration.
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1. SCOPE OF THE POLICY PAPER

1.1 The Context

The relations with Western Balkan countries are acquiring an increasing relevance for the European Union, as “*the future of the Western Balkans is within the EU*”.¹ In this context, the European Commission promotes the scientific and technological co-operation with the Western Balkan countries, aiming firstly to reinforce the research capacity of these countries, and secondly to integrate the region in the European Research Area. In this direction, the 5th and 6th Framework Programmes (for Research and Technological Development) opened up to the Western Balkan countries, while the 7th Framework Programme (FP7) creates new research & development opportunities for actors in the region in the period 2007 to 2013.

One of the Research & Development (R&D) fields identified as promising for EU-Western Balkan collaboration is Information and Communication Technologies (ICT) based on the “*EU-Balkan countries Action Plan in Science & Technology*” adopted in 2003². Along this direction, the IST Programme of the 5th and 6th Framework Programmes for Research and Technological Development opened up to the Western Balkan countries resulting in a number of projects involving partners from the region (e.g. ISIS, TRISTAN-EAST, GREAT-IST, IS2WEB, ELLECTRA-WEB, SCORE).

The IS2WEB project (predecessor of SCORE) was the first support action covering the Western Balkan Region that performed an initial mapping and training of Western Balkan ICT research organisations on Framework Programme procedures.

SCORE, being the logical continuation of this work, aims at identifying the further steps for the successful integration of the region within European research activities, by identifying future priorities for ICT R&D collaboration (in view of FP7) and concrete recommendations that the Western Balkan Countries on the one hand and the EU on the other hand should act upon in order to further enhance this collaboration.

The following Western Balkan countries³ are involved in the SCORE project and addressed by this policy paper:

- Albania
- Bosnia-Herzegovina
- Former Yugoslav Republic of Macedonia
- Serbia

¹European Commission (2003), *The Western Balkans and European Integration*, Communication from the Commission, COM (2003)

² This action plan was adopted at a Ministerial Conference in Thessaloniki on 26-27 June 2003.

³ Note that Montenegro is the only Western Balkan country not represented in the policy paper, due to the fact that in the proposal phase of the SCORE project, Montenegro was still part of the former union of Serbia and Montenegro.

1.2 The Policy Paper

The SCORE project addresses the need for well-defined Research & Development priorities that will enhance scientific co-operation between the Western Balkan region and the EU in the field of Information Communication Technologies (ICT).

The most important deliverable of the project is thus the present Policy Paper which addresses **decision-makers both within the Western Balkan countries and the European Union.**

Western Balkan decision-makers include policy makers / governmental officials related to the field of ICT / ICT research, decision-makers in the academia / universities as well as top-level management of the ICT private sector. EU decision-makers primarily targeted in this paper are policy-makers related to the field of ICT R&D.

Specifically, the **Policy Paper**:

- Proposes commonly accepted R&D priorities for EU-Western Balkan cooperation in the FP7 context that reflect the actual socio-economic needs and R&D capabilities of the Western Balkan countries. Moreover, it correlates/maps these priorities to FP7 ICT challenges.
- Identifies key problems and barriers faced by ICT R&D actors in the Western Balkan countries and proposes concrete recommendations for Western Balkan countries' decision-makers in order to address/minimise these.
- Makes specific recommendations for EU decision-makers which if implemented could facilitate the further integration of the Western Balkan region in the European Research Programmes.

The content of the policy paper is based on the findings of a broad consultation process that involved more than **320** ICT stakeholders in the participating Western Balkan countries (including ICT experts, research actors, policy makers, ICT company representatives, NGO and civil society representatives) who were involved through a combination of the following means: ICT expert panel, consultation workshops, online consultation and ICT workshops (with a dedicated session on barriers to ICT research and recommendations to Western Balkan and EU decision-makers). An overview of the consultation process is provided in **Annex I**.

As a result of the consultation process, ICT Strategic Research Agendas (SRAs) were developed for the four countries in the region (documented in a separate deliverable "D6-ICT Strategic Research Agendas"). The SRAs outline the **ICT research & development priorities** for which each country has the appropriate human resources and research infrastructures in order to pursue research and development in the short to medium term. Moreover, they present potential-based ICT R&D priorities which are considered attractive for the country and have future, long-term potential.

Based on the countries' SRAs the Policy Paper brings together the common elements and concerns for the four countries involved.

2. REGIONAL ICT R&D PRIORITIES PROPOSED FOR COLLABORATION IN FP7

2.1 Regional ICT R&D priorities

In this section the ICT Research & Development priorities of the represented Western Balkan Countries for the period 2008-2013 are summarised. The priorities have been identified following a broad consultation process with ICT stakeholders, which resulted in country-specific ICT Strategic Research Agendas. The priorities per country were grouped in two categories as follows:

- **ICT R&D priorities with a high level of attractiveness and high level of readiness:** these are priorities for which the country has the appropriate capacity and resources to pursue research and development and at the same time are considered to be attractive. They are suggested as feasible priorities in the short-to-medium term.
- **ICT R&D priorities with a high level of attractiveness and low/moderate level of readiness:** these are priorities that are considered attractive for the country, however the level of readiness and capacities is currently moderate. As such they are suggested as long-term priorities for the country.

The next table presents all priorities identified by the participating Western Balkan countries.

ICT R&D Priorities	ALBANIA		BOSNIA-HERZEGOVINA		FYROM		SERBIA	
	High A & High R	High A & Low R	High A & High R	High A & Low R	High A & High R	High A & Low R	High A & High R	High A & Low R
ICTs for Government & eGovernment	✓		✓		✓		✓	
ICTs for Enterprises & eBusiness	✓		✓		✓		✓	
Internet & Broadband Technologies	✓			✓	✓		✓	
ICTs for Learning & eLearning	✓		✓		✓			✓
ICTs for Health & eHealth	✓		✓			✓		✓
Software Engineering		✓		✓	✓		✓	
Mobile Technologies					✓		✓	
ICTs for Agriculture						✓		✓
Digital Content & Digital Libraries		✓				✓		
Distributed Systems	✓							
Embedded & Pervasive Systems								✓
Network Technologies		✓						
Knowledge Technologies						✓		

Table 1 – Integrated list of ICT R&D Priorities for all countries (2008-2013)

[Legend: “A” stands for Attractiveness, “R” stands for Readiness]

The first 6 R&D priorities are considered as the common priorities for the region **proposed for future collaboration between the EU and Western Balkan countries**.

The criterion for the selection of a priority as regional (in the context of being suitable for EU-WB collaboration) is the evidenced high level of attractiveness for all countries accompanied by high level of readiness to pursue R&D in the given priority by at least two out of the four countries.

Once identified, these regional priorities were presented to approx. 140 ICT R&D stakeholders (representing academia, industry and policy-makers) during four ICT workshops (held in October 2008) as well as to 109 regional ICT R&D stakeholders at the final SCORE Conference “*Towards an Information Society in the Western Balkans*” held on 11-12 December in Belgrade. In the workshops and final conference, the regional ICT R&D priorities and were broadly accepted as representing the actual needs of all Western Balkan countries (including Croatia and Montenegro). Moreover, at the final conference, in collaboration with the WBC-INCO.Net project that were co-organisers of the event, it was possible to determine also the positioning of Croatia and Montenegro vis a vis the common regional priorities identified by SCORE. The outcome of this exercise is provided in Annex II.

2.2 Mapping of regional priorities to FP7 ICT Challenges

Since one of the objectives of the policy paper is to suggest areas and objectives for cooperation in the FP7 context the following table maps relevant FP7 ICT Challenges (based on the 2007-2008 ICT Work-Programme) to the identified Western Balkan ICT research and development priorities (cf. Table 1).

FP7 ICT Challenge (2007-2008)	Western Balkan ICT R&D priority (2008-2013)	Proposed ICT R&D objectives (per priority)	Proposed relevant ICT R&D areas (per objective)
Challenge 1: Pervasive and Trusted Network and Service Infrastructures	Internet & Broadband Technologies	Providing broadband for all.	<ul style="list-style-type: none"> • Service-enabling technologies and platforms based on interoperability of telecom and internet infrastructures. • Development and introduction of broadband technologies and services based on wireless communications for all.
		Development and design of multimedia network and service infrastructure.	<ul style="list-style-type: none"> • Systems and applications for interoperability of multimedia networks. • Development of application and tools for interactive broadcasting.
		Development and implementation of secure solutions for broadband transfer through existing infrastructures.	<ul style="list-style-type: none"> • Secure and resilient architecture and technologies to ensure end-to-end secure transmission of data and services across heterogeneous infrastructure.

FP7 ICT Challenge (2007-2008)	Western Balkan ICT R&D priority (2008-2013)	Proposed ICT R&D objectives (per priority)	Proposed relevant ICT R&D areas (per objective)
	Software Engineering	Software tools and service oriented architectures for distributed information systems.	<ul style="list-style-type: none"> • Models and mechanisms for security and data privacy integration into system environment. • Model driven architectures. • Development of multi-agent software systems architecture • Tools for support of interoperability and collaboration on heterogeneous systems
		Methods and tools for software development improvement.	<ul style="list-style-type: none"> • Applied research in system design, software development, integration and end-user driven development. • Methods and tools software quality control and assurance
	ICTs for Enterprises & eBusiness	Tools and solutions for the support of business processes management and integration.	<ul style="list-style-type: none"> • Adaptive business process management, modelling and design of business processes, workflow systems, decision support systems, CRM. • Business integration based on B2B models (including electronic and m-payment systems, digital signature). • Web services enabled business models and ICT support architectures • Advanced supply chain management solutions.
		ICTs for the networked business.	<ul style="list-style-type: none"> • New networked applications and services capable of interoperation across a wide variety of business domains and organisations of all sizes. • Distributed and collaborative intelligent-based network oriented systems for efficient and secure service creation and delivery
Challenge 4: Digital Libraries and Content	ICTs for Learning & eLearning	Personalized education process over the Internet.	<ul style="list-style-type: none"> • Adaptive learning systems development, able to configure according to learners' behaviour. • Intelligent systems for learning process personalization (student modelling & learner model development).

FP7 ICT Challenge (2007-2008)	Western Balkan ICT R&D priority (2008-2013)	Proposed ICT R&D objectives (per priority)	Proposed relevant ICT R&D areas (per objective)
		Software systems for learning process management and support.	<ul style="list-style-type: none"> • Design and development of software tools for digitalization of content, digital libraries, content management and Multilanguage environments. • Integration of distributed sources of information and digital libraries into eLearning systems. • Synergies between learning and knowledge management systems for complex learning contexts and resources.
Challenge 5: Towards sustainable and personalised healthcare	ICTs for Health and eHealth	Integrated health data retrieving, processing and analysis.	<ul style="list-style-type: none"> • Innovative data mining and integration techniques of existing databases and electronic health record systems. • Common Electronic Patient Record - one virtual patient record based on unique patient electronic identification (eCard) updated and available on line. • Intelligent systems that combine multi-parametric data (e.g. vital body signs) with expert biomedical knowledge.
		Integration of electronic healthcare system	<ul style="list-style-type: none"> • Common infrastructure available for hospitals, family medicine practitioners, laboratories, pharmacies and all other health care facilities. • Integration of healthcare ISs by introduction of interoperability framework (on line data exchange between ISs of healthcare facilities, integration of diagnostic devices, integration with healthcare insurance funds).
		Surveillance of groups at risk and early diagnosis of critical health situations.	<ul style="list-style-type: none"> • Innovative systems and services aimed at health status monitoring for persons at risk or with chronic health conditions.

Table 2 - Mapping of Western Balkan ICT Research Priorities to ICT challenges (2007-2008)

Moreover, “ICTs for Government and eGovernment” is identified as an **additional priority** suitable for EU-Western Balkan collaboration programmes. This priority was not directly

addressed by the ICT work-programme for 2007-8 but was included in many previous ICT work-programmes and it was considered at that time in the context of future annual ICT workprogrammes. Indeed, ICT for Government was recently (re-)introduced in the WP 2009-2010 (as part of Challenge 7 “ICTs for Independent Living, Inclusion and Governance”).

Western Balkan ICT R&D priority (2008-2013)	Proposed ICT R&D objectives	Proposed relevant ICT R&D areas (per objective)
ICTs for Government & eGovernment	Development of electronic document and databases infrastructure for Government.	<ul style="list-style-type: none"> • Software for exchange of electronic documentation and data of citizens and companies with public institutions. • Middleware development for Government-to-Government applications (e.g. web based service providing from registers of citizens and legal entities to all e-government applications).
	Fast and secure access to information and services for citizens and the business sector.	<ul style="list-style-type: none"> • Models and mechanisms for authorization and authentication of access to administrative and other data. • Security concepts for ensuring trust and confidentiality of eGovernment applications and services.

Table 3 –Additional ICT R&D priority proposed for EU-Western Balkan co-operation

3. HOW THE WESTERN BALKAN COUNTRIES CAN SUPPORT R&D COLLABORATION WITH THE EU: SOME RECOMMENDATIONS

Research capabilities in the Western Balkan region have been severely affected by the rapid political change, internal conflict and the transformation from state run to market economies. Specific barriers and problems faced by ICT research in the region as well as concrete actions that need to be taken by the countries have been brought forward during four country-specific consultation workshops (held between June-July 2007) and four ICT workshops (held in October 2008) in the context of the SCORE project.

During the workshops, participants mentioned various obstacles and challenges that research institutions in the Western Balkan countries face continuously in their ICT research & development activities and while trying to increase their participation in Framework Programme projects.

3.1 Common barriers and recommendations

In this section, the key problems / barriers identified are grouped at a regional level and presented together with recommended actions that decision-makers in the countries can take to effectively address these.

Institutional / Political barriers & recommendations

Barrier/Problem	Recommended action(s)
Lack of defined government policy for ICT research at a national level⁴.	<ul style="list-style-type: none"> • Development of clear regulations and guidelines for ICT research, including national funding schemes, criteria for application etc. • Improve access to existing public policies and strategies.
Regional ICT R&D Collaboration is not institutionalised.	<ul style="list-style-type: none"> • Enhance collaboration among Ministries in the region with a view to develop a regional ICT R&D policy. • Development of <u>concrete initiatives</u> for intra-regional R&D collaboration⁵. (e.g. eSEE initiative can be used as model for regional collaboration).
Weak organisational support to R&D organisations and individual researchers in the	<ul style="list-style-type: none"> • Further capacity-building and training of civil servants within relevant Ministries dealing with ICT R&D⁶

⁴ It should be noted that the particularities of the BiH state structures create further barriers to co-ordinated ICT R&D policies and activities at a national level.

⁵ An example of concrete regional initiative is the joint call of SEE-ERA.NET on the mobility of young researchers in the region.

Barrier/Problem	Recommended action(s)
pursuit of national and FP-related R&D activities.	<ul style="list-style-type: none"> • Development and training of more National Contact Points for ICT per country.
Weak communication channels between policy makers and R&D actors.	<ul style="list-style-type: none"> • Formation of central co-ordinating body for ICT research & development within each country. • Establishment of permanent communication channels between policy makers and researchers e.g. consultation processes (during the definition of ICT strategies) • Enhancement of a cultural environment where mutual consultation between the policy and R&D spheres is a common habit
Government funding for R&D projects is intended only for organizations that are officially recognized as research organizations.⁷	<ul style="list-style-type: none"> • Allow any organisation to obtain government funding for R&D projects based only on scientific excellence criteria.
Difficulties with researchers' mobility exchange (i.e. visa, residence permits, work permits etc.)	<ul style="list-style-type: none"> • Complete liberalization of the visa process in the region and between the region and EU. Until this is achieved: facilitation of process by reducing the required documentation and waiting times. • Development of twinning programs in which local researchers visit EU organisations and then visit together the originating Western Balkan country. • Develop mobility grants for individual researchers <u>within the Western Balkan region</u>. (e.g. regional students' exchange initiative). • Improve information on and access to bilateral initiatives fostering researcher's mobility (when already existing).
Unclear intellectual property rights and insufficient implementation of existing IPR regulations.	<ul style="list-style-type: none"> • Alignment of IPR regulations with European standards. • Development of mechanisms and organisations monitoring the implementation of IPR regulations.
Political & economic instability in the countries/region hinders cooperation within the region and with the EU	<ul style="list-style-type: none"> • Continued initiatives by political leadership in the region for the implementation of measures for stability and economic growth in the region. • Speed up of region's integration process in the EU.

⁶ The lack of capacities within public institutions was a key issue highlighted by representatives of Ministries in the Western Balkan Region, during the regional Conference on 11-12 December 2008, in Belgrade.

⁷ In BiH, Serbia and FYROM, recognized R&D organisations are referred to as "Science & Research Organisations", from which thousands of private sector companies are excluded. Similarly, in Albania only organisations whose status mentions that they perform research and development can benefit from Government funds.

Financial barriers & recommendations

Barrier/Problem	Recommended action(s)
<p>Low level of national funds for ICT research (significantly lower than EU average).</p>	<ul style="list-style-type: none"> • Increase of the % of national budget dedicated to research in ICT • Development of a fund for supporting advanced R&D in the ICT field • Initiatives in collaboration with neighbouring countries for funding regional collaboration in ICT research • Better exploitation of existing funds (if applicable) • Clear identification of <u>incentives</u> for funding (answering the “<i>why to fund?</i>” question). Such incentives should be determined by the academic and private sector.
<p>Absence of defined national financial support policy & incentives for participating in FP projects (and preparatory events).</p>	<ul style="list-style-type: none"> • Determination of clear financial support incentives for the participation in FP projects. For example, national co-funding of, provision of funds for FP proposals that are ranked high (over the threshold) but not retained for funding by the EC⁸. • Give financial incentives such as travel grants for participation in preparatory meetings for proposal writing, brokerage events, international conferences etc.
<p>Lack of investments from the business sector in R&D.</p>	<ul style="list-style-type: none"> • Determination of tax incentives for companies to invest in R&D, in particular for SMEs (e.g. no/lower taxes for donations in R&D, de-taxation of profits reinvested in R&D, etc). • R&D activities by private companies should be valued as a competitive advantage during the tendering process (for national projects). • Scholarships from business sector for PHD research.
<p>Lack of financial incentives for collaboration between universities and businesses.</p>	<ul style="list-style-type: none"> • Develop financial incentives for public-private partnerships in RTD. • Follow-up existing collaborations and publication of success stories. • Fostering job-rotation between academic and business sector.

⁸ A good-practice in the funding of unsuccessful FP proposals that are above threshold has been adopted by the Government of Montenegro.

Barrier/Problem	Recommended action(s)
Different financial rules among research organisations (in particular public ones) and those stipulated by FP projects.	<ul style="list-style-type: none"> • Facilitate the financial rules for organisations (in particular the public ones) and align them as much as possible with European standards in order to facilitate participation in EU projects. • Increase the financial autonomy of public organisations by replacing the control towards these institutions with monitoring instruments and promotion approaches for researchers.

Education / academic sector related barriers & recommendations

Barrier/Problem	Recommended action(s)
Lack of willingness by academic leadership to engage in FP projects	<ul style="list-style-type: none"> • Determination of incentives and the added-value for the participation of academia in FP projects (e.g. with best practices that could be disseminated via NCPs). • Development of management structures within universities that co-ordinate the knowledge and capacities of universities on the one hand and map to relevant R&D opportunities on the other hand.
Low motivation for students who could be involved in FP projects (& lack of students).	<ul style="list-style-type: none"> • Provision of incentives to students in order to obtain qualification in R&D within the country and abroad e.g. study trips in EU countries • Financial support for full-time PHD students involved in ICT research.
Lack of specialized ICT professors	<ul style="list-style-type: none"> • Incentives for advanced specialization of ICT professors in European universities
Lack of ICT PHD studies and programmes⁹	<ul style="list-style-type: none"> • Availability of further public funds for PHD studies in ICT. • Introduction of grants for PHD studies partly or totally financed by the private sector.
Education system not in line with needs of ICT industry	<ul style="list-style-type: none"> • ICT businesses to be consulted (for their current and future needs) in the development of academic curricula • Develop state-of-art IT courses at all levels of education (starting from primary schools)

⁹ For example in Serbia, there are limited public funds for PHD studies, while each professor is allowed to tutor only up to 5 PHD students at the same time.

Human resource barriers & recommendations

Barrier/Problem	Recommended action(s)
Skilled ICT researchers leaving the country (brain drain).	<ul style="list-style-type: none"> • Financial and other incentives for researchers to remain in their country. • Incentives for ex-pat researchers to return to their country. • Financial support for research periods abroad under the condition of return to the homeland.
Weak networks/contacts among researchers and R&D organisations within the region and between the region and rest of Europe.	<ul style="list-style-type: none"> • Development of a regional database of R&D actors and organisations • Improved processes for partner search facilities within the region (e.g. through better collaboration of NCPs across Europe, Regional Collaboration Council etc.)
Lack of professionals able to provide assistance on FP proposal writing and project management	<ul style="list-style-type: none"> • Western Balkan researchers should be encouraged to act as evaluators of FP proposals due to the important know-how obtained for proposal writing through this experience. • Raising awareness on the importance of the research manager within SMEs and other organisations • Training on proposal development and project management (including financial management) in the FP project context.

ICT business sector related barriers & recommendations

Barrier/Problem	Recommended action(s)
ICT private companies are not recognized as R&D organizations by the state institutions (and as a result are not eligible for national funding).	<ul style="list-style-type: none"> • Recognition of private companies that pursue R&D activities as R&D organisations • Opening up of the tendering process for national R&D funds to private companies
Limited ICT research in the business community / private sector.	<ul style="list-style-type: none"> • Demonstrating the added value for participating in FP projects especially for SMEs (business decision on investment). This could be supported with case studies to be developed by the EU and disseminated through National Contact Points. • Fiscal and administrative incentives to ICT companies for pursuing research activities • Development of action plan to raise the awareness among the companies about the benefits of research within their companies. There should be focused on the results (impact) of such projects.

Barrier/Problem	Recommended action(s)
Insufficient collaboration between the ICT industry and universities.	<ul style="list-style-type: none"> • Development of industry-university co-operation mentality through specific national programmes and appropriate legal framework. • Cooperation between universities and companies can start with co-operation in teaching, to be followed with joint research. • Develop opportunities for student internships within private companies (e.g. through memoranda and agreements between universities and business associations).

Infrastructure barriers & recommendations

Barrier/Problem	Recommended action(s)
Insufficient ICT research infrastructure¹⁰.	<ul style="list-style-type: none"> • Investments in the set-up of cutting-edge R&D laboratories, business incubators, innovation centres, centres of excellence etc. • Further national & international investments in basic and advanced ICT infrastructure. • Incentives (such as co-investments, subsidies) to be offered to infrastructure providers for ICT investments in rural areas.

Cultural & other barriers

Barrier/Problem	Recommended action(s)
Insufficient demand for ICT Research & Development	<ul style="list-style-type: none"> • It is important to cultivate the demand for R&D. For example, business IT solutions create further demand for ICT business applications. • Promote demand-driven R&D
Lack of familiarity with FP and other funding programs.	<ul style="list-style-type: none"> • Organisation of dedicated training courses on the FP and other funding programs (in collaboration with National Contact Points and the EC). • Development of success stories and best practices demonstrating to the public what are <u>the benefits (added value)</u> of participating in FP projects. (this to be followed up in collaboration with EU policy-

¹⁰ Bosnia-Herzegovina has in particular infrastructure problems following the dissolution of the R&D structures after the war.

Barrier/Problem	Recommended action(s)
	makers).
ICT R&D projects, after being completed, disappear without producing a real impact.	<ul style="list-style-type: none"> • Actions should be taken by policy-makers to ensure the sustainability and impact of ICT R&D projects e.g. appropriate monitoring mechanisms, exploitation of research outputs.
Low appreciation of international cooperation in R&D (resulting in low levels of EU-regional and intra-regional R&D collaboration).	<ul style="list-style-type: none"> • Measures for the facilitation of contacts between research organisations in the country and others in the region and EU. • Presentation of benefits from international collaboration to ICT companies.
Low international reputation of the “scientific image” of countries.	<ul style="list-style-type: none"> • Promotion of the countries’ ICT research strengths and achievements abroad e.g. through supported participation in relevant EU or regional events. • Development of success stories. • Organisation of more regional ICT R&D conferences and other events.
Lack of information and statistics on R&D activities (e.g. transparency of funds, access to projects results).	<ul style="list-style-type: none"> • Enhanced standardization of methodologies used in Statistical Offices (e.g. further alignment with Eurostat methods) and matching the information needs of researchers and policymakers alike. • Improve the access to statistics and research results (e.g. list of country’s participants in previous national and FP projects)

3.2 Mapping of barriers to R&D priorities and key messages

In the following table, the impact of the above-mentioned barriers are mapped to the regional ICT R&D priorities proposed for EU-Western Balkan collaboration. The scoring has been performed by SCORE subject experts per country, based on the cumulative experience and knowledge on their countries' ICT R&D environment.

ICT R&D PRIORITIES BARRIERS / COUNTRIES	ICT for Government & eGovernment FYR				ICTs for Enterprises & eBusiness FYR				ICTs for Learning & eLearning FYR				ICTs for Health & eHealth FYR				Software Engineering FYR				Internet & Broadband Technologies FYR				TOTAL SCORE All countries			
	AL	OM	BH	SR	AL	OM	BH	SR	AL	OM	BH	SR	AL	OM	BH	SR	AL	OM	BH	SR	AL	OM	BH	SR				
Institutional/Political barriers																												
IP1	Lack of defined government policy for ICT research	7	7	7	7	4	4	4	7	4	7	7	7	7	4	4	4	7	4	4	1	7	7	4	4	4	129	
IP2	Non-institutionalised regional ICT R&D Collaboration	4	4	4	4	4	4	1	4	7	4	7	4	4	4	7	4	4	4	4	1	7	7	4	7	1	4	105
IP3	Weak organisational support to R&D organisations and researchers	7	7	4	4	4	4	1	4	7	4	7	4	4	4	4	4	4	4	4	7	7	1	4	7	1	1	105
IP4	Weak communication channels with policy makers	7	7	4	7	1	4	4	4	4	4	7	4	4	4	7	7	4	4	1	7	4	4	4	4	4	4	111
IP5	Government funding intended only for organizations recognized as research organizations	1	7	4	7	7	1	1	1	1	7	7	4	1	7	7	4	4	4	7	1	1	4	7	4	4	4	99
IP6	Difficulties with researchers' mobility exchange (e.g. visa regime)	1	4	4	4	4	4	1	4	7	4	7	4	4	4	1	4	4	4	7	4	4	1	1	4	4	4	90
IP7	Unclear intellectual property rights	4	4	4	1	4	7	1	4	4	7	7	1	4	4	4	4	4	4	7	7	4	4	1	4	1	4	96
IP8	Political instability in the countries/region	7	7	4	7	1	4	1	4	4	7	7	1	4	4	7	4	4	1	7	4	1	1	4	4	4	4	99
Financial barriers																												
F1	Low level of national funds for ICT research & development	7	7	4	7	4	7	1	4	7	7	7	7	7	4	7	7	7	7	7	7	7	7	7	4	1	7	141
F2	Absence of defined national financial support policy for participating in FP projects (and preparatory events).	4	7	4	4	4	1	1	4	4	4	4	4	4	7	7	4	4	4	7	1	4	4	7	4	4	4	102
F3	Lack of investments from the business sector in R&D.	1	1	4	4	7	7	4	4	1	4	7	1	4	1	4	4	4	4	7	7	7	1	4	4	4	4	96
F4	Lack of financial incentives for collaboration between universities and businesses.	1	4	4	4	7	4	1	4	1	7	7	4	4	4	7	4	4	4	7	7	4	1	4	4	4	4	102
F5	Different financial rules among research organisations and those stipulated by FP projects.	4	4	4	1	4	4	1	1	4	4	7	1	4	4	7	1	4	4	7	1	4	4	4	4	1	4	84
Education / Academic sector barriers																												
E1	Lack of high-level willingness by academic leadership to engage in FP projects	7	7	4	4	4	4	1	4	7	4	7	4	7	4	7	4	7	4	7	4	4	4	4	4	4	4	117
E2	Low motivation for students who could be involved in FP projects	4	4	4	1	4	4	1	1	4	7	7	1	4	4	7	1	4	7	7	1	4	4	4	1	4	4	90
E3	Lack of specialized ICT professors	4	4	4	4	4	7	1	4	4	4	7	1	4	7	7	4	4	7	7	4	4	4	4	4	4	4	108
E4	Lack of ICT PHD studies and programmes	4	7	4	7	4	7	1	4	4	4	7	1	4	4	7	7	4	7	7	4	4	4	4	7	4	4	117
E5	Education system not in line with needs of ICT industry	4	4	4	7	4	7	1	4	4	4	7	7	7	4	7	4	4	4	7	7	7	1	4	4	7	4	120
Human Resource barriers																												
HR1	Skilled ICT researchers leaving the country (brain drain).	7	1	1	7	4	4	1	7	7	4	1	4	7	4	1	7	7	7	7	4	4	4	4	7	4	4	111
HR2	Weak networks/contacts among researchers and R&D organisations within the region and with Europe.	7	4	4	7	7	4	7	7	7	4	7	7	7	4	7	7	7	7	7	7	7	7	4	7	4	4	147
HR3	Lack of professionals to support FP proposal writing and project management	7	7	7	4	7	7	7	4	7	7	7	4	7	4	7	7	7	7	7	4	7	4	7	4	4	4	147
ICT business sector related barriers																												
B1	ICT private companies (not recognized officially as R&D organizations) are not eligible for national funding.	1	4	1	7	7	4	1	4	4	4	7	4	4	1	7	7	1	4	7	4	1	4	4	4	4	4	96
B2	Limited ICT research in the business community / private sector.	1	4	1	4	7	4	1	4	1	4	7	4	1	4	7	4	1	7	7	4	1	1	4	4	4	4	87
B3	Insufficient collaboration between the ICT industry and universities.	4	4	7	4	4	7	1	7	4	4	7	4	4	4	7	4	4	4	7	7	4	4	4	4	7	4	120
Infrastructure barriers																												
INF1	Insufficient ICT research infrastructure	1	1	1	1	1	4	1	1	1	4	7	1	4	4	1	4	1	4	7	1	4	4	4	4	4	4	66
Cultural & other barriers																												
C1	Insufficient demand for ICT Research & Development	7	4	4	4	7	7	4	4	4	4	4	1	7	4	4	4	7	7	4	1	7	4	4	4	4	4	111
C2	Lack of familiarity with FP and other funding programs.	4	4	1	4	4	4	1	4	4	4	7	4	4	4	1	4	4	7	7	4	4	4	4	4	4	4	96
C3	ICT R&D projects, after being completed, disappear without producing a real impact.	4	7	4	4	4	4	1	4	4	4	7	4	4	4	4	4	4	1	7	4	4	1	4	4	4	4	96
C4	Low appreciation of international cooperation in R&D	4	4	4	4	4	4	1	4	4	7	7	1	4	4	4	4	4	4	7	1	4	4	4	4	4	4	96
C5	Low international reputation of the "scientific image" of countries.	7	7	7	1	7	1	1	4	7	4	7	1	7	4	7	4	7	7	7	1	7	4	4	4	4	4	117
C6	Lack of information and statistics on R&D activities	7	1	1	1	7	1	1	1	7	1	1	4	7	1	1	4	7	1	1	1	7	4	1	4	4	4	72

Table 4 – Mapping of barriers to regional ICT R&D priorities

(Legend: 7 indicates High impact, 4 indicates Medium impact, 1 indicates Low impact of a barrier for each R&D priority;
AL: Albania ; FYROM: Former Yugoslav Republic of Macedonia ; BH: Bosnia-Herzegovina; SR: Serbia)

The scoring in the table reveals that the barriers with the highest impact on the regional ICT R&D priorities are in the areas of human resources, closely followed by barriers related to

education, that are closely linked. Attention should be given primarily to address the **weak networks/contacts** among researchers and R&D organizations between the region and Europe and the **lack of professionals to support FP proposal writing and project management** (HR3), both receiving an average score of 147 (out of 168 if all priorities would have scored 7).

Key recommendations to address the first barrier are the development of improved processes for partner search facilities within the region as well as the development of a regional database of R&D actors and organizations. With respect to the second barrier, recommendations suggested are apart from training on proposal development and project management, the creation of awareness on the importance of developing R&D managers within organizations and the encouragement of Western Balkan researchers to act as evaluators of FP proposals due to the important know-how obtained for proposal writing through this experience.

Another important issue that still remains unresolved in the region is the brain-drain phenomenon (i.e. “**skilled ICT researchers leaving the country**” - HR1 scored 111-). Indeed one of the main conclusions of the final regional conference held in the context of the SCORE project (on 10-11 December in Belgrade “Towards an Information Society in the Western Balkans”), was the consensus among participants that the lack of human resources and weak capacities at an institutional, organisational and individual level are the key issues for the region.

The third most important barrier to be addressed is the **low level of national funds** for ICT research & development (F1, scored 141), which is related to **the lack of defined government policy for ICT R&D** (IP1) that also has a medium-to-high impact (scored 129) in all countries. Policy-makers in the Western Balkan countries should be encouraged to define specific policies for research & development in ICT accompanied by the dedication of more funds. In this process, the need for open consultation processes in the definition of R&D policies is also derived by the barrier “**weak communication channels with policy-makers**” (IP4, scored 111).

Moreover, in order to make more national funds available to R&D, the **insufficient demand for ICT R&D** (C1, scored 111) needs to be addressed by demonstrating to policy-makers, R&D actors and society as whole the added-value and impact of R&D in addressing actual societal needs. Indeed one of the key issues highlighted at the final conference of SCORE (on 11-12 December in Belgrade) was the need for demand-driven R&D as opposed to supply-driven or R&D addressing different needs than the actual ones in the Western Balkan countries.

The following barriers related to the educational system as well as its link with the private sector should receive the next attention: “**insufficient collaboration between the ICT industry and universities**” (scored 120) closely linked with the “**education system not being in line with the needs of the ICT industry**” (also scored 120). Furthermore, the barriers “**lack of ICT PHD studies and programmes**” and the “**lack of high-level willingness of the academic leadership to engage in FP projects**” have a medium-to-high impact on all priorities (both scored 117) and need to be addressed by the countries’ decision-makers. Key recommendations in this respect include the development of industry-university co-operation mentality through specific national programmes and appropriate legal framework, the consultation of ICT businesses in the development of academic curricula, the development of state-of-art IT courses in all levels of education and the dedication of further public funds in particular for PHD studies in ICT and the demonstration of the added-value (and determination of incentives) for the participation of academic institutions in FP projects.

Finally, a barrier emerging as having a medium-to-high impact on all priorities that should receive the appropriate attention by decision-makers and individual R&D actors is the **low**

international reputation of the “scientific image” of the Western Balkan countries (C5, scored 117). In this respect, key recommendations are the promotion of the countries’ ICT R&D strengths and achievements across Europe (for example through supported participation in relevant EU or regional events), the organisation of more regional ICT R&D conferences and other events and at a grass-root level the development of sustainable contacts and co-operation between regional and European R&D actors (e.g. through participation in joint projects etc.)

4. HOW THE EU CAN ENHANCE R&D COLLABORATION WITH THE WESTERN BALKAN COUNTRIES: SOME RECOMMENDATIONS

From the open discussions during the consultation workshops and ICT workshops held in the context of the SCORE project a number of recommendations for EU decision-makers were also put forward in view of facilitating future EU-Western Balkan scientific collaboration.

Indeed many of these recommendations were already the conclusion from previous workshops and consultations in the Western Balkan Region, mainly during the IS2WEB Project, which proves their importance and consistency.

The main recommendations are summarised below:

Recommendation	Justification
Targeted regional calls should be retained for key/common Western Balkan ICT R&D priorities.	In previous FP6 calls, targeted objectives for the region enabled Western Balkan organisations to participate more successfully. ICT experts in all countries suggest that the same approach should be retained in future FP calls. Some quotations by experts involved in the consultation process are revealing: <i>“They are the only reason why an EU partner would look for a Western Balkan partner”</i> ; <i>“Region is not competitive enough to participate in open calls”</i> . At the same time, regional R&D actors acknowledge ¹¹ that counterpart measures also need to be taken by further developing the human resource capacities of the Western Balkan countries both at an organisational and individual level.
Targeted calls should focus on demand/application-oriented priorities.	The results of the consultations reveal the need for research and development in specific ICT application areas and in particular in eGovernment, eBusiness, eLearning and eHealth.
Inclusion of R&D priorities in the next work-programmes that reflect the <u>actual needs</u> and R&D capacities of the Western Balkan countries.	R&D priorities and objectives well-reflecting the needs and capacities of the region can help in better mobilizing the participation of actors from the Western Balkan Countries. As one expert noted: <i>“EU Funding for ICTs should be targeted – have clear objectives and impact for the countries in the region”</i> .

¹¹ As expressed during the open panels and discussions held in the final SCORE Conference on 11-12 December 2008 in Belgrade.

Recommendation	Justification
Apart from targeted calls on regional priorities, there should be support actions for other (EU) priorities that are underdeveloped in the region.	Overall, the EU should encourage the participation of more Western Balkan partners in horizontal non-targeted objectives so that they can obtain know-how on state-of-art research carried out at a pan-European level.
Support actions on FP7 procedures and proposal development are still considered important for the region, in order to assist research actors in the region to fully exploit FP7 opportunities.	Although a number of support actions have been completed in the region, there is still a need for support to organizations with regards to understanding the FP programme and procedures.
Future RTD projects should strongly encourage cooperation between academia and business in applied research.	Although this is a fundamental principle of FP, it could be further encouraged by determining for example a minimum number of organizations representing academia and the private business sector.
Need for stricter evaluation and review procedures with regards to the sustainability and impact of ICT R&D projects (<u>both</u> at the proposal and project implementation phases).	ICT projects upon completion usually end in a vacuum. They have limited follow-up activity and results are seldom actually used either in further research or real-life application.
Develop a process that enables Western Balkan researchers to participate in existing FP projects (e.g. in Networks of Excellence) either as individuals or organizations (e.g. extension of consortia) ¹² .	Such visiting programs and extensions of consortia will enable Western Balkan researchers to further build their capacities and bring back important know-how while returning to their home countries.
Create awareness on the benefits of participating in FP projects. E.g. best practices could be developed out of successful projects demonstrating the added value of participating in FP projects.	This was specifically recommended during the regional Conference held in Belgrade on 11-12 December 2008. In particular in the case of small ICTs, it should be clear what the tangible benefits are before making the “decision on co-investment” in FP projects.

¹² This recommendation was put forward by participants during the Regional Conference held in Belgrade on 11-12 December 2008.

5. FUTURE OUTLOOK

One of the key problems identified during the SCORE consultations was that FP projects are **treated as one-off projects** with limited actual potential and follow-up activities. Indeed, there have been many R&D initiatives from the EU aiming at starting the digital economy in the region, however, so far, when the various Framework Programme projects end, “nothing happens”.

In particular, EU projects in the Western Balkan region, after completion, **“disappear”** and do not have real impact. The results and services/tools of R&D projects are not implemented by organizations and national governmental actors, despite having obtained the knowledge.

To address this problem, recommendations are made to both the Western Balkan Countries and the EU:

- **The Countries to try to systematically benefit and exploit the projects’ achievements, not only in the technical aspect (know-how, research expertise etc.) but also in the aspect of developing contacts, both scientific and commercial.**
- **The EU to stress the element of sustainability as a very important criterion when evaluating proposals and during the review process of contracted projects.**

Finally it is **not** the intention of SCORE to become one more project whose results are “stored in the shelf”. In order to achieve its stated objectives further actions are required on the part of decision-makers in the Western Balkan countries (as initiators) as well as in the EU to build the next steps for EU-Western Balkan scientific cooperation.

The implementation of the recommendations goes certainly **beyond the power or the influence of SCORE partners.**

Under this consideration SCORE initiated the collaboration with other existent and upcoming projects, in order to foster the sustainability and the further exploitation of its achievements.

The project namely co-organised with the WBC-INCO.Net project the Regional Conference on 11-12th December 2008 in Belgrade and presented its results to representatives of Ministries and researchers from the Western Balkans and broader region. In this way SCORE has ideally “delivered its results” to WBC-INCO.Net, which started in 2008, with the expectations that WBC-INCO.Net Consortium being a political forum could have the means to further deepen and implement the SCORE recommendations.

Similarly, SCORE networked with two upcoming FP7 ICT initiatives: WINS-ICT “*Western Balkan Countries Inco-Net Support in the field of ICT*” and ICT WEB-PROMS “*Promoting ICT cooperation opportunities and policy dialogue with the WB countries*”¹³.

WINS-ICT being coordinated by ZSI will multiply the efforts of WBC-INCO.NET, but with clear focus on ICT only, in order to foster the integration of the SCORE recommendations and outputs by the policy makers. WINS-ICT is expected to establish a regular “Dialogue Forum on ICT Research for the WB countries” with the participation of key decision makers (whose findings will feed the Steering Platform on Research for the WB) and it is likely that the SCORE Policy Paper will constitute the input for discussion at the first dialogue forum meeting (approx. May 2009). Other actions decided during the WINS-ICT kick off meeting (and that further ensure the sustainability of the SCORE outputs) concern the creation of

¹³ Both projects were funded under the 3rd call FP7-ICT and officially started on 01.01.2009

summaries from the SCORE main deliverables to be disseminated to the members of the ICTC Committee, and the continuous updating of the analysis of ICT R&D priorities identified by SCORE.

ICT WEB PROMS will also contribute to the sustainability of the SCORE achievements. This project is expected to base its activities on the identified ICT areas of mutual interest defined by the SCORE project, and, as confirmed during the kick off meeting, in the next two years several “Vertical workshops” will be organised to transfer know how in those specific ICT fields.

Finally, SCORE has achieved the creation of a sustainable network of “subject matter experts” (within and beyond the SCORE consortium) across the region. Contacts with high level policy makers were successfully built in each country, and this will additionally facilitate the communication and integration of the recommendations and outputs of the SCORE project.

ANNEX I - OVERVIEW OF THE CONSULTATION PROCESS

A common consultation process was implemented across the four involved countries in the SCORE project.

The consultation process involved three phases that can be summarised as follows:

- **1st phase – “Expert consultation”**: A panel of approx. 15 expert stakeholders (identified based on a set of criteria) was formed per country and consulted by means of a consultation document which includes also a set of questions. After the contributions were collected, a Consultation Workshop was held in order to consolidate the findings (workshops were held between June and July 2007). The initial contributions and outcomes of the workshop formed the basis for a first version of the ICT Strategic Research Agendas (one per country), that were available at the end of October 2007.
- **2nd phase – “Open consultation”**: the initial version of the ICT Strategic Research Agenda was consulted openly with the broader stakeholder communities (direct and indirect stakeholders) via targeted mailing lists and publication at the SCORE project’s website (the open consultations commenced on the 7th November and ended on the 14th December). Comments were collected and analysed in order to develop the final ICT Strategic Research Agendas (one per country). The final ICT SRAs constitute the basis for the development of the Policy Paper.
- **3rd phase – “ICT workshops”**: the overall findings in the SRAs and the Policy Paper were reviewed and enhanced during four ICT workshops organised in October 2008. The workshops engaged a total of 139 participants across the region (approx. 35 per country). In the workshops, ICT experts and governmental representatives participated to discuss the key challenges and respective recommendations for enhancing scientific cooperation between the respective country and the EU.

During the expert consultation phase, a total of **68 ICT experts** were consulted via a consultation document and participation in a consultation workshop as follows:

- 17 experts in Albania
- 13 experts in Bosnia-Herzegovina
- 18 experts in FYR of Macedonia
- 20 experts in Serbia

The consultation workshops were held as follows:

- Albania: 14+15 June 2007
- Serbia: 21+22 June 2007
- Bosnia: 28+29 June 2007
- FYR of Macedonia: 5+ 6 July 2007

The following table presents some key statistics from the open consultation phase per country. A total of **181 direct and indirect ICT stakeholders** in the region provided their opinion on the initial Strategic Research Agendas.

	Target base (# of direct & indirect stakeholders to which email invitations were sent)	Comment Forms Received (via email & online) from Target Base (A)	Response rate (as % of target base)	Comment Forms Received (via email & online) from non-targeted audience (B)	Total Comment Forms Received (A&B)	Responses from target group as % of total responses
Albania	190	30	16 %	21	51	59%
Bosnia-Herzegovina	164	16	10 %	10	26	61%
FYR of Macedonia	225	35	16 %	7	42	83%
Serbia	159	53	33 %	9	62	85%
TOTAL	738	134	18 %	47	181	74%

Table 5 – Statistics on open consultations

The profile of respondents' organisation is as follows:

- higher education/university – 39 %
- commercial organization – 30 %
- governmental body - 9 %
- non-governmental organization – 6 %
- other – 17 %

The majority (**66%**) of respondents participated on a personal basis, while **34%** responded on behalf of their organisation. This is an indication that most organisations may not have a well defined strategy in their research planning, or that this strategy, if existing, is not properly communicated.

- The majority (**68%**) of respondents indicated that **90%** of the initially identified priorities in the Strategic Research Agendas fully reflect the needs and capacities of their respective country, while the remaining 32% either indicated “don't know / no answer” for certain priorities or did not agree with on average 2 out of approximately 10 priorities in the SRA per country.
- Moreover, **66%** of respondents believed that no priority needed to be added in the country-specific SRAs, while **34%** identified at least 1 priority to be added. However, given that the proposed priorities for addition were not sufficiently justified in terms of proposed research objectives and areas, the list of priorities in the country-specific SRAs has remained overall the same (while minor changes do not affect the common priorities identified at a regional level).
- For the defined research priorities in the SRAs **83%** did not wish to add or modify research objectives or research areas within these, while 14% indicated objectives or research areas for addition or modification. Some of these additional objectives were included where appropriate in the final SRAs.

Finally, during the 3rd phase of the consultation, four “**ICT workshops**” were organised in October 2008 as follows:

- Albania: 2-3 October 2008
- Bosnia-Herzegovina: 9-10 October 2008
- Serbia: 16 October 2008

- FYR of Macedonia: 21 October 2008

In total the workshop engaged 139 participants across the region. The specific breakdown per country according to participants' profile is provided below:

	Albania	Bosnia & Herzegovina	Serbia	FYR of Macedonia	Total
Total Number of Participants, out of which:	36	32	42	29	139
National authorities, policy representatives	5	7	11	6	29
SMEs	10	11	12	5	38
Research Organisations	14	7	11	4	36
NCPs/NIPs or other EU-related guests	3	1	2	3	9
Other-NGO	4	6	6	11	27

Table 6 - Summary of SCORE ICT workshop participation

ANNEX II – POSITIONING OF CROATIA & MONTENEGRO ON REGIONAL PRIORITIES

The following table with respect to Croatia and Montenegro (countries not represented in the SCORE project) was completed following the involvement of ICT R&D experts in these countries in October 2008 in the scope of the WBC-INCO.Net (Co-ordination of Research Policies with the Western Balkan Countries) project. Specifically, an expert consultation phase was conducted in these countries, that were co-ordinated by the Ivo Pilar Institute of Social Sciences (based in Croatia) and the Ministry of Education and Science of Montenegro, that are partners of WBC-INCO.Net.

ICT R&D	ALBANIA		BiH		FYROM		SERBIA		CROATIA		MONTENEGRO	
	High A + High R	High A + Low R	High A + High R	High A + Low R	High A + High R	High A + Low R	High A + High R	High A + Low R	High A + High R	High A + Low R	High A + High R	High A + Low R
ICTs for Government & eGovernment	✓		✓		✓		✓		✓		✓	
ICTs for Enterprises & eBusiness	✓		✓		✓		✓		✓		✓	
Internet & Broadband Technologies	✓			✓	✓		✓			✓	✓	
Software Engineering		✓		✓	✓		✓		✓			✓
ICTs for Learning & eLearning	✓		✓		✓			✓	✓			✓
ICTs for Health & eHealth		✓	✓			✓		✓		✓		✓
Mobile Technologies					✓		✓				✓	
ICTs for Agriculture						✓		✓				✓
Digital Content & Digital Libraries		✓				✓				✓		✓
Distributed Systems	✓											✓
Embedded & Pervasive Systems								✓				✓
Network Technologies		✓									✓	
Knowledge Technologies						✓						✓

Figure 1 – Regional ICT R&D priorities, including Montenegro & Croatia
(Legend: “A” stands for attractiveness, “R” stands for readiness)

ANNEX III – CLASSIFICATION OF ICT R&D FIELDS

The methodology adopted for the consultation process and the identification of the Research & Development priorities was based on an extended version of the taxonomy developed by the CISTRANA project (www.cistrana.org). The reason for this decision, which was taken after an extensive debate, was that the stakeholders in the region could better understand and correlate their expertise with this taxonomy and would have the possibility to identify additional priorities on top of those already included in the FP7 ICT work-programme (2007-2008) as an input for future ICT work-programmes.

Id.	ICT R&D Fields	Id.	ICT R&D Fields
	<i>ICT Software & Information Processing</i>		<i>ICT Hardware Components</i>
1	Artificial intelligence	33	Digital systems, digital representation
2	Bioinformatics	34	Display systems and technologies
3	Cognitive systems	35	Embedded & pervasive systems
4	Computational modeling	36	High frequency technology
5	Database management	37	Micro/nano systems
6	Distributed systems	38	Nanoelectronics
7	Entertainment computing	39	Nanotechnologies
8	Grid technologies	40	Organic electronics
9	Identity management	41	Optical networks and systems
10	Image processing & pattern recognition	42	Peripheral technologies
11	Knowledge Technologies	43	Photonic components and subsystems
12	Middleware	44	Printed and Integrated circuits
13	Privacy	45	Quantum Informatics
14	Security technologies	46	Robotics
15	Semantic technologies	47	Smart cards and access systems
16	Sensor systems and networks		<i>Telecommunications</i>
17	Service engineering	48	Broadband technologies
18	Simulation technologies	49	Internet & broadband technologies
19	Software engineering	50	Network security
20	Speech & Language processing technologies	51	Network technology
21	Signal processing systems	52	Satellite technologies
22	Virtualisation tools	53	Mobile technologies
	<i>ICT software applications</i>		<i>Multimedia</i>
23	Electronic commerce	54	Digital content & digital libraries
24	GIS – Geographic Information Systems	55	Digital video broadcasting
25	ICTs for Agriculture	56	ICTs for Cultural Heritage
26	ICTs for Energy	57	ICTs for Learning & eLearning
27	ICTs for Enterprises & eBusiness	58	Multimedia infrastructures

Id.	ICT R&D Fields
28	ICTs for Environment
29	ICTs for Government & eGovernment
30	ICTs for Health & eHealth
31	ICTs for Independent living & eInclusion
32	ICTs for Transport & eTransport

Id.	ICT R&D Fields
59	Virtual reality
60	Visualisation tools
-	Other