



SERBIA

Deliverable 9  
Simplified Report

SERBIA – ICT RTD TECHNOLOGICAL AUDIT

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## ***Introduction***

### **0.1.1 Subject and objectives**

This report is produced as the public version of the report "ICT RTD technological audit" in the form accessible to a broad public and decision making constituency. The main goal of the study was to explore the existing ICT RTD potential in Serbia, considering its capability to become the part of the European Research Area (ERA).

This study gives the review and presentation of the current ICT RTD policy environment and main opportunities and barriers as well as the review and presentation of the current ICT RTD main stakeholder activities and their potential for the future achievements. Also, FP6-IST Priority and FP7-ICT Themes were outlined with particular attention given to: participation trends; listing of all participation entities as well as presentation of success and failure rates in Serbian submitted proposals completed with reasons. In addition, present and planned ICT-RTD infrastructure was analyzed and the corresponding actions that have to be taken were presented.

Further research focused on detection centers of excellence in both private and public sectors, in order to identify key players with potential per FP7-ICT Theme Challenge and Objectives. Finally, the study provides conclusions followed by recommendations of the actions needed to be taken at the national and European level in order to increase the participation of both private and public sectors carrying out ICT RTD in Serbia.

As the live interviews cannot cover the whole ICT community in Serbia, the survey was extended to cover the maximum number of stakeholders using the Delphi survey process. In this respect, a 2 round on-line Delphi survey was carried out.

To accomplish the SWOT analysis of the objective defined as "Successful participation and integration of Serbian ICT RTD in the FP7 – ICT Theme", the assessment considered various perspectives in identification and analysis of opportunities and barriers.

### **Why Research and Technology Development (RTD) in ICT?**

Unbreakable chain of political stability, investments and economy growth directly influences the level of ICT investment in one society. Today, the above- mentioned Serbian three link chain is linked to the process of joining the EU, with expectations that this process will bring more peaceful politics, direct foreign investments and economic recovery. One of the significant ways for Serbia's full integration with the EU could be achieved through its integration in the European Research Area and FP7 ICT-Theme participation.

Serbia, as part of Yugoslavia, was the centre of knowledge, science and technology. After the breakup of Yugoslavia, Serbia has lost its capacities, but still has the biggest potential in the West

Balkan region. Unfortunately, the potentials are far from being fully used for many reasons. A few significant ones are:

- ⇒ Definition of policies and research strategies in ICT area is still at the beginning;
- ⇒ The business sector in Serbia is not making efficient use of research results, in spite of the fact that Serbia is relatively advanced in RTD;
- ⇒ Serbian ICT sector is very fragmented and there is no strategy and policy for making ICT clusters;
- ⇒ No ICT analysis has been carried out, although there were some efforts in the past. It is high time for Serbia to have a clear picture of the present situation in the ICT segment.

### **Why ICT?**

- ⇒ Building ICT infrastructure is one of the most important conditions for any country's societal and economy development;
- ⇒ ICT industry is cheaper but more profitable than the other ones;
- ⇒ ICT industry development prevents the "brain drain".

## 0.2 Steering Management Dash Board



SERBIA

### 0.2.1 General statistics<sup>1</sup>

**Population:** 7.36 million

**Capital:** Belgrade

**Territory area:** 88,361 km<sup>2</sup>

**Border countries:** Hungary, Romania, Bulgaria, Macedonia, Albania, Montenegro, Bosnia and Herzegovina, Croatia

**Religions:** Serbian Orthodoxy 85.0%, Catholic 5.5%, Protestant 1.1%, Muslim 3.2%, unspecified 2.6%, other, unknown, or atheist 2.6% (2002 census)



**GDP (absolute):** 29.5 billion EUR (per capita: 3,994 EUR)

#### **GDP - composition by sector:**

18,3% Manufacturing

16,4% Real estate, renting and other business activities

12,8% Wholesale and retail trade; repairs

11,2% Agriculture, hunting, forestry and water works supply

8,1% Transport, storage and communications (33,1% Others)

**Percent of GDP spent on R&D:** less than 0.4% (estimated 0.3%)

**Percent of GDP spent on Education:** 2.4%

**Percent of GDP spent on Healthcare:** 3.5%

<sup>1</sup> Starting from 1999 the Statistical Office of the Republic of Serbia has not at disposal and may not provide available certain data relative to AP Kosovo and Metohia and therefore these data are not included in the coverage for the Republic of Serbia (total).

## 0.2.2 Participation in FP6-IST and FP7-ICT Theme

Table 1 Success and failure rates of proposals in FP6-IST and FP7-ICT Theme.

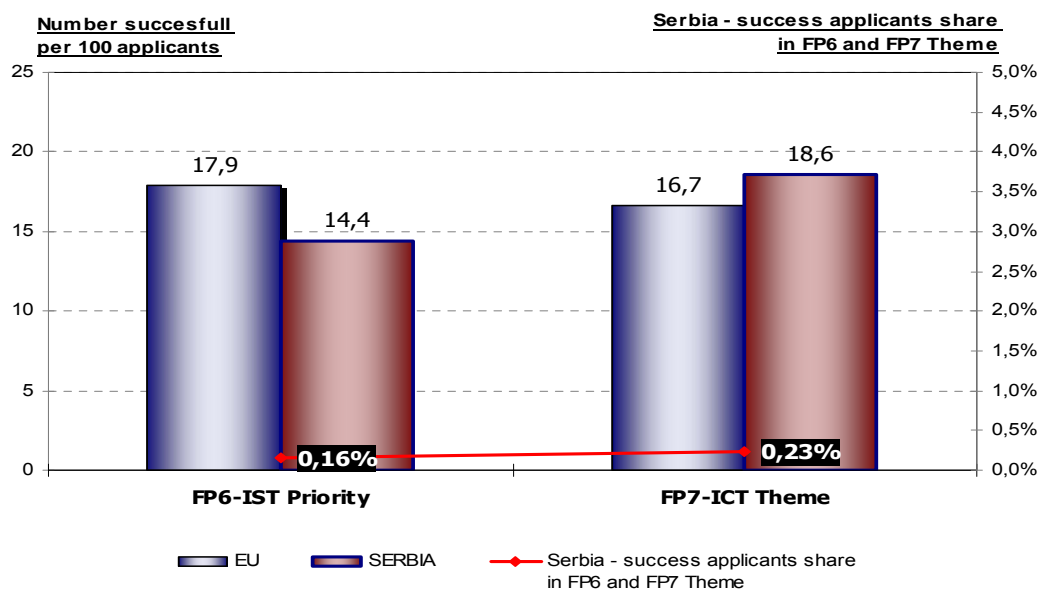
	EU Proposals		Serbian Proposals		Ratio (%) of successful proposals		SERBIA - Proposals share	
	Total	Successful	Total	Successful	EU	SERBIA	Successful	Failure
FP6-IST Priority	8383	1123	125	16	13,4	<b>12,8</b>	<b>1,4%</b>	1,5%
FP7-ICTTheme	5586	840	77	12	15,0	<b>15,6</b>	<b>1,4%</b>	1,4%

Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)

In FP6-IST Priority EU countries achieved success rate of 13,4% (8383 submitted proposals and 1123 approved) and Serbia 12,8% (125 submitted proposals and 16 approved) showing slightly lower passing (success) rate of Serbian proposals than EU average. Serbian entities submitted their proposals to six of seven thematic categories showing the big dispersion of the proposals, while the accepted proposals were in only three thematic categories.

- ⇒ In the FP7-ICT Theme, the EU countries achieved success rate of 15,0% (with 5586 submitted proposals and 840 approved),
- ⇒ Serbia accomplished higher passing rate of 15,6% (with 77 submitted and 12 approved proposals). In addition, this represents the growth of 2,8 percentage points compared to the Serbian success in FP6-IST Priority.

Figure 1 Success rates of applicants in the FP6-IST and FP7-ICT for EU and Serbia



Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)

- ⇒ With 18 successful applicants in FP7-ICT Theme Serbia achieved 18,6 successful applicants per 100 (Serbian) applicants compared to 16,7 of EU countries. Serbian rate of successful applicants (18,6%) is among the highest in the Europe.

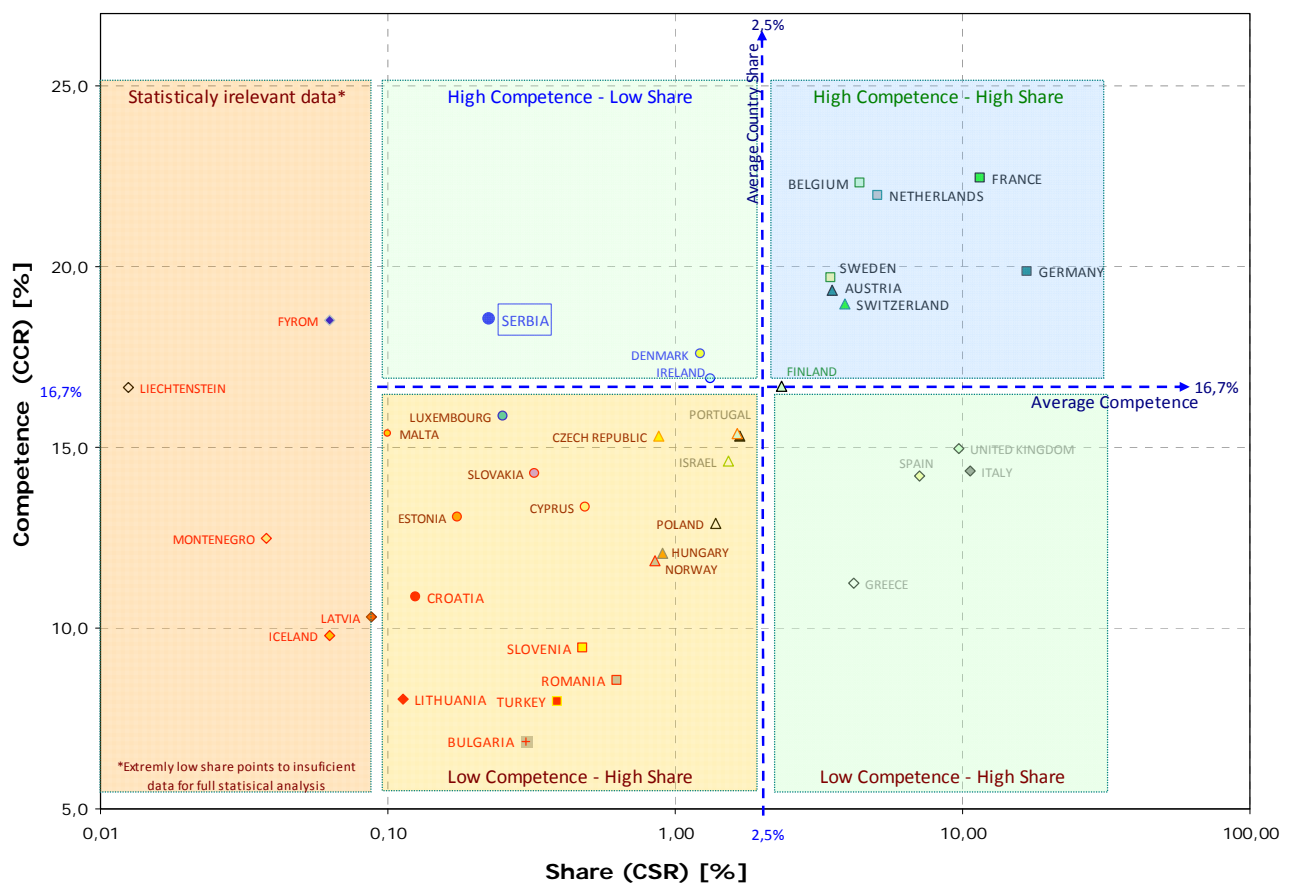


- ⇒ The share of Serbian participations in total EU successful participations (applications) raised to 0,23% from 0,16% in FP6-IST Priority.
- ⇒ Despite detected growth Serbia is still among the countries with the lowest number of participants.

### Comparison of Serbia applicants to EU27 and AC

Figure 5 presents the Competence/Share Matrix of EU27 and AC applicants in FP7-ICT Theme. In this figure Serbia is positioned in the “high competence - low share” quadrant, with the highest competence in this quadrant. There is a visible contradiction between impressive successes of Serbian applicants (**among the 38 most influential countries, Serbia is on the 8<sup>th</sup> place**) and a small share in number of projects (**among the 38 most influential countries, Serbia is 28<sup>th</sup>**). This indicates either lack of critical mass of researchers or their modest interest in FP7-ICT participation.

Figure 2 EU27 and AC applicants in FP7-ICT Theme – Individual Countries Positions



Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)

Explanation: The Country Share Ratio (CSR) and individually Country Competence Ratio (CCR) for each of 40 countries (EU27 and AC) are presented.

⇒ CSR [%] = number of Country's successful applicants / number of all successful applicants in FP7-ICT; CCR [%] = number of Country's successful applicants / total number of Country's applicants.

The average value of Share (2,5%) is emphasized. This line represents the borderline between the big and small share. Similarly, for the Competence, the average competence of all countries, 16,7% separates the more from the less successful countries.

### **Centres of Excellence (CoE)**

For the requirements of this analysis the quantitative and qualitative criteria were defined and then applied to obtain the consolidated list of CoE and consolidated list of potential CoE. The first quantitative criterion is based on data analysis from Annex I Who is Who in ICT Research, *Section Research areas of main expertise according to FP7-ICT Challenge and Objectives*. For each research unit the data on its expertise according to FP7-ICT objectives is considered (from Annex I – Who is Who). For each research unit the sum of declared expertise is presented as a number in a column "Total". Explanation: CSM presents two parameters compound for each research unit: Centre Competence Ratio (column CCR in Table 2) and Centre Share Ratio (column CSR).

⇒ CCR [%] is ratio of number of expertise for particular research unit and a number of Challenges from which these expertise are coming, combined with ratio of number of researchers of that particular research unit and total number of researchers (of all consolidated research units).

⇒ CSR [%] is ratio of number of expertise for particular research unit and the total number expertise (of all consolidated research units).

As the second quantitative criterion the number of researchers (Ph.D, M.Sc. and B.Sc) and the number of employees in development sector were used, column "NoR".

**Identified CoE** are organizations and research units with necessary critical mass of knowledge, resources and infrastructure, thus capable for achieving research results. For identifying the CoE the threshold of at least 3 FP7-ICT expertises and minimum of 9 researchers (Ph.D, M.Sc. and B.Sc) was set. Selection of 17 entities is presented. Among them three research units, all of them institutes, have significantly bigger number of researchers than average and three research units have significantly bigger number of expertise than average. Only two organizations from consolidated list of CoEs came outside High Education Sector and Institutes: one from industry sector and one from SME.

Table 2 Consolidated list of identified centres of excellence

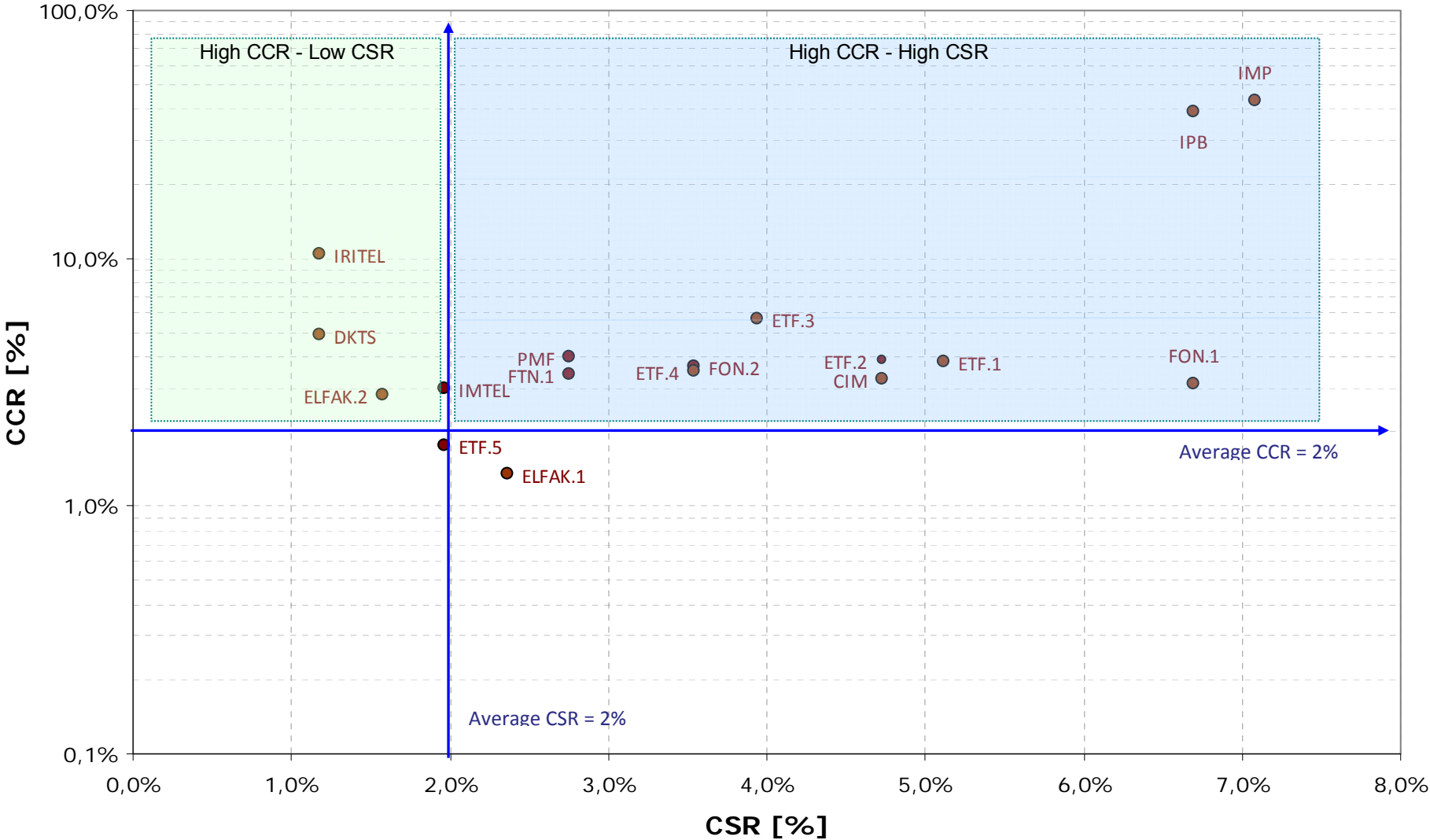
Short name	Research unit	NoE	NoR	Expertise by FP7-ICT Challenge and Objective								Total	CC1	CSR [%]	CCR [%]
				1	2	3	4	5	6	7	FET				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
IMP	INSTITUTE MIHAILO PUPIN	437	205	[1.2] [1.3]	[2.1] [2.2]	[3.4] [3.5] [3.6]	[4.2] [4.3]	-	[6.1] [6.2] [6.3] [6.4] [6.5]	[7.2] [7.3]	2	<b>18</b>	2,6	7,1	43,0
IPB	INSTITUTE OF PHYSICS BELGRADE	180	140	[1.1] [1.2] [1.6]	-	[3.1] [3.2] [3.5] [3.6] [3.7]	[4.1] [4.2]	-	[6.3] [6.4]	-	5	<b>17</b>	3,4	6,7	38,8
FON.1	FACULTY OF ORGANIZATIONAL SCIENCES (FOS), UoB, Chair for e-Business and System Management	9	9	[1.1] [1.2] [1.3] [1.4] [1.5] [1.6]	-	-	[4.1] [4.2] [4.3]	-	[6.1] [6.2] [6.3] [6.4] [6.5]	[7.1] [7.2] [7.3]	-	<b>17</b>	4,3	6,7	3,1
ETF.1	SCHOOL OF ELECTRICAL ENGINEERING, UoB, Department of Electronics	21	18	[1.1]	-	[3.2] [3.3] [3.5] [3.6] [3.9]	-	[5.2]	[6.1] [6.2] [6.3] [6.5]	-	2	<b>13</b>	2,6	5,1	3,8
ETF.2	SCHOOL OF ELECTRICAL ENGINEERING, UoB. Chair of Automatic Control	24	24	-	[2.1]	[3.4]	-	[5.1] [5.2] [5.3]	[6.1] [6.2] [6.3]	[7.1] [7.2]	2	<b>12</b>	2,0	4,7	3,9
CIM	CIM COLLEGE (CIM GROUP)	25	20	[1.2] [1.3] [1.6]	-	-	[4.3]	[5.2]	[6.1] [6.3] [6.4] [6.5]	[7.3]	2	<b>12</b>	2,0	4,7	3,3
ETF.3	SCHOOL OF ELECTRICAL ENGINEERING, Department of Telecommunications	28	28	[1.1] [1.2] [1.4] [1.6]	-	[3.4] [3.5] [3.6]	-	-	[6.2]	-	2	<b>10</b>	2,5	3,9	5,7

Short name	Research unit	NoE	NoR	Expertise by FP7-ICT Challenge and Objective								Total	CC1	CSR [%]	CCR [%]
				1	2	3	4	5	6	7	FET				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
FON.2	FACULTY OF ORGANIZATIONAL SCIENCES (FOS), UoB. GOOD OLD AI	100	20	[1.2] [1.3] [1.6]	[2.1] [2.2]	-	[4.1] [4.2] [4.3]	-	-	[7.2]	-	9	2,3	3,5	3,7
ETF.4	SCHOOL OF ELECTRICAL ENGINEERING, UoB. Chair Of Computer Engineering and Information Theory	24	24	[1.2] [1.5]		-	[4.2] [4.3]	[5.1] [5.2]	[6.1] [6.2]	[7.3]	-	9	1,8	3,5	3,5
FTN.1	FACULTY OF TECHNICAL SCIENCES, University of NOVI SAD Chair of Communications and Signal Processing	25	24	-	[2.1] [2.2]	-	[4.3]	-	-	[7.1] [7.2]	2	7	1,8	2,8	3,4
PMF	FACULTY OF MATEMATICS UNIVERSITY OF BELGRADE Department of Computing and Informatics	35	21	[1.1] [1.2] [1.3]	[2.2]	-	[4.1] [4.2] [4.3]	-	-	-	-	7	2,3	2,8	4,0
ELFAK.1	Faculty of Electronic Engineering, University of Niš, Laboratory for Electronic Design Automation (LEDA)	12	11	-	-	[3.2] [3.4]	[4.2]	-	[6.3] [6.5]	-	1	6	1,5	2,4	1,3
IMTEL	Institute for Microwave Techniques and Electronics (IMTEL)	49	22	[1.6]	[2.1]	[3.4] [3.5] [3.9]	-	-	-	-	-	5	1,7	2,0	3,0
ETF.5	SCHOOL OF ELECTRICAL ENGINEERING, UoB. Chair of General Electrical Engineering	13	13	[1.6]	-	[3.2] [3.9]	-	-	[6.2] [6.4]	-	-	5	1,7	2,0	1,8
ELFAK.2	Faculty of Electronic Engineering, University of Niš Chair Of Telecommunications	26	26	-	[2.1] [2.2]	[3.4]	-	-	[6.2]	-	-	4	1,3	1,6	2,8
IRITEL	IRITEL AD BEOGRAD	195	85	[1.1]	-	[3.4] [3.5]	-	-	-	-	-	3	1,5	1,2	10,4
DKTS	PUPIN TELECOM DKTS	165	40	-	-	[3.4]	-	-	[6.3] [6.5]	-	-	3	1,5	1,2	4,9
	<b>TOTAL</b>	<b>1368</b>	<b>730</b>	<b>30</b>	<b>11</b>	<b>28</b>	<b>18</b>	<b>7</b>	<b>33</b>	<b>12</b>	<b>18</b>	<b>157</b>			

**Legend:**

- |   |  |
|---|--|
| 1 - Pervasive and Trustworthy Network and Service Infrastructures | 5 - Towards sustainable and personalized healthcare      |
| 2 - Cognitive Systems, Interaction, Robotics                      | 6 - ICT for Mobility                                     |
| 3 - Components, systems, engineering                              | 7 - ICT for Independent Living, Inclusion and Governance |
| 4 - Digital Libraries and Content                                 | FET - Future and Emerging Technologies                   |

Figure 3 Competence/Share Matrix of identified CoE in Serbia



**Identified potential CoE** are organizations and research units with potentially sufficient critical mass of knowledge, resources and infrastructure and perspective to manage achieving research results in the near future.

Table 3 Consolidated list of identified potential centres of excellence

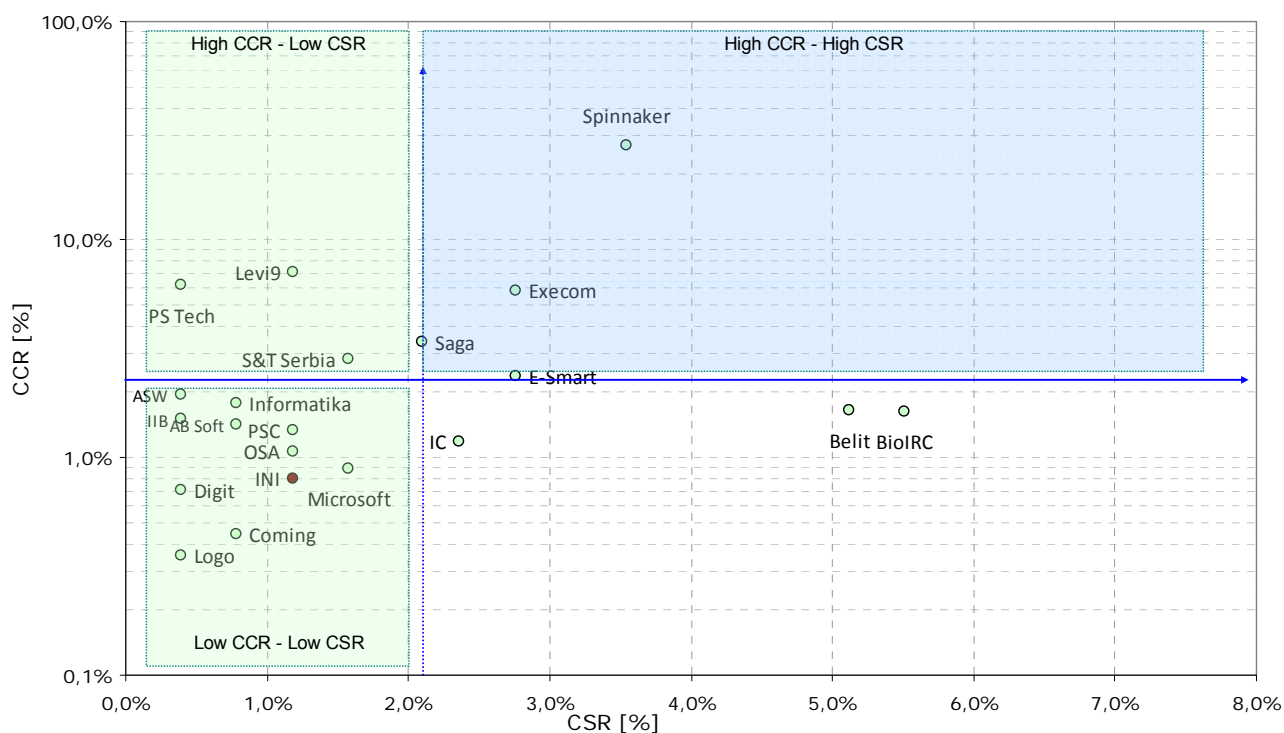
Research unit	NoE	NoR	Expertise by FP7-ICT Challenge and Objective								Total	CC1	CSR	CCR
			1	2	3	4	5	6	7	FET				
BioIRC, Bioengineering Research and Development Center, Kragujevac	15	10	-	2.1 2.2	3.6 3.9	4.3	5.1 5.2 5.3 5.4	6.1	7.1	3	14	2,0	5,5%	1,6%
Belit Ltd. - Belgrade Information Technologies	17	10	1.2 1.3	2.2	3.5	4.1 4.2 4.3	5.1 5.2	6.1 6.4 6.5	-	1	13	1,9	5,1%	1,6%
SPINNAKER NEW TECHNOLOGIES Ltd.	212	136	1.2 1.3	-	-	4.1 4.3	5.1 5.2 5.3	-	7.2 7.3		9	2,3	3,5%	27,2%
E-SMART SYSTEMS DOO	48	19	1.2 1.3	-	3.4	-	5.1	6.1 6.3	7.3		7	1,4	2,8%	2,4%
EXECOM d.o.o	41	28	1.2 1.3	-	-	-	5.1 5.2	-	7.1 7.2 7.3		7	2,3	2,8%	5,8%
Innovation Center, School of ETF	14	11	1.6	-	3.5	-	5.1 5.2	6.3	7.3		6	1,2	2,4%	1,2%
SAGA d.o.o.	290	23	1.1 1.2 1.3	2.2	-	-	-	-	7.3		5	1,7	2,0%	3,4%
RCUB			1.1 1.2 1.4 1.5 1.6	-	-	-	-	-	-		5	5,0	2,0%	0,0%
S&T Serbia	86	16	1.2 1.3	-	-	4.1 4.3	-	-	-		4	2,0	1,6%	2,8%
Microsoft Software Ltd.	19	5	-	2.2	-	4.1 4.2 4.3	-	-	-		4	2,0	1,6%	0,9%
INI	20	6	1.2	-	-	4.2 4.3	-	-	-		3	1,5	1,2%	0,8%
OSA Racunarski Inzenjering	29	8	1.1	-	-	4.1 4.3	-	-	-		3	1,5	1,2%	1,1%
PSC doo	42	15	-	-	-	4.3	-	-	7.3	1	3	1,0	1,2%	1,3%
Levi9 Global Sourcing Balkan	102	80	-	-	3.6	4.3	-	6.2	-		3	1,0	1,2%	7,1%
Coming Computer Engineer.	30	5	1.2	-	3.5	-	-	-	-		2	1,0	0,8%	0,4%
AB Soft	40	16	1.3	-	-	4.1	-	-	-		2	1,0	0,8%	1,4%
INFORMATIKA AD	200	10	-	-	3.4 3.6	-	-	-	-		2	2,0	0,8%	1,8%
IIB d.o.o.	25	17	1.3	-	-	-	-	-	-		1	1,0	0,4%	1,5%
ASW INZENJERING Ltd.	42	22	1.3	-	-	-	-	-	-		1	1,0	0,4%	2,0%
PSTech d.o.o.	75	70	1.2	-	-	-	-	-	-		1	1,0	0,4%	6,2%
Digit	76	8	1.3	-	-	-	-	-	-		1	1,0	0,4%	0,7%
LOGO d.o.o.	74	4	1.4	-	-	-	-	-	-		1	1,0	0,4%	0,4%
INTENS d.o.o Novi Sad	42	4	-	-	-	-	-	-	-		1			0,0%
	1539	523	28	5	9	18	14	8	10	5	98	12,3	38,2%	

**Legend:**

- 1 - Pervasive and Trustworthy Network and Service Infrastructures
- 2 - Cognitive Systems, Interaction, Robotics
- 3 - Components, systems, engineering
- 4 - Digital Libraries and Content
- 5 - Towards sustainable and personalized healthcare
- 6 - ICT for Mobility
- 7 - ICT for Independent Living, Inclusion and Governance
- FET - Future and Emerging Technologies

For identifying the potential CoE the threshold of at least one FP7-ICT expertise and minimum of four senior researchers (Ph.D, M.Sc. and B.Sc) was set. Selection of 23 entities is presented. Among these organizations three research units, all of them very active on international IT market, have significantly bigger number of researchers than average and three research units have significantly bigger number of declared expertise than average. Only one organization was successful in FP7-ICT Theme

Figure 4 Competence/Share Matrix of identified potential CoE in Serbia



### 0.2.3 R&D capacity

The Competence and the Share ratio of identified Serbian FP7-ICT Theme Objectives are presented in the Table below. (Competence [%] = number of Serbian successful proposals / total number of FP7-ICT Theme successful proposals; Share [%]= number of Serbian proposals / total number of FP7-ICT Theme proposals).

The value of competence and the value of share of 2,5% are considered as the borderlines between the low and high competence and accordingly, between the low and high share (2,5% is estimated level for Serbia according to its potential as a country for FP7-ICT).

Based on proposed method, the Competence/Share Matrix of Serbian FP7-ICT Theme objectives are presented below. The area of particular interest for raising the participation in FP7-ICT Theme of Serbian entities is High Competence-Low Share quadrant.

Table 4 Identification of Serbian FP7-ICT objectives

High competence – low share:	High competence – high share:
<ul style="list-style-type: none"> <li>1.1 The Network of the Future</li> <li>2.1 Cognitive Systems and Robotics</li> <li>7.2 Accessible and Assistive ICT</li> <li>8.2 FET – Proactive</li> </ul>	<ul style="list-style-type: none"> <li>1.3 Internet of Things and enterprise environments</li> <li>3.4 Embedded Systems Design</li> <li>3.5 Engineering of Networked Monitoring and Control systems</li> <li>4.1. Digital Libraries and Digital Preservation</li> <li>4.2. Technology-Enhanced Learning</li> <li>5.3 Virtual physiological human</li> <li>6.3 ICT for Energy Efficiency</li> <li>9.1 International cooperation</li> </ul>
Low competence – low share:	Low competence – high share:
<ul style="list-style-type: none"> <li>1.2 Internet of Services, Software &amp; virtualization</li> <li>1.4 Trustworthy ICT</li> <li>1.5 Networked Media &amp; 3D Internet</li> <li>3.1 Nanoelectronics Technology</li> <li>3.7 Photonics</li> <li>4.3 Intelligent Information Management</li> <li>5.1 <b>Personal Health Systems</b></li> <li>5.2 ICT for Patient Safety</li> <li>7.1 ICT &amp; ageing</li> </ul>	-

Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)



## **0.2.4 Macro-economic/technical ICT RTD related overview**

**Relevant financing authorities.** Government is the main relevant authority financing ICT RTD through the Ministry of Science and Technological Development (MSTD) and the Ministry for National Investment Plan (NIP). Budget is the main financing source of ICT RTD in Serbia. From the budget are financed programs of general interest of the Republic. The science share in 2003 reached 0.3% GDP and stands at that level for now. According to the (MSTD), with an annual growth of 0.15 percentage points the budget allocations in 2014 shall reach 1.05% GDP.

The total budget for science in 2008 was about EUR 100 million (from which the 14.2 million for technological development and 5.5 million for electronics and telecommunications and industrial software and informatics. All investments are not comparable to the world renowned universities or institutes whose annual budgets are above one billion Euros. The financing of Serbian science is facing the problem of the small amount coming mainly from the one source and than split on number of projects (more than 1000 from which 471 projects in the area of technological development).

The economic situation of the entities from ICT RTD sector is hindered by a lack of financial resources. In addition, solutions competitive both in quality and financially, both business and governmental sector cannot afford for the same reasons – the lack of finances. However, institutions active in ICT RTD have achieved significant results and preserved a solid base of experts in spite of the “brain drain”.

Although Serbia has necessary institutions in government, science and research, their influence on society and economy is insufficient. For now, there is no synchronized work. However, linkages among and between every single group are of the highest importance for ICT RTD development, important almost as their activities.

Despite the system of ICT RTD in Serbia is of inadequate efficiency, this sector is alive and active, mainly thanks to the ingenious isolated individuals. Number of activities seems to come from a single or small group of individuals, which invest their knowledge, expertise, authority and energy – with no or insufficient government support. However, several hundred ICT related science and research projects are held.

## 0.2.5 SWOT Analysis for ICT RTD

A comprehensive overview of present ICT RTD sector in Serbia examines four major aspects: (1) Legal and Regulatory Environment; (2) Serbian ICT RTD Infrastructure; (3) Serbian ICT RTD Sector; (4) Serbian ICT RTD Sector in FP7-ICT Theme. Each section is examined through a SWOT analysis lens, i.e., by examining related strengths, weaknesses, opportunities and threats. The final SWOT table is presented below.

Table 5 SWOT Analysis Summary

Strengths	Weaknesses
<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>• Present ICT RTD L&amp;R Environment is in process of harmonization with EU</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>• Advantage of existing research infrastructure of Academic Network of Serbia (AMRES) can be measured by number of connected entities and users as well as services and applications provided for these users</li> <li>• The existence of the Academic and Educational Grid Initiative of Serbia (AEGIS)</li> <li>• NIP investment in capital equipment for scientific research</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>• Despite the economic, social and institutional crisis and a difficult transition process, the Serbian ICT RTD sector has survived</li> <li>• A solid number of preserved Serbian experts</li> <li>• ICT related Education system</li> <li>• Solid institutes market orientation</li> <li>• Experts experienced in the ICT business sector</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>• Above EU average Success Rates of Serbian participants</li> <li>• Solid competence of Serbian entities</li> <li>• Programs of institutes and faculties are in line with the FP7-ICT Theme</li> </ul>	<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>• Insufficient political support in practice</li> <li>• Lack of one dedicated Government body in charge of ICT RTD</li> <li>• Problematic implementation of ICT RTD strategic documents</li> <li>• Weak communication of the ICT RTD sector with the policy creators</li> <li>• Government attitude towards the “third sector”</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>• Current infrastructure for ICT RTD activities in Serbia is undeveloped</li> <li>• Lack of large-scale R&amp;D equipment</li> <li>• Low investments in infrastructure</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>• Inadequate efficiency of the Serbian ICT RTD system</li> <li>• The brain drain (internal causes)</li> <li>• Neither visible focus on ICT RTD priorities defined in Strategy, nor partnering</li> <li>• Low level of national funds for ICT RTD</li> <li>• Lack of official Centres of Excellence</li> <li>• No transparent evidence of business participation</li> <li>• Weak cooperation between industry and education</li> <li>• Insufficient political will, financial resources and expertise</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>• Serbia is a latecomer to the FP programs</li> <li>• Insufficient experience in search for consortium partners</li> <li>• Limited Serbian lobbying ability</li> <li>• Insufficient interest of academic researchers to participate in FP7-ICT</li> <li>• Lower follow up of upcoming calls</li> <li>• Missing public national ICT RTD database</li> <li>• Weak administration capacities for FP7-ICT requirements</li> <li>• Insufficient support in project proposal preparation</li> </ul>

Table 6 SWOT Analysis Summary - Continued

Opportunities	Threats
<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>• Ambitious plans expressed in strategy papers in the ICT RTD field</li> <li>• Creation and rapid adoption of Action Plan for the Strategy for Science and Technological Development</li> <li>• New legal documents</li> <li>• Strengthen cooperation and networking</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>• 50-80M Euro of 300 M Euro Investment initiative</li> <li>• Development of Broadband Access (AMRES/EMRES)</li> <li>• Establishment of a regional centre for supercomputing</li> <li>• Improvement of the SEE-GRID-SCI (SEE-GRID eInfrastructure for regional eScience)</li> <li>• Huge potential of the EPS optical network</li> <li>• More advanced and competitive public telecommunication sector</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>• Good price / quality ratio of Serbian services</li> <li>• Solid expertise in particular FP7-ICT areas</li> <li>• Reorganization of Serbian Education system</li> <li>• Implementation of the “Focus and partnering” Strategy, which is expected to come soon</li> <li>• Exploit the hidden potential of the ICT business sector</li> <li>• Rising compatibility with international ICT RTD sector</li> <li>• Meet the Government needs for ICT solutions and services</li> <li>• Serbia as a natural gathering and coordinating regional center</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>• Room for increasing participation</li> <li>• Use capacity of leading Serbian entities</li> <li>• Fully recognizing of benefits from participation in FP7-ICT</li> <li>• Positive attitude towards FP7-ICT</li> <li>• Experts’ familiarity with FP7-ICT opportunities</li> <li>• Transfer of evaluators’ knowledge and experience</li> <li>• Targeted regional FP7 calls</li> <li>• Regional conferences, events and support actions</li> <li>• Harmonize Serbian thematic areas with the FP7-ICT Theme</li> <li>• Work on raising the critical mass of ICT researchers</li> </ul>	<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>• Political instability in the country/region</li> <li>• Low level of investments in science and research</li> <li>• Uncertain sources of funding</li> <li>• Non-customized mirrored policy</li> <li>• Mistrust in the promises of the policy makers</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>• Obsolete existing infrastructure</li> <li>• Lack of the connection between private faculties and the AMRES</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>• Serbia as a latecomer to the international market</li> <li>• The brain drain (external causes)</li> <li>• Weak cooperation on ICT projects</li> <li>• Long time present differences between Serbian and European researchers</li> <li>• Stereotype image of Serbian research</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>• Difficulties in reaching the big EU15 consortia</li> <li>• Low participation of Serbian entities</li> <li>• Negative “cash flow”</li> <li>• Generally low FP7-ICT financial support for Serbian ICT RTD</li> <li>• Insufficient Government funding for FP7-ICT projects</li> <li>• Complex proposal writing/preparation</li> <li>• Excessive bureaucracy</li> <li>• Lack of evaluation and scientific ranking of projects</li> <li>• Missing the real impact of FP projects</li> </ul>

## 0.2.6 Barriers and ways to overcome them

### ICT RTD Sector in FP7-ICT Theme

**Serbia is the new player in Framework Programs**, that came after many years of sanctions and standing aside of European research area and world RTD science.

⇒ It is suggested to create actions on EU level to promote and encourage Serbian RTD science through brokerage events, knowledge exchange and networking.

**Low participation of Serbian entities indicates the absence of the ICT RTD critical mass and insufficient interest of academic elite for participation in FP7-ICT.** In general, the focus of Serbian researchers is not on FP7-ICT projects, putting the total number of Serbian participants among the lowest in Europe – only 14 Serbian successful applicants (representing 0,24% of total EU applicants). Low participation could in turn bring Serbia to negative balance in the following FP cycle. As a consequence, the share of Serbian contribution to the EU budget could exceed the amount that Serbian entities will be able to pool based on their results.

⇒ The actions considered of having the most influence on increasing participation of Serbian entities in FP7-ICT Theme are: EDUCATION and MOTIVATION programs. For entities that have participated in the FP6-IST and FP7-ICT Theme but did not have success (have willingness, but low capacity) **educational programs** (training) are proposed. For number of entities in Serbia that have not participated in previous FP cycles although have the required ICT RTD capacity for successful participation (have capacity but not willingness) **motivation programs** are proposed.

⇒ The preparation of proposals for FP7-ICT requires high expertise and other skills and it should be properly evaluated in the meaning of scientific ranking. The suggestion is to include the participation and successfulness in FP7 projects in the existing evaluation criteria of science and research work. For example the project could be evaluated similar to the published works in international journals.

**Difficulties in reaching the big EU15 consortia:** In the time between the starting of the FP initiative and the moment when Serbia joined the FP (after almost two decades), big and successful consortia had already been established in the EU15, even before the EU12 extension. Rigidity of these consortia for new partners joined by weak connections of Serbian ICT RTD entities with EU research institutions create one of the main barriers to Serbian bigger participation in the FP-ICT Theme.

⇒ Targeted regional calls for common Western Balkan ICT R&D priorities are suggested for improving the regional cooperation, experience exchange and speeding up solving the

common problems and barriers. It is recommended to focus on demand/application-oriented issues.

⇒ Apart from targeted calls on regional priorities, the support actions for other (EU) priorities that are underdeveloped in the region are recommended.

**The high demanding administration activities and weak Serbian administration capacities for FP7-ICT requirements** have been observed as one of the main barriers. The proposal writing/preparation is a complex and time-consuming work. Opposite to Serbia, in the EU15 this complex process of preparation is successfully distributed to well trained and experienced consortia partners, which brings them significant advantage.

⇒ Consider capacity-building actions for improving skills of Serbian ICT researchers, particularly in FP7 application procedures, project planning and management (including financial management). In collaboration with National Contact Points and the EC establish the National organization dedicated to training courses on FP7-ICT topics.

⇒ It is suggested to enable FP7 participants to outsource their administration activities by establishing of the centers with capacity for administration, financial reporting and project management support.

⇒ Consider establishing regional administrative center for FP7-ICT to enable ICT RTD organizations in the region to outsource these activities.

**Negative "cash flow" is frequent appearance in Serbia.** For organizations with weak financial capacity and with the team of researchers dedicated to the FP7 project, period of 3 years with the lack of capital can become a serious problem.

⇒ Government should consider possibility of giving guaranties for organizations with approved FP7 projects if they need financial support from banks (loans or other financial options). This would help organizations that participate in FP7 to cover their expenses in the period from project approval to the real pay off by the EC.

**Insufficient Government funding for FP7-ICT projects.** Current additional funding for FP7 projects in Serbia provided by Government is 10% of total project value.

⇒ According to interviewees, it is proposed to increase this amount to 25% of the project value. Also, it is suggested to provide additional sources of financing at the national level for organizations with approved FP projects. This will encourage participants for FP7 and help building the necessary critical mass of researchers in the most of successful entities.

⇒ Additional measures regarding ICT projects financing could be: Abrogation on taking 40% of incomes of faculties and budget-funded research centres.

**Average EU FP7 financial support for Serbian ICT RTD is small** (results from the Delphi survey). It is estimated that FP7-ICT projects contribute to Serbian ICT RTD sector with about EUR 2 million per year.

- ⇒ It is suggested to consider actions for increasing the amounts for contracted monthly payments of Serbian ICT RTD researchers, which are currently significantly lower than EU average – as it will significantly increase their motivation to participate in FP7.

### **ICT RTD Sector in general**

**The general perception of European researchers is that, with exceptions of some recognized cases of excellence, the level of Serbian research is low, particularly compared with the EU15.**

- ⇒ In order to change this stereotype about Serbia, either a lot of years of hard and successful work or a very good “successful cases” marketing is needed, focused on a target group of exquisite European research organizations.

**Brain drain** is a very complex barrier, which can be identified as an internal weakness of the organization, sector or country but also as an external threat coming from the outside.

- ⇒ The Government has announced a plan (through the Strategy for Science and Technological Development) for stopping the ‘brain drain’ as well as for stimulating the return of the experts already abroad. It is suggested to speed up the realization of this plan.

**Missing public national ICT RTD database:** Due to the lack of a national public database of ICT RTD participants and organizations, Serbian entities are faced with the challenge of identifying the project partners within Serbia as well as connecting to other researchers and industry (networking). Partner search processes both within the national and European level are hampered.

- ⇒ It is recommended to create a public national database of R&D actors and organizations and to improve processes for partner search both within the country and SEE region;
- ⇒ In addition, such a database could be used as a knowledge base as well as a source for “know-how” and ICT solutions. This kind of database could be useful for attracting big users of IT solutions and help applicants in their search for partners from the end-user sector.

**Low participation of “third sector”:** The Government almost exclusively follows up and regulates the relationships inside ICT RTD area of state-owned entities and their financing. One of observed general problems from the Delphi survey (Task 6) is low participation of Serbian “third sector” (business, private, SME and NGO) in FP7-ICT projects.

⇒ It is recommended to define policy/strategy for including the “third sector” (industry, business and SME sector) with its hidden ICT RTD potential, which is currently invisible for Government. It is suggested to the Ministry for Science and Technological Development to put the special emphases on the SME sector and its involvement in different international cooperation programmes and particularly FP7-ICT through the following actions: (1) Case studies for presenting the added value of participation in FP7 projects; (2) 10 most successful SME participants in FP7 granted from ICT RTD fund every year; (3) Tax stimulations for SME whose proposals for FP7 are evaluated above defined threshold.

**Lack of focusing:** “Focus and partnering” - the key words from the adopted Strategy, show that the Government, as the key player, recognized and understood the importance of ICT RTD development and made serious decision towards its realization. Considering ICT RTD segment, there is still neither a visible focus on ICT RTD priorities defined in the Strategy, nor partnering, and there is no action plan. The way of financing remains the same.

⇒ National ICT RTD priorities need to be defined. Fast implementation of the “Strategy for rising participation of domestic research priorities in ICT research” and a “Strategy and policy for making ICT clusters” is necessary.

⇒ Partnering of private enterprises and public research and education ICT institutions has to be improved. Stimulation measures to increase the number of projects related directly to industry/business are highly recommended.

**Weak communication of ICT RTD sector with policy creators:**

⇒ It is recommended, before adopting the final Action Plan for the Strategy, that the Government in cooperation with ICT RTD experts concretizes/redefines ICT RTD priorities according to the needs of the ones most interested. Government has just initiated defining the ICT RTD priorities in cooperation with experts.

**ICT RTD Infrastructure**

**Low investments in infrastructure resulted in current infrastructure for ICT RTD activities in Serbia which is undeveloped due to the low and irregular investments, inadequate – due to the short amortization period of this type of equipment and discontinuity in upgrades or renewing and only partially meets the real needs of Serbian science and research.**

⇒ Serbian R&D investment initiative (EUR 300 million), which is a part of the Science and Technological Development Strategy of the Republic of Serbia 2010 – 2015, is the main infrastructure opportunity. For the development of information and communication technology infrastructure budget of about EUR 50 – 80 million is planned. However, the

lack of transparency, public available procedures and criteria on spending this amount are the barriers that could throw in the shade all other barriers as well as the planned results.

⇒ Enable clear procedure and criteria on spending the amount of EUR 300 million in R&D infrastructure and make it transparent and public available.

**Governmental funding for R&D projects is intended to limited number of organizations and institutions registered as SRO (Science & Research Organizations). There are insufficient investments in R&D infrastructure through collaboration of businesses and universities.**

⇒ Large ICT companies have potential for R&D in ICT but have low interest for investing in infrastructure. They should be stimulated or supported through governmental funds or tax benefits to invest in R&D infrastructure.

⇒ In addition, EU is encouraged to continue its financial support by participating in further projects / actions for specific ICT RTD infrastructure (like regional projects SEEREN, SEEREN2, SEE-GRID, SEE-GRID-2, SEE-GRID-SCI, SEERA-EI; SEE-Light, AEGIS, Blue Danube and others).

## **Legal and Regulatory Environment**

**Unrealized or partially realized implementation of adopted strategic documents is one of the most visible weaknesses in the ICT RTD area.**

⇒ The Action Plan for the Strategy for Development of Science and Research in Serbia (2010-2015) is the key document for realization and acceleration of progress in ICT RTD area but does not exist yet. Rapid adoption of reliable and concrete Action Plan is the first and necessary step. In order to obtain this goal, it is needed: to assure that the Strategy gets a wide and strong political and professional support; to engage the best experts for its implementation and for the Government to relocate the budget money from populist goals to development programs.

**Mistrust in the promises of the RTD policy makers represents a serious threat to accomplishing the given goals in ICT RTD development.**

⇒ The amount of skepticism shown by a number of experts can be understood as „a realistic observation“ of the issue, based on their previous experience. To overcome the identified gap between attitude of ICT “branch” and the one of RTD “policy creators” towards realization of government plans, it is necessary to significantly intensify and widen the dialogue between them. The convergence of their positions is the key for the success of future work and plans.



**Low level of investments in science and research: Investments of around 0,3% GDP are among the lowest in Europe (the total budget for science in 2008 was about EUR 100 million). Considering vast differences in GDP of Serbia and the EU countries and the investments percentages, a situation might emerge where Serbia won't be able to follow EU ICT RTD programs.**

⇒ It is suggested to increase the budget funding and necessarily include the funding from the business sector. Unless this is achieved, the budget funds won't be sufficient for science development. According to recession and falling GDP, regulation (on an annual basis) of GDP expenditure is necessary for achieving the plan to increase investments in Research and Science.

**Non-customized mirrored policy: Instead of creating national and sustainable ICT RTD policy, there is a potential threat of non-customized imported policy from the EU.**

⇒ Careful creating of national and sustainable ICT RTD policy is needed, that will support High Tech projects and the best national ICT RTD institutes, instead of closing them and leading the ICT RTD sector into technologically subordinated position.

## **0.2.7 The list of actions to maximize the Serbian potential in the FP7-ICT**

### **The List of actions that need to be taken at national level**

- ⇒ Government is highly suggested **to increase significantly investments in infrastructure required for FP7 –ICT Theme** or to cover part of the expenses for equipment purchased within FP7-ICT.
- ⇒ **The preparation of proposals for FP7-ICT requires high expertise** and other skills and it should be properly evaluated in the meaning of scientific ranking.
- ⇒ **Negative "cash flow" is frequent appearance in Serbia.** Government should consider possibility of giving guaranties for organizations with approved FP7 projects if they need financial support from banks (loans or other financial options).
- ⇒ **The high demanding administration activities** have been observed as one of the main barriers. It is suggested that Government enable FP7 participants to outsource these activities by encouraging the establishment of the centers with capacity for administration, financial reporting and project management support.

- ⇒ It is recommended **to create a public national database of R&D actors** and organizations and to improve processes for partner search both within the country and SEE region.
- ⇒ **Consider capacity-building actions for improving skills** of Serbian ICT researchers, particularly in FP7 application procedures, project planning and management (including financial management).
- ⇒ It is suggested **to harmonize thematic areas, initiatives and goals in ICT area** (National Strategy, regional initiatives) with FP7-ICT challenges and objectives.
- ⇒ It is recommended **to define policy/strategy for including the "third sector"** (industry, business and SME sector) with its hidden ICT RTD potential, which is currently invisible for Government.
- ⇒ Finally, the actions considered of having the most influence on increasing participation of Serbian entities in FP7-ICT Theme: EDUCATION and MOTIVATION programs are presented. For entities that have participated in the FP6-IST and FP7-ICT Theme but did not have success (have willingness, but low capacity) educational programs (training) are proposed. For number of entities in Serbia that have not participated in previous FP cycles although have the required ICT RTD capacity for successful participation (have capacity but not willingness) motivation programs are proposed.

#### **List of actions that need to be taken at EU level**

- ⇒ **Serbia is the new player in Framework Programs** after many years of sanctions and standing aside of European research area and world science (1992-2000). It is suggested to create actions on EU level to promote and encourage Serbian science through brokerage events, knowledge exchange and networking.
- ⇒ **Targeted regional calls for common West Balkan ICT R&D priorities** are suggested for improving the regional cooperation, experience exchange and speeding up solving the common problems and barriers.
- ⇒ Apart from targeted calls on regional priorities, **the support actions for other (EU) priorities that are underdeveloped in the region** are recommended.
- ⇒ **Average EU FP7 financial support for Serbian ICT RTD is small** (results from the Delphi survey). It is estimated that FP7 contribute to Serbian ICT RTD sector with about EUR 2 million per year. Consider actions for increasing the amounts for contracted monthly payments of Serbian ICT RTD researchers – as it will significantly increase their motivation to participate in FP7.
- ⇒ **EU is encouraged to continue its financial support** by participating in further projects / actions for specific ICT RTD infrastructure.

- ⇒ It is suggested **to create awareness of the FP participation benefits through regional conferences and events** dedicated to demonstrations of the success stories and best practices. Consider transfer of knowledge and experience from EU to Serbian participants.
- ⇒ **Consider financing travel expenses for the EU experts** so they can present particular FP7 issues on regional conferences.
- ⇒ **Consider criteria for achieving grants for universities** and faculties such as access to renowned digital libraries (as IEEE and similar), as the COBSON, although amazing, does not cover sufficient number of ICT magazines.
- ⇒ **Consider benefits for FP7-ICT successful participant** for licenses for specialized software or access to specific data bases.
- ⇒ **Consider establishing regional administrative center for FP7-ICT** to enable ICT RTD organizations in the region to outsource this activity.
- ⇒ **Support actions on FP7 procedures and proposal development** are still important for the region.

**[End of Steering Management Dash Board]**

## **0.3 Executive Summary**

### **0.3.1 Review of studies and strategy papers**

Task 1 gives a review of any studies and strategy papers, regarding the technological status of Serbia in the field of ICT RTD. In addition, it reviews national action plans on RTD technological status of Serbia in the field of ICT RTD and identifies ICT RTD policy environment and the opportunities and barriers it presents.

The Serbian ICT RTD Legal and Policy Framework are in the early stage of development. All the processes initiated in this field were set up for the first time in 2005. The regulatory vacuum has just begun to fill; the Strategy on Development of Science and Technological Research has just started to follow the basic laws in this area. However, there is still no visible activity on the horizon which is why the action plans will be more than welcomed.

The following adopted laws define ICT RTD legal environment: Law on Science and Research Activities, Law on Innovative Activity, Law on Telecommunications, Law on Digital Signature, Law on Digital Document, Law on e-Commerce, Law on Personal Data Protection, Law on Data Access, and Law on Intellectual Property. Draft Version of the Law on Consumer Protection has been presented nowadays. Strategy for Information Society Development and the Strategy for Science and Technological Development (2010-2015) are the key policy documents for continuing ICT RTD development in Serbia.

The main document defining the ICT RTD operational framework in Serbia is The Action Plan for Implementation of the Strategy for Science and Technological Development in Serbia 2010-2015. Unfortunately, this Action Plan was expected to be adopted before the end of the year (2009) and currently does not exist. However, if Serbia wishes to get closer to the EU, the progress in RTD area has to be faster.

#### **Key national documents**

Taking into account that there are many documents with different degrees of impact and importance on ICT RTD, it was necessary to select the most relevant documents for deeper analysis. All the documents were divided according to two criteria: (1) Document type and (2) Area covered by the document. They were assigned an appropriate impacts (0,1,2,3) in both categories. Impacts for document type: Law (impact 1); Strategy (impact 2) and Action Plan (impact 3). Impacts for area covered by document: Information Society (IS) – Impact 1; ICT area – Impact 2; ICT RTD - Impact 3. The key national documents are presented in the table below.

Table 7 ICT RTD national documents – Legal and policy framework

Id	Document title Year, source of document	Type 1	Type 2	Impact level ICT RTD
<b>Law</b>				
1	<b>Law on Scientific Research Activities</b> 2005, Government of the Republic of Serbia, Official Gazette RS br. Xxxo	1	3	● 1 2 3 4 5 6
2	<b>Law on Innovative Activity</b> 2005, Government of the Republic of Serbia, Official Gazette RS br. 87/2006	1	3	● 1 2 3 4 5 6
3	<b>Law on Telecommunications</b> 2003 and 2006, Government of the Republic of Serbia, Official Gazette RS br. 44/2003; 6/2006	1	2	● 1 2 3 4 5 6
<b>Strategy</b>				
1	<b>Strategy for the Scientific and Technological Development of the Republic of Serbia 2010-2015. (Adopted in March 2010)</b> 2009, Ministry for scientific and technological development, www.nauka.gov.rs	2	3	● 1 2 3 4 5 6
2	<b>Strategy on Development of Telecommunication of Serbia, 2006-2010</b> 2006, Government of the Republic of Serbia, Official Gazette RS br. 99/2006	2	2	● 1 2 3 4 5 6
3	<b>Strategy for Development of Information Society in Serbia</b> 2006, Government of the Republic of Serbia, Official Gazette RS br. 87/2006	2	1	● 1 2 3 4 5 6
<b>Action Plan</b>				
1	<b>The Action Plan for Implementation of the Strategy for the Scientific and Technological Development of the Republic of Serbia 2010-2015. (Planned for adoption in March 2010)</b> 2009, Ministry for scientific and technological development, www.nauka.gov.rs	3	3	● 1 2 3 4 5 6
2	<b>eSEE Agenda+ for Development of Information Society in SEE 2007-2012</b> 2007, Ministers' conference in Sarajevo	3	2	● 1 2 3 4 5 6

**Legend:**

**Type 1** - Document type: (1) Law; (2) Strategy; (3) Action Plan.

**Type 2** - Focus Area: (1) Information Society; (2) Information and Communication technology (3) Research Technology Development

### 0.3.2 Review of activities and capabilities of entities in Serbia carrying out ICT RTD

The scope of Task 2 is to give a review of activities and capabilities of entities in Serbia carrying out ICT RTD. Potential of these entities for the future achievements, primarily for the participation in following FP7 projects, was analyzed.

For the purpose of analysis more than 40 relevant institutions were taken into account. 16 main stakeholders were selected on the basis of the criteria of having the most influence on ICT RTD. The analysis is based on desk research of publicly available information. Four groups appear to be best suited for setting the scene of main ICT RTD related activities: (1) Government institutions; (2) high education institutions; (3) research institutions; and (4) industry/ business.

The creation of a National RTD policy framework was started in 2005 and the relevant Government institutions were founded: National Council for Science and Technological Development (NC), Ministry of Telecommunication and Information Society (MTIS), Republic

Agency for Telecommunication (RATEL), while Ministry of Science and Technical Development (MSTD) and National Information Technology and Internet Agency (NITIA) were transformed. However, ICT RTD progress is slow. The possible reasons might lie in frequent changes of Government. In period 2005-2009 there were three Governments and accordingly three different Ministers of Science which results in the delay of Strategy for Scientific and Technological Development adoption and a deceleration of ICT RTD.

Table 8 The most relevant institutions for ICT RTD

No	INSTITUTIONS	Area IS	Area ICT	Area RTD	Total	Impact level ICT RTD
	Ponder (1-3)	1	2	3		
	Maximal Mark	3	3	3	18	
<b>Government Sector</b>						
1	<b>Ministry of Science and Technological Development (MSTD)</b>	1	1	3	12	①②③④⑤⑥
2	<b>Ministry of Telecommunication and Information Society (MTIS)</b>	3	3	1	12	①②③④⑤⑥
3	<b>National Council for Scientific and Technological Development (NC)</b>	1	1	3	12	①②③④⑤⑥
4	<b>The Republic Telecommunication Agency (RATEL)</b>	1	3	1	10	①②③④⑤⑥
5	<b>National Information Technology and Internet Agency (NITIA)</b>	2	2	1	9	①②③④⑤⑥
<b>High Education Sector</b>						
1	<b>FACULTY OF ELECTRICAL ENGINEERING (ETF)</b>	1	3	3	16	①②③④⑤⑥
2	<b>FACULTY OF ORGANIZATIONAL SCIENCE (FON)</b>	2	3	2	14	①②③④⑤⑥
3	<b>FACULTY OF MATEMATICS</b>	1	2	3	14	①②③④⑤⑥
4	<b>ELCTRONIC FACULTY - UNIVERSITY OF NIS (ELFAK)</b>	1	3	3	16	①②③④⑤⑥
5	<b>FACULTY OF TECHNICAL SCIENCES NOVI SAD</b>	1	3	3	16	①②③④⑤⑥
6	<b>FACULTY OF NATURAL SCIENCE AND MATHEMATICS - NOVI SAD</b>	1	2	3	14	①②③④⑤⑥
<b>Institute</b>						
1	<b>INSTITUTE MIHAILO PUPIN (IMP)</b>	1	2	3	14	①②③④⑤⑥
2	<b>INSTITUTE OF PHYSICS</b>	-	1	3	11	①②③④⑤⑥
3	<b>SERBIAN ACADEMY OF SCIENCE AND ART (SASA)</b>	3	1	3	14	①②③④⑤⑥
4	<b>IRITEL</b>	-	3	2	12	①②③④⑤⑥
5	<b>IMTEL Komunikacije A.D.</b>	-	3	2	12	①②③④⑤⑥

**Legend**

Area of influence:

- (1) IS Information Society
- (2) ICT Information Communication Technology
- (3) RTD ICT Research Technology Development

The Government is playing active role in strengthening Serbian ICT RTD capacities for the three main reasons: (1) RTD polices are set at the national level; (2) majority of ICT RTD activities are funded by Government institutions; and (3) majority of relevant research institutions are state-owned.

Institutes active in ICT RTD have achieved significant results and preserved a solid base of experts in spite of the "brain drain". Most of the ICT RTD projects are funded by the Government and not related directly to industry/business. However, there are visible efforts, results and potential in international and FP7 projects. ICT RTD sector is fragmented and there is no strategic course for development.

Several hundred ICT related science and research projects held in Faculties, indicate that scientific and research potential and results are exceed the actual possibilities and interest of Serbian society to make use of them. The result is an increasing lagging of the Serbian economy and IS development compared with EU countries.

The private sector in Serbia is only tangentially involved in ICT RTD and role of ICT RTD business sector in Serbia is modest. There is low or no connection to ICT RTD institutes. However, companies from private sector are business oriented and long for applied solutions. Between these steps lies the currently hidden potential for RTD. The Government almost exclusively follows up and regulates the relationships inside ICT RTD area of state-own entities and their financing.

Despite the system of ICT RTD in Serbia is of inadequate efficiency, this sector is alive and active, mainly thanks to the ingenious isolated individuals. Number of activities seems to come from a single or small group of individuals, which invest their knowledge, expertise, authority and energy – with no or insufficient government support. However, several hundred ICT related science and research projects are held.

### **0.3.3 Analysis of the participation of Serbia in the FP6-IST and FP7-ICT Theme**

Task 3 presents Serbian participation in FP6-IST and FP7-ICT Theme and the key reasons for success and failure in submitting proposals.

For almost two decades of economic, social and institutional crisis and difficult transition process resulted in lost capacities, both in financial and human resources and in visible ICT RTD fragmentation, **Serbian ICT RTD sector shared the destiny of the whole society**. It is remarkable how this sector has not only survived, but is still achieving success. All this has to be taken into consideration when exploiting the results of the Serbian Framework Programme trend participation analysis.

In FP6-IST Priority EU countries achieved success rate of 13,4% (8383 submitted proposals and 1123 approved) and Serbia 12,8% (125 submitted proposals and 16 approved) showing slightly lower passing (success) rate of Serbian proposals than EU average. Serbian entities submitted

their proposals to six of seven thematic categories showing the big dispersion of the proposals, while the accepted proposals were in only three thematic categories.

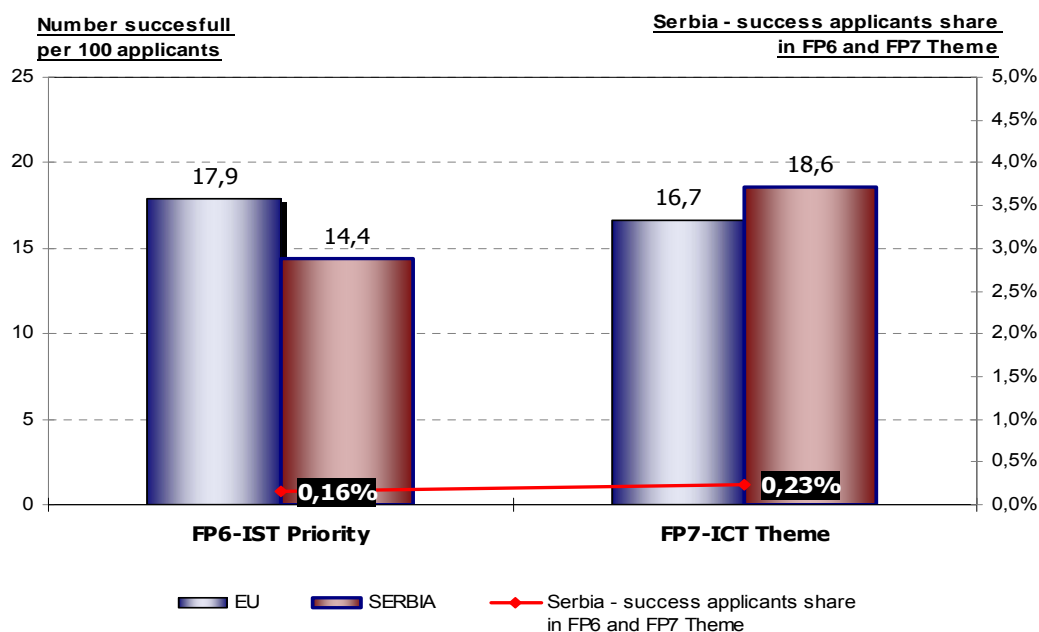
Table 9 Success and failure rates of proposals in FP6-IST and FP7-ICT Theme.

	EU Proposals		Serbian Proposals		Ratio (%) of successful proposals		SERBIA - Proposals share	
	Total	Successful	Total	Successful	EU	SERBIA	Successful	Failure
FP6-IST Priority	8383	1123	125	16	13,4	<b>12,8</b>	<b>1,4%</b>	1,5%
FP7-ICTTheme	5586	840	77	12	15,0	<b>15,6</b>	<b>1,4%</b>	1,4%

Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)

- ⇒ In the FP7-ICT Theme, the EU countries achieved success rate of 15,0% (with 5586 submitted proposals and 840 approved),
- ⇒ Serbia accomplished higher passing rate of 15,6% (with 77 submitted and 12 approved proposals). In addition, this represents the growth of 2,8 percentage points compared to the Serbian success in FP6-IST Priority.

Figure 5 Success rates of applicants in the FP6-IST and FP7-ICT for EU and Serbia



Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)

- ⇒ With 18 successful applicants in FP7-ICT Theme Serbia achieved 18,6 successful applicants per 100 (Serbian) applicants compared to 16,7 of EU countries. Serbian rate of successful applicants (18,6%) is among the highest in the Europe.
- ⇒ The share of Serbian participations in total EU successful participations (applications) raised to 0,23% from 0,16% in FP6-IST Priority.



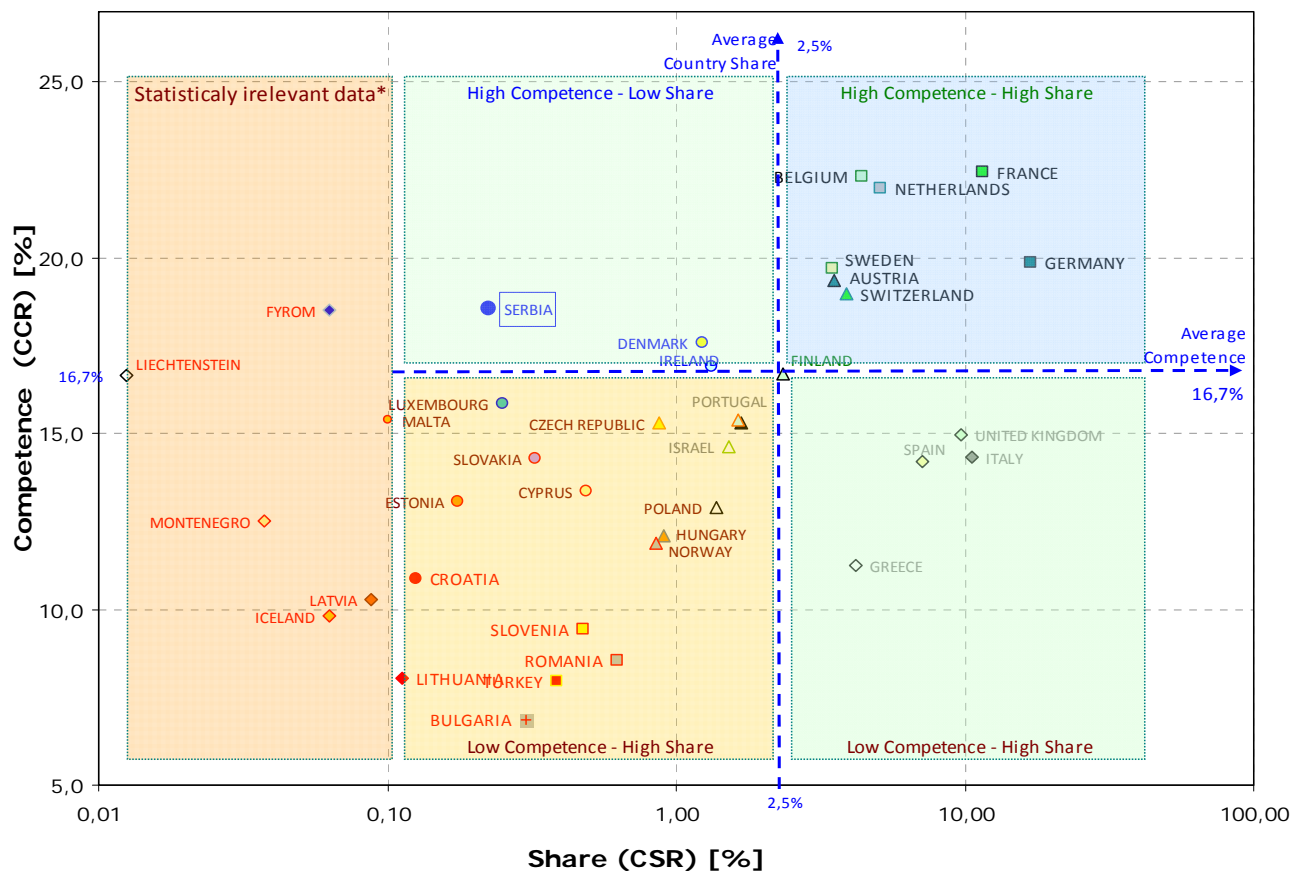
⇒ Despite detected growth Serbia is still among the countries with the lowest number of participants.

### Comparison of Serbia applicants to EU27 and AC

Figure below presents the Competence/Share Matrix of EU27 and AC applicants in FP7-ICT Theme. In this figure Serbia is positioned in the “high competence - low share” quadrant, with the highest competence in this quadrant. There is a visible contradiction between impressive successes of Serbian applicants (**among the 38 most influential countries, Serbia is on the 8<sup>th</sup> place**) and a small share in number of projects (**among the 38 most influential countries, Serbia is 28<sup>th</sup>**). This indicates either lack of critical mass of researchers or their modest interest in FP7-ICT participation.

Explanation: The Country Share Ratio (CSR) and individually Country Competence Ratio (CCR) for each of 40 countries (EU27 and AC) are presented.

Figure 6 EU27 and AC applicants in FP7-ICT Theme - Competence / Share Matrix



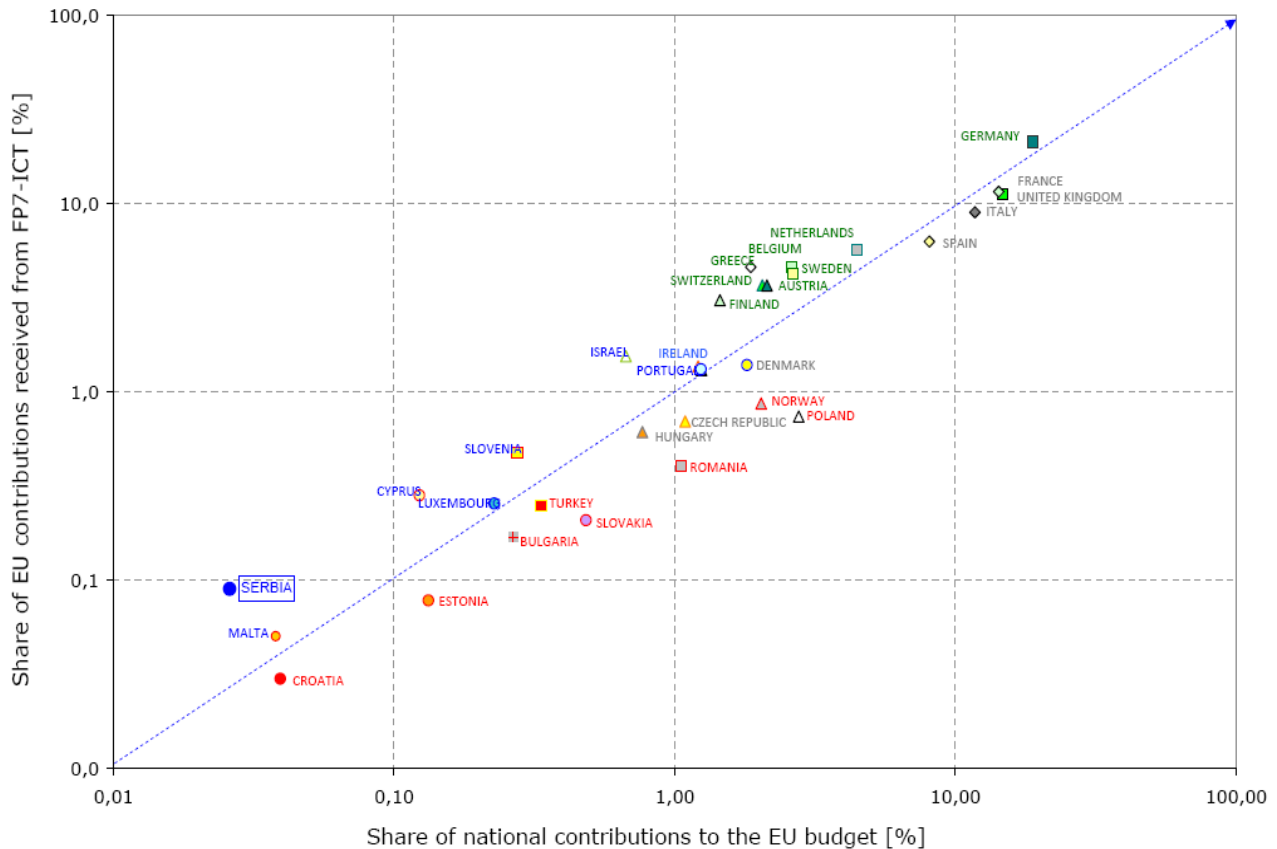
Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)

⇒  $CSR [\%] = \text{number of Country's successful applicants} / \text{number of all successful applicants in FP7-ICT};$

⇒ CCR [%] = number of Country's successful applicants / total number of Country's applicants.

The average value of Share (2,5%) is emphasized. This line represents the borderline between the big and small share. Similarly, for the Competence, the average competence of all countries, 16,7% separates the more from the less successful countries.

Figure 7 EU27 and AC „juste-retour“ comparison for FP7 INFISO call



Source: EC-DG INFISO (FP7-ICT Theme Call 3 inclusive) \* NOTE: Albania, Montenegro, Iceland and Lichtenstein have national money withdrawal less than 0.01% each

In figure above the share of national contribution to the total FP7-ICT budget (x-axis) and share EU contributions received from FP7-ICT (y-axis) are presented.

- ⇒ Based on the main trend (blue line), two groups of countries can be distinguished: (1) above the main trend line and (2) below that line.
- ⇒ Serbia is positioned in the first group characterized by bigger money withdrawal than its budget participation. In addition, it is noticeable that Serbia both invests small amounts and withdraws small amounts of money.

### 0.3.4 Present and planned infrastructure in Serbia for ICT-RTD

Task 4 estimates the current and planned Serbian research infrastructures related to ICT RTD activities with the particular respect to infrastructures' capability to meet the Serbian needs for an effective participation in FP7-ICT Theme.

Serbia's yearly budget spent on ICT RTD infrastructure is estimated on EUR 2 million (0,005% GDP), which is similar to the yearly budget of a solid university or institute from EU15. This situation has lasted for more than twenty years. Extremely low investments in ICT RTD area are detected as the main barrier in all obtained analysis (policy environment, main stakeholders, infrastructure, interviews...).

For **current ICT RTD infrastructure**, the focus was on common infrastructure necessary for academic community: academic network AMRES, GRID initiative and supercomputer center.

AMRES is one of the most important national-research and educational resources and for sure - the most important resource for ICT RTD infrastructure. Without the "light from the dark fiber" of AMRES there is no national nor international Serbian cooperation in ICT R&D field. Without cooperation - there is no ICT development and finally - there is no Information Society in Serbia. Academic and Educational Grid Initiative of Serbia (AEGIS) seeks to unify High Performance Computing in Serbia integrating it into robust national, regional and pan-European infrastructures. In addition, Institute for Physics in Belgrade has become a regional centre for supercomputing. The first strategic project was 'The Blue Danube', which has duration of 7 years.

Analysis based on desk research shows that current infrastructure for ICT RTD activities in Serbia is **undeveloped** due to the low and irregular investments, **inadequate** – due to the short amortization period of this type of equipment and discontinuity in upgrades or renewing and **only partially meets** the real needs of Serbian science and research. With the respect to all above, the general estimation is that current infrastructure is not the significant obstacle and that is sufficient for current Serbian participation in FP7-ICT Theme. However, it is not expected from present Serbian infrastructure to have positive influence on effectiveness of Serbian participation. In addition, the existing infrastructure, with some exceptions, will hardly meet the needs for the future FP7-ICT Theme.

Considering **planned infrastructure** for ICT RTD activities the main Government plans are connected to the Government project for investment in Serbian R&D infrastructure, SEE Light project, National Supercomputing and Data Storage Center Project – Blue Danube. For sure, the most important is the Serbian R&D infrastructure investment initiative.

The Government Project for investments in infrastructure, worth EUR 300 million should start in March and last till the end 2015. **Budget planed for ICT infrastructure is between EUR 50 and 80 million.** Main targets are advanced infrastructure and new human resources in this area: campus of faculties in the area of ICT Sciences, University of Belgrade and infrastructure for supercomputing initiative "Blue Danube".

The SEELight project tackles the materialization of the South-East European Lambda Network Facility for the regional research, academic and education communities. The project envisages leasing optical telecommunication systems for a period of 15 years and the purchase of equipment for the academic network in Serbia. The project is expected to be completed by 2011.

The South-East European eInfrastructure initiatives are committed to ensuring equal participation of the less-resourced countries of the region in European trends. SEE-GRID-SCI is a 2 year project co-funded by the European Commission, started on 1 May 2008. SEEREN initiative has established a regional network for Serbia and other SEE countries.

The estimation is that planned infrastructure **mainly satisfies** the need of Serbian researcher for an effective participation in the FP7 – ICT Theme. However, as the equipment include instruments, computer equipment, networks and other equipment that lie on the boundary of acceptable technical and technological level, consistent realization of the planned investment in infrastructure for ICT RTD is necessary. The large scale and similar R&D equipment is missing.

### **0.3.5 Analysis of the ICT-RTD capabilities in Serbia and the measures to maximize the Serbia's potential in the FP7-ICT Theme**

Task 5 is focused on detection centers of excellence in both private and public sector, in order to identify the key players with potential per FP7–ICT Theme Challenge and Objectives. Finally, this Task provides conclusions followed by recommendations of the actions needed to be taken at national and European level in order to increase the participation of both private and public sector carrying out ICT RTD in Serbia.

Within Task 5 relevant financing authorities, major centers of ICT RTD excellence and potential centers of ICT RTD excellence were detected. In addition, live interviews with relevant entities were conducted with the main goal to get the qualitative picture on Serbian ICT RTD entities' readiness for participation in FP7 projects.

Based on direct contacts (in the period from October 15 until December 03, 2009) with the key research units and organizations Serbian Competence Data Base (SCDB) "Who is who in ICT RTD in Serbia" was created. Database contains 40 profiles of research units and organizations in ICT area in Serbia from High Education sector, Institutes, Business sector and Others.

Actions need to be taken both at national level and at EU level and to overcome the problems and barriers which significantly inhibit the participation of Serbian entity in FP7 were proposed and presented separately.

### **Centres of Excellence (CoE)**

For the requirements of this analysis the quantitative and qualitative criteria were defined and then applied to obtain the consolidated list of CoE and consolidated list of potential CoE. The first quantitative criterion is based on data analysis from Annex I Who is Who in ICT Research, Section Research areas of main expertise according FP7-ICT Challenge and Objectives. The main idea was to form the Competence/Share Matrix (CSM) of identified CoE, presented in Figure 10. For each research unit the data on its expertise according to FP7-ICT objectives is considered (from Annex I – Who is Who). For each research unit the sum of declared expertise is presented as a number in a column "Total".

Explanation: CSM presents two parameters compound for each research unit: Centre Competence Ratio (CCR) and Centre Share Ratio (CSR). CCR [%] is ratio of number of expertise for particular research unit and a number of Challenges from which these expertise are coming combined with ratio of number of researchers of that particular research unit and total number of researchers (of all consolidated research units). CSR [%] is ratio of number of expertise for particular research unit and the total number expertise (of all consolidated research units).

As the second quantitative criterion the number of researchers (Ph.D, M.Sc. and B.Sc) and the number of employees in development sector (Senior and Junior R&D staff) were used, column "NoR".

**Identified CoE** are organizations and research units with necessary critical mass of knowledge, resources and infrastructure, thus capable of achieving research results. For indentifying the CoE the threshold of at least 3 expertise and minimum of 9 researchers (Ph.D, M.Sc. and B.Sc) was set. Selection of 17 entities is presented. Among them three research units, all of them institutes, have significantly bigger number of researchers than average and three research units have significantly bigger number of expertise than average. Only two organizations from consolidated list of CoEs came outside High Education Sector and Institutes: one from industry sector and one from SME.

Table 10 Consolidated list of identified centres of excellence

Short name	Research unit	NoE	NoR	Expertise by FP7-ICT Challenge and Objective								Total	CC1	CSR [%]	CCR [%]
				1	2	3	4	5	6	7	FET				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
IMP	INSTITUTE MIHAILO PUPIN	437	205	[1.2] [1.3]	[2.1] [2.2]	[3.4] [3.5] [3.6]	[4.2] [4.3]	-	[6.1] [6.2] [6.3] [6.4] [6.5]	[7.2] [7.3]	2	<b>18</b>	2,6	7,1	43,0
IPB	INSTITUTE OF PHYSICS BELGRADE	180	140	[1.1] [1.2] [1.6]	-	[3.1] [3.2] [3.5] [3.6] [3.7]	[4.1] [4.2]	-	[6.3] [6.4]	-	5	<b>17</b>	3,4	6,7	38,8
FON.1	FACULTY OF ORGANIZATIONAL SCIENCES (FOS), UoB, Chair for e-Business and System Management	9	9	[1.1] [1.2] [1.3] [1.4] [1.5] [1.6]	-	-	[4.1] [4.2] [4.3]	-	[6.1] [6.2] [6.3] [6.4] [6.5]	[7.1] [7.2] [7.3]	-	<b>17</b>	4,3	6,7	3,1
ETF.1	SCHOOL OF ELECTRICAL ENGINEERING, UoB, Department of Electronics	21	18	[1.1]	-	[3.2] [3.3] [3.5] [3.6] [3.9]	-	[5.2]	[6.1] [6.2] [6.3] [6.5]	-	2	<b>13</b>	2,6	5,1	3,8
ETF.2	SCHOOL OF ELECTRICAL ENGINEERING, UoB. Chair of Automatic Control	24	24	-	[2.1]	[3.4]	-	[5.1] [5.2] [5.3]	[6.1] [6.2] [6.3]	[7.1] [7.2]	2	<b>12</b>	2,0	4,7	3,9
CIM	CIM COLLEGE (CIM GROUP)	25	20	[1.2] [1.3] [1.6]	-	-	[4.3]	[5.2]	[6.1] [6.3] [6.4] [6.5]	[7.3]	2	<b>12</b>	2,0	4,7	3,3
ETF.3	SCHOOL OF ELECTRICAL ENGINEERING, Department of Telecommunications	28	28	[1.1] [1.2] [1.4] [1.6]	-	[3.4] [3.5] [3.6]	-	-	[6.2]	-	2	<b>10</b>	2,5	3,9	5,7

Consolidated list of identified centres of excellence – Objective’s expertise – Continued Table 8.

Short name	Research unit	NoE	NoR	Expertise by FP7-ICT Challenge and Objective								Total	CC1	CSR [%]	CCR [%]
				1	2	3	4	5	6	7	FET				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
FON.2	FACULTY OF ORGANIZATIONAL SCIENCES (FOS), UoB. GOOD OLD AI	100	20	[1.2] [1.3] [1.6]	[2.1] [2.2]	-	[4.1] [4.2] [4.3]	-	-	[7.2]	-	9	2,3	3,5	3,7
ETF.4	SCHOOL OF ELECTRICAL ENGINEERING, UoB. Chair Of Computer Engineering and Information Theory	24	24	[1.2] [1.5]		-	[4.2] [4.3]	[5.1] [5.2]	[6.1] [6.2]	[7.3]	-	9	1,8	3,5	3,5
FTN.1	FACULTY OF TECHNICAL SCIENCES, University of NOVI SAD Chair of Communications and Signal Processing	25	24	-	[2.1] [2.2]	-	[4.3]	-	-	[7.1] [7.2]	2	7	1,8	2,8	3,4
PMF	FACULTY OF MATEMATICS UNIVERSITY OF BELGRADE Department of Computing and Informatics	35	21	[1.1] [1.2] [1.3]	[2.2]	-	[4.1] [4.2] [4.3]	-	-	-	-	7	2,3	2,8	4,0
ELFAK.1	Faculty of Electronic Engineering, University of Niš, Laboratory for Electronic Design Automation (LEDA)	12	11	-	-	[3.2] [3.4]	[4.2]	-	[6.3] [6.5]	-	1	6	1,5	2,4	1,3
IMTEL	Institute for Microwave Techniques and Electronics (IMTEL)	49	22	[1.6]	[2.1]	[3.4] [3.5] [3.9]	-	-	-	-	-	5	1,7	2,0	3,0
ETF.5	SCHOOL OF ELECTRICAL ENGINEERING, UoB. Chair of General Electrical Engineering	13	13	[1.6]	-	[3.2] [3.9]	-	-	[6.2] [6.4]	-	-	5	1,7	2,0	1,8
ELFAK.2	Faculty of Electronic Engineering, University of Niš Chair Of Telecommunications	26	26	-	[2.1] [2.2]	[3.4]	-	-	[6.2]	-	-	4	1,3	1,6	2,8
IRITEL	IRITEL AD BEOGRAD	195	85	[1.1]	-	[3.4] [3.5]	-	-	-	-	-	3	1,5	1,2	10,4
DKTS	PUPIN TELECOM DKTS	165	40	-	-	[3.4]	-	-	[6.3] [6.5]	-	-	3	1,5	1,2	4,9
	TOTAL	1368	730	30	11	28	18	7	33	12	18	157			

**Legend:**

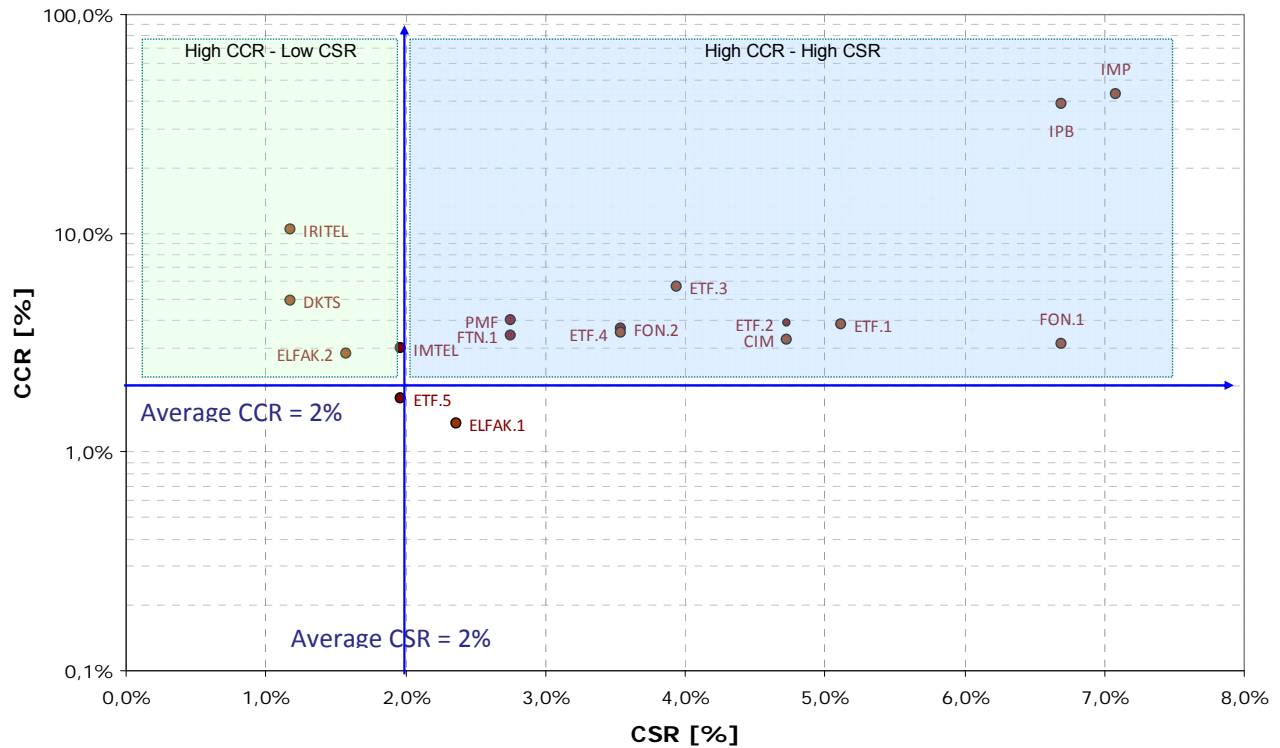
- |   |  |
|---|--|
| 1 - Pervasive and Trustworthy Network and Service Infrastructures | 5 - Towards sustainable and personalized healthcare      |
| 2 - Cognitive Systems, Interaction, Robotics                      | 6 - ICT for Mobility                                     |
| 3 - Components, systems, engineering                              | 7 - ICT for Independent Living, Inclusion and Governance |
| 4 - Digital Libraries and Content                                 | FET - Future and Emerging Technologies                   |

Table 11 Identification of FP7-ICT objectives of Serbian entities

		Research areas of main expertise according FP7-ICT Challenge and Objectives	Expertise		Competence Share Matrix	
			No. of research units	No of researchers	CCS	CCR
1	A.0	<b>Pervasive and Trustworthy Network and Service Infrastructures</b>		1004		
[1.1]	A.1	The Network of the Future	9	332	27,1%	37
[1.2]	A.2	Internet of Services, Software and Virtualisation	18	780	63,6%	43
[1.3]	A.3	Internet of Things and Enterprise environments	15	570	46,5%	38
[1.4]	A.4	Trustworthy ICT17	4	41	3,3%	10
[1.5]	A.5	Networked Media and 3D Internet	3	33	2,7%	11
[1.6]	A.6	Future Internet experimental facility and experimentally driven research	9	263	21,4%	29
2	E.0	<b>Cognitive Systems, Interaction, Robotics</b>		364		
[2.1]	E.1	Cognitive Systems and Robotics	7	305	24,9%	44
[2.2]	E.2	Language-Based Interaction	9	318	25,9%	35
3	B.0	<b>Components, systems, engineering</b>		731		
[3.1]	B.1	Nanoelectronics Technology	1	140	11,4%	70
[3.2]	B.2	Design of Semiconductor Components and Electronic Based Miniaturised Systems	4	182	14,8%	46
[3.3]	B.3	Flexible, Organic and Large Area Electronics	0	0		
[3.4]	B.4	Embedded Systems Design	11	462	37,7%	42
[3.5]	B.5	Engineering of Networked Monitoring and Control systems	9	524	42,7%	58
[3.6]	B.6	Computing Systems	7	491	40,0%	70
[3.7]	B.7	Photonics	1	140	11,0%	70
[3.8]	B.8	Organic Photonics and Other Disruptive Photonics Technologies	0	0		
[3.9]	B.9	Microsystems and Smart Miniaturised Systems	4	63	5,1%	16
4	F.0	<b>Digital Libraries and Content</b>		804		
[4.1]	F.1	Digital Libraries and Digital Preservation	10	381	31,1%	38
[4.2]	F.2	Technology-Enhanced Learning	10	451	36,8%	45
[4.3]	F.3	Intelligent Information Management	16	609	49,6%	38
5	D.0	<b>Towards sustainable and personalized healthcare</b>		300		
[5.1]	D.1	Personal Health Systems	8	262	21,4%	33
[5.2]	D.2	ICT for Patient Safety	9	281	22,9%	31
[5.3]	D.3	Virtual Physiological Human	3	170	13,9%	57
[5.4]	D.4	International Cooperation on Virtual Physiological Human	1	10	0,8%	10
6	G.0	<b>ICT for Mobility, Environmental Sustainability and Energy Efficiency</b>		690		
[6.1]	G.1	ICT for Safety and Energy Efficiency in Mobility	9	339	27,6%	38
[6.2]	G.2	ICT for Mobility of the Future	9	401	32,7%	45
[6.3]	G.3	ICT for Energy Efficiency	10	497	40,5%	50
[6.4]	G.4	ICT for Environmental Services and Climate Change Adaptation	6	397	32,4%	66
[6.5]	G.5	Novel ICT Solutions for Smart Electricity Distribution Networks (Joint call between the ICT and Energy Themes)	7	313	25,5%	45
7	C.0	<b>ICT for Independent Living, Inclusion and part. Governance</b>		568		
[7.1]	C.1	ICT & Ageing	5	95	7,7%	19
[7.2]	C.2	Accessible and Assistive ICT	7	446	36,3%	64
[7.3]	C.3	ICT for Governance and Policy Modelling	10	490	39,9%	49



Figure 8 Competence/Share Matrix of identified CoE in Serbia

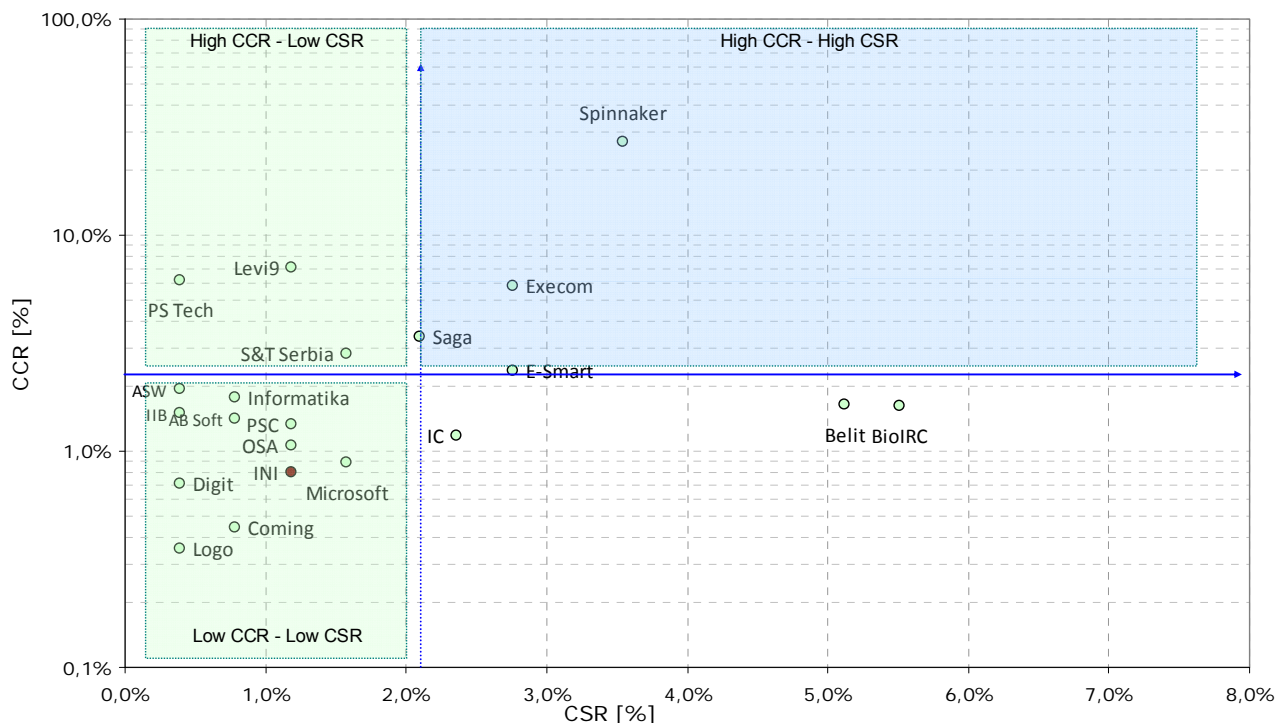


**Identified potential CoE** are organizations and research units with potentially sufficient critical mass of knowledge, resources and infrastructure and perspective to manage achieving research results in the near future. For indentifying the potential CoE the threshold of at least one FP7-ICT expertise and minimum of four senior researchers (Ph.D, M.Sc. and B.Sc) was set. Selection of 23 entities is presented. Among these organizations three research units, all of them very active on international IT market, have significantly bigger number of researchers than average and three research units have significantly bigger number of declared expertise than average. Only one organization was successful in FP7-ICT Theme.

The diagram below can be considered as a good base as well as an instrument for monitoring potential CoE.

Figure below presents competence (CCR) and share (CCS) matrix of potential CoE. Diagram shows that Spinnaker, Execom, E-Smart and Saga have both competences and share to the extent that qualifies them for becoming the CoE. For these entities is necessary only to verify their declared FP7-ICT expertise. Levi9, S&T Serbia and PS Tech are with solid competences, but are insufficiently in line with Fp7-ICT Objectives. Belit, BioIRC are in solid line with FP7-ICT Objectives, but are missing the critical mass of researchers.

Figure 9 Competence/Share Matrix of identified potential CoE in Serbia



⇒ Entities, which find themselves in the lower left quadrant of the diagram, are with potential for becoming CoE. However, this potential is, for now, not sufficient both in competences (CCR) and share (CSR). The main reason for this situation lies in these entities' focus, which is not on ICT RTD.

Table 12 Consolidated list of identified potential centres of excellence

Research unit	NoE	NoR	Expertise by FP7-ICT Challenge and Objective								Total	CC1	CSR	CCR
			1	2	3	4	5	6	7	FET				
BioIRC, Bioengineering Research and Development Center, Kragujevac	15	10	-	2.1 2.2	3.6 3.9	4.3	5.1 5.2 5.3 5.4	6.1	7.1	3	14	2,0	5,5%	1,6%
Belit Ltd. - Belgrade Information Technologies	17	10	1.2 1.3	2.2	3.5	4.1 4.2 4.3	5.1 5.2 6.4 6.5	6.1	-	1	13	1,9	5,1%	1,6%
SPINNAKER NEW TECHNOLOGIES ltd.	212	136	1.2 1.3	-	-	4.1 4.3	5.1 5.2 5.3	-	7.2 7.3		9	2,3	3,5%	27,2%
E-SMART SYSTEMS DOO	48	19	1.2 1.3	-	3.4	-	5.1 6.3	6.1 6.3	7.3		7	1,4	2,8%	2,4%
EXECOM d.o.o	41	28	1.2 1.3	-	-	-	5.1 5.2	-	7.1 7.2 7.3		7	2,3	2,8%	5,8%
Innovation Center, School of ETF	14	11	1.6	-	3.5	-	5.1 5.2	6.3	7.3		6	1,2	2,4%	1,2%

Research unit	NoE	NoR	Expertise by FP7-ICT Challenge and Objective								Total	CC1	CSR	CCR	
			1	2	3	4	5	6	7	FET					
SAGA d.o.o.	290	23	1.1 1.2 1.3	2.2	-	-	-	-	-	7.3		5	1,7	2,0%	3,4%
RCUB			1.1 1.2 1.4 1.5 1.6	-	-	-	-	-	-	-		5	5,0	2,0%	0,0%
S&T Serbia	86	16	1.2 1.3	-	-	4.1 4.3	-	-	-	-		4	2,0	1,6%	2,8%
Microsoft Software Ltd.	19	5	-	2.2	-	4.1 4.2 4.3	-	-	-	-		4	2,0	1,6%	0,9%
INI	20	6	1.2	-	-	4.2 4.3	-	-	-	-		3	1,5	1,2%	0,8%
OSA Racunarski Inzenjering	29	8	1.1	-	-	4.1 4.3	-	-	-	-		3	1,5	1,2%	1,1%
PSC doo	42	15	-	-	-	4.3	-	-	7.3	1		3	1,0	1,2%	1,3%
Levi9 Global Sourcing Balkan	102	80	-	-	3.6	4.3	-	6.2	-	-		3	1,0	1,2%	7,1%
Coming Computer Engineer.	30	5	1.2	-	3.5	-	-	-	-	-		2	1,0	0,8%	0,4%
AB Soft	40	16	1.3	-	-	4.1	-	-	-	-		2	1,0	0,8%	1,4%
INFORMATIKA AD	200	10	-	-	3.4 3.6	-	-	-	-	-		2	2,0	0,8%	1,8%
IIB d.o.o.	25	17	1.3	-	-	-	-	-	-	-		1	1,0	0,4%	1,5%
ASW INZENJERING Ltd.	42	22	1.3	-	-	-	-	-	-	-		1	1,0	0,4%	2,0%
PSTech d.o.o.	75	70	1.2	-	-	-	-	-	-	-		1	1,0	0,4%	6,2%
Digit	76	8	1.3	-	-	-	-	-	-	-		1	1,0	0,4%	0,7%
LOGO d.o.o.	74	4	1.4	-	-	-	-	-	-	-		1	1,0	0,4%	0,4%
INTENS d.o.o Novi Sad	42	4	-	-	-	-	-	-	-	-		1			0,0%
	1539	523	28	5	9	18	14	8	10	5		98	12,3	38,2%	

#### Legend:

- |   |  |
|---|--|
| 1 - Pervasive and Trustworthy Network and Service Infrastructures | 5 - Towards sustainable and personalized healthcare      |
| 2 - Cognitive Systems, Interaction, Robotics                      | 6 - ICT for Mobility                                     |
| 3 - Components, systems, engineering                              | 7 - ICT for Independent Living, Inclusion and Governance |
| 4 - Digital Libraries and Content                                 | FET - Future and Emerging Technologies                   |

### 0.3.6 Delphi survey to identify latent ICT-RTD potential in Serbia

Task 6 considered two rounds of Delphi process on selected group of experts in Serbia. The whole process is divided into three phases: (1) preparation phase, which covers the development of methodology, identification of the initial expert group and defining the plan (time schedule) for all activities; (2) questionnaire preparation and two rounds of interviews are conducted; (3) the analysis of all the answers and writing the report.

Delphi survey is based on the principle that forecasts using a structured group of experts is more accurate than those using unstructured groups or individuals. The questions in survey were prepared aiming to give as realistic picture as possible of present situation in Serbian ICT

RTD area. Questions are regarding participation in FP7-ICT projects (section B); current situation, problems and actions (section A); barriers in Serbian ICT RTD area (section C) and probability of Government plans realization (section D).

### **Section B – Participation in FP7-ICT projects**

- ⇒ **Information level of Serbian entities on FP7-ICT projects:** Serbian entities have positive level of information regarding participation in FP7-ICT projects. 78% of experts were familiar with the FP7-ICT opportunities.
- ⇒ **Cooperation of Serbian entities in FP7- ICT projects:** Less than half of interviewed have experience in cooperation with partners from EU. 49% knows how to find EU partners, 42% have tried, and only 25% was successful in partner search.
- ⇒ **Participation of Serbian ICT RTD organizations in consortia:** Only 35,6% of experts have participated in consortia with other partners.
- ⇒ **Support for preparation of project proposal:** Three quarters of interviewed need support for FP7-ICT project proposals, while 24% does not need any support as having the experience.
- ⇒ **Main barriers for participating in FP7 calls/projects:** Individual answers express some common barriers such as (1) current research is not in the line with FP7 priorities; (2) time schedule is already fulfilled; (3) too much bureaucracy for proposal preparation and (4) lack of administrative capacities.
- ⇒ **Benefits from participation in FP7\_ ICT projects:** The interviewed experts absolutely recognize the exceptional benefit from participation in FP7\_ ICT projects.
- ⇒ **Reasons for not participating in FP7\_ ICT projects:** The interviewed agreed on lack of the administrative capacities mark (6,9) and that Budget for local participants is usually low (insufficient) (5,8). Unsuitable time to market was marked with 5.3.

### **Section A – Current situation, problems and actions**

- ⇒ **Current situation:** Financial resources for ICT researches in Serbia are still inefficient for increasing participation in FP7-ICT projects (7,7 of 10 for maximal agreement) and that Serbian participation in FP7-ICT is unsatisfactory (7,3). Government is playing active role in strengthening the Serbian capacities in ICT research (6,9). Political support for ICT RTD in Serbia is inefficient for increasing participation in FP7-ICT projects (6,8).
- ⇒ **Problems and differences:** Identified problems on Serbian side are: insufficient knowledge of possibilities for cooperation with EU (7,0), insufficient involvement of actors from private sector in ICT researches (7,0) as well as insufficient involvement of actors from industry sector (7,6) because of hampering the usage of the research results. As for

the EU side, there is a problem of excessive bureaucracy (7,3) and opposite to this one, EU coordination of programs and support measures (5,9), which indicates that this is not seen as an serious barrier.

**Top3 recommendations and proposed actions on the national level:** Using the evaluation marks as criteria, the proposed actions are in the following order:

- ⇒ Rise the investment in professional education as this is the only way out from the unsustainable situation of Serbian economy (8,6);
- ⇒ Set up various financing models/programms for stimulating ICT research from the aspect of Serbian participation in FP7-ICT projects (8,4);
- ⇒ Significantly increase the investment in infrastructure for FP7-ICT projects (8,3);

### **Section C – Barriers in Serbian ICT RTD area**

- ⇒ **Evaluation of the barriers in Serbian ICT RTD area:** Most important detected barriers are two financial barriers: lack of investments from the business sector in R&D (8,3) and low level of national financial funds for RTD in ICT sector (8,0).
- ⇒ **Education – academic barriers in ICT RTD sector – Delphi Round 2:** Interest of academic society to participate in FP7-ICT Theme and number of PhD studies in ICT area were marked medium low, between (4,6) and (5,1) which indicates that these issues are considered as modest barriers for Serbian ICT RTD sector.

**Section D – Probability of Government plans realization:** The level of confidence in realization of the key Government plans related to ICT RTD in Serbia was analyzed through answers on the three questions where experts were asked to give probability of realization in the range from 0% - unrealizable to 100% - realizable. Given answers show the high level of suspicion (mistrust) of the interviewed regarding realization of the presented Government goals.

### **0.3.7 Opportunities and barriers for increasing the contribution of Serbia to the FP7-ICT**

Task 7 provides a comprehensive overview of ICT RTD sector in Serbia today. To accomplish the SWOT analysis of the objective defined as "Successful participation and integration of Serbian ICT RTD in the FP7 – ICT Theme", the following perspectives in identification and analysis of the opportunities and barriers were considered: (1) Legal and Regulatory Environment; (2) Serbian ICT RTD Infrastructure; (3) Serbian ICT RTD Sector; (4) Serbian ICT RTD Sector in FP7-ICT Theme. Each section is examined through a SWOT analysis lens, i.e., by examining related strengths, weaknesses, opportunities and threats. The final SWOT table is presented below.

Table 13 SWOT Analysis Summary

Strengths	Weaknesses
<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>Present ICT RTD L&amp;R Environment is in process of harmonization with EU</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>Existing research infrastructure of Academic Network of Serbia (AMRES)</li> <li>Existing of Academic and Educational Grid Initiative of Serbia (AEGIS)</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>Solid number of preserved Serbian experts</li> <li>ICT related Education system</li> <li>Solid institutes market orientation</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>Above EU average Success Rates of Serbian participants</li> <li>Solid competence of Serbian entities</li> <li>Programs of institutes and faculties are in line with the FP7-ICT Theme</li> </ul>	<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>Insufficient political support in practice</li> <li>Lack of dedicated Government body in charge of ICT RTD</li> <li>Problematic implementation of ICT RTD strategic documents</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>Current infrastructure for ICT RTD activities in Serbia is undeveloped</li> <li>Lack of large-scale R&amp;D equipment</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>Serbian ICT RTD system is of inadequate efficiency</li> <li>Brain drain</li> <li>Neither visible focus on ICT RTD priorities defined in Strategy, nor partnering</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>Serbia is a latecomer to the FP programs (2002)</li> <li>Insufficient experience in search for consortium partners</li> <li>Limited Serbian lobbying ability</li> </ul>
Opportunities	Threats
<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>Ambitious plans expressed in strategy papers in the ICT RTD field</li> <li>Creation and rapid adoption of Action Plan for the Strategy for Science and Technological Development</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>50-80 M Euro ICT RTD investment from 300 M Euro Investment initiative</li> <li>Development of Broadband Access (AMRES/EMRES)</li> <li>Establishment of regional centre for supercomputing</li> <li>Improvement of SEE-GRID-SCI (SEE-GRID eInfrastructure for regional eScience)</li> <li>Huge potential of EPS optical network</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>Good price / quality ratio of Serbian services</li> <li>Solid expertise in particular FP7-ICT areas</li> <li>Implementation of the Strategy “Focus and partnering”, which is expected to come soon</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>Room for increasing participation</li> <li>Use capacity of leading Serbian entities</li> <li>Fully recognizing of benefits from participation in FP7-ICT</li> <li>Positive attitude towards FP7-ICT</li> <li>Transfer of evaluators’ knowledge and experience</li> </ul>	<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>Still present political instability in the country/region</li> <li>Low level of investments in science and research (around 0,3% GDP)</li> <li>Non-customized mirrored policy</li> <li>Mistrust in the promises of the policy makers</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>With few exceptions, obsolete existing infrastructure</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>Serbia as a latecomer to the international ICT RTD scene (2001)</li> <li>Brain drain</li> <li>Weak cooperation on ICT projects</li> <li>Long time present differences between Serbian and European researchers</li> <li>Stereotype image of Serbian research</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>Difficulties in reaching the big EU15 consortia</li> <li>Low participation of Serbian entities</li> <li>Negative “cash flow”</li> <li>Generally low FP7-ICT financial support for Serbian ICT RTD</li> <li>Complex proposal writing/preparation</li> <li>Excessive bureaucracy</li> <li>Lack of evaluation and scientific ranking of projects</li> </ul>

### 0.3.8 Conclusions and Recommendations

Main conclusions and following recommendations are presented through detected barriers and the ways to overcome them, aiming to be actionable as much as possible. Each recommendation begins with a conclusion (a core sentence) which is stressed in a bold font. The priority was given to **measures to maximize the Serbia's potential in the FP7-ICT Theme**. Following are **recommendations regarding ICT RTD sector** and **recommendations on current and planned ICT-RTD infrastructure in Serbia**. Finally, there are **recommendations regarding ICT RTD Legal and Policy Environment**.

The recommendations were separated into recommendations at EU Level and National Level.

#### List of recommendations at EU level

**Serbia is the new player in Framework Programs**, that came after many years of sanctions and standing aside of European research area and world RTD science.

⇒ It is suggested to create actions on EU level to promote and encourage Serbian RTD science through brokerage events, knowledge exchange and networking.

**The general perception of European researchers is that, with exceptions of some recognized cases of excellence, the level of Serbian research is low, particularly compared with the EU15.**

⇒ In order to change this stereotype about Serbia, either a lot of years of hard and successful work or a very good "successful cases" marketing is needed, focused on a target group of exquisite European research organizations.

**Low participation of Serbian entities indicates the absence of the ICT RTD critical mass and insufficient interest of academic elite for participation in FP7-ICT.** In general, the focus of Serbian researchers is not on FP7-ICT projects, putting the total number of Serbian participants among the lowest in Europe – only 18 Serbian successful applicants (representing 0,23% of total EU applicants). Low participation could in turn bring Serbia to negative balance in the following FP cycle. As a consequence, the share of Serbian contribution to the EU budget could exceed the amount that Serbian entities will be able to pool based on their results.

⇒ The actions considered of having the most influence on increasing participation of Serbian entities in FP7-ICT Theme are: EDUCATION and MOTIVATION programs. For entities that have participated in the FP6-IST and FP7-ICT Theme but did not have success (have willingness, but low capacity) **educational programs** (training) are proposed. For number of entities in Serbia that have not participated in previous FP cycles although have the

required ICT RTD capacity for successful participation (have capacity but not willingness) **motivation programs** are proposed.

**Difficulties in reaching the big EU15 consortia:** In the time between the starting of the FP initiative and the moment when Serbia joined the FP (after almost two decades), big and successful consortia had already been established in the EU15, even before the EU12 extension. Rigidity of these consortia for new partners joined by weak connections of Serbian ICT RTD entities with EU research institutions create one of the main barriers to Serbian bigger participation in the FP-ICT Theme.

- ⇒ Targeted regional calls for common Western Balkan ICT R&D priorities are suggested for improving the regional cooperation, experience exchange and speeding up solving the common problems and barriers. It is recommended to focus on demand/application-oriented issues.
- ⇒ Apart from targeted calls on regional priorities, the support actions for other (EU) priorities that are underdeveloped in the region are recommended.

**Average EU FP7 financial support for Serbian ICT RTD is small.** It is estimated that FP7-ICT projects contribute to Serbian ICT RTD sector with about EUR 2 million per year. The results from Delphi survey show that the extent to which the budget for local participants in FP7-ICT is sufficient is low (evaluated with the average mark 4.6 out of 10).

- ⇒ In the years to come Serbia will have to increase more than three times its participation according to future bigger national contribution amount. There is a perception that contracted monthly payments of Serbian researchers are not seen as stimulation for further increasing participation.
- ⇒ It is suggested to Ministry of Science and Technological Development to consider actions for increasing the amounts for monthly payments of Serbian ICT RTD researchers, which are currently significantly lower than EU average.
- ⇒ In addition, EU is encouraged to continue its financial support by participating in further projects / actions for specific ICT RTD infrastructure (like regional projects SEEREN, SEEREN2, SEE-GRID, SEE-GRID-2, SEE-GRID-SCI, SEERA-EI; SEE-Light, AEGIS, Blue Danube and others).

### **List of recommendations at EU level and national level**

**The high demanding administration activities and weak Serbian administration capacities for FP7-ICT requirements** have been observed as one of the main barriers. The proposal writing/preparation is a complex and time-consuming work. Opposite to Serbia, in the



EU15 this complex process of preparation is successfully distributed to well trained and experienced consortia partners, which brings them significant advantage.

- ⇒ Consider capacity-building actions for improving skills of Serbian ICT researchers, particularly in FP7 application procedures, project planning and management (including financial management). In collaboration with National Contact Points and the EC establish the National organization dedicated to training courses on FP7-ICT topics.
- ⇒ It is suggested to enable FP7 participants to outsource their administration activities by establishing of the centers with capacity for administration, financial reporting and project management support.
- ⇒ Consider establishing regional administrative center for FP7-ICT to enable ICT RTD organizations in the region to outsource these activities.

### **List of recommendations at national level**

**Brain drain** is a very complex barrier, which can be identified as an internal weakness of the organization, sector or country but also as an external threat coming from the outside.

- ⇒ The Government has announced a plan (through the Strategy for Science and Technological Development) for stopping the 'brain drain' as well as for stimulating the return of the experts already abroad. It is suggested to speed up the realization of this plan.

**Negative "cash flow" is frequent appearance in Serbia.** For organizations with weak financial capacity and with the team of researchers dedicated to the FP7 project, period of 3 years with the lack of capital can become a serious problem.

- ⇒ Government should consider possibility of giving guaranties for organizations with approved FP7 projects if they need financial support from banks (loans or other financial options). This would help organizations that participate in FP7 to cover their expenses in the period from project approval to the real pay off by the EC.

**Insufficient Government funding for FP7-ICT projects.** Current additional funding for FP7 projects in Serbia provided by Government is 10% of total project value (results of the Delphi survey).

- ⇒ According to interviewees, it is proposed to increase this amount to 25% of the project value. Also, it is suggested to provide additional sources of financing at the national level for organizations with approved FP projects. This will encourage participants for FP7 and help building the necessary critical mass of researchers in the most of successful entities.
- ⇒ Additional measures regarding ICT projects financing could be: Abrogation on taking 40% of incomes of faculties and budget-funded research centres.

**The preparation of proposals for FP7-ICT requires high expertise** and other skills and it should be properly evaluated in the meaning of scientific ranking.

- ⇒ Due to high evaluation criteria and generally low success rate in FP7-ICT Theme, the suggestion is to include the participation and successfulness in FP7 projects in the existing evaluation criteria of science and research work

**Missing public national ICT RTD database:** Due to the lack of a national public database of ICT RTD participants and organizations, Serbian entities are faced with the challenge of identifying the project partners within Serbia as well as connecting to other researchers and industry (networking). Partner search processes both within the national and European level are hampered.

- ⇒ It is recommended to create a public national database of R&D actors and organizations and to improve processes for partner search both within the country and SEE region;
- ⇒ In addition, such a database could be used as a knowledge base as well as a source for "know-how" and ICT solutions. This kind of database could be useful for attracting big users of IT solutions and help applicants in their search for partners from the end-user sector.

**Low participation of "third sector":** The Government almost exclusively follows up and regulates the relationships inside ICT RTD area of state-owned entities and their financing. One of observed general problems from the Delphi survey (Task 6) is low participation of Serbian "third sector" (business, private, SME and NGO) in FP7-ICT projects.

- ⇒ It is recommended to define policy/strategy for including the "third sector" (industry, business and SME sector) with its hidden ICT RTD potential, which is currently invisible for Government. It is suggested to the Ministry for Science and Technological Development to put the special emphases on the SME sector and its involvement in different international cooperation programmes and particularly FP7-ICT through the following actions: (1) Case studies for presenting the added value of participation in FP7 projects; (2) 10 most successful SME participants in FP7 granted from ICT RTD fund every year; (3) Tax stimulations for SME whose proposals for FP7 are evaluated above defined threshold.

**Weak communication of ICT RTD sector with policy creators:**

- ⇒ It is recommended, before adopting the final Action Plan for the Strategy, that the Government in cooperation with ICT RTD experts concretizes/redefines ICT RTD priorities according to the needs of the ones most interested. Government has just initiated defining the ICT RTD priorities in cooperation with experts.

**Low investments in infrastructure** resulted in current infrastructure for ICT RTD activities in Serbia which is **undeveloped** due to the low and irregular investments, **inadequate** – due to the short amortization period of this type of equipment and discontinuity in upgrades or renewing and **only partially meets** the real needs of Serbian science and research.

- ⇒ Serbian R&D investment initiative (EUR 300 million), which is a part of the Science and Technological Development Strategy of the Republic of Serbia 2010 – 2015, is the main infrastructure opportunity. For the development of information and communication technology infrastructure budget of about EUR 50 – 80 million is planned. However, the lack of transparency, public available procedures and criteria on spending this amount are the barriers that could throw in the shade all other barriers as well as the planned results.
- ⇒ Enable clear procedure and criteria on spending the amount of EUR 300 million in R&D infrastructure and make it transparent and public available.

**Governmental funding for R&D projects is intended to limited number of organizations and institutions registered as SRO** (Science & Research Organizations). There are insufficient investments in R&D infrastructure through collaboration of businesses and universities.

- ⇒ Large ICT companies have potential for R&D in ICT but have low interest for investing in infrastructure. They should be stimulated or supported through governmental funds or tax benefits to invest in R&D infrastructure.

**Unrealized or partially realized implementation of adopted strategic documents is one of the most visible weaknesses in the ICT RTD area.**

- ⇒ The Action Plan for the Strategy for Development of Science and Research in Serbia (2010-2015) is the key document for realization and acceleration of progress in ICT RTD area but does not exist yet. Rapid adoption of reliable and concrete Action Plan is the first and necessary step. In order to obtain this goal, it is needed: to assure that the Strategy gets a wide and strong political and professional support; to engage the best experts for its implementation and for the Government to relocate the budget money from populist goals to development programs.

**Mistrust in the promises of the RTD policy makers represents a serious threat to accomplishing the given goals in ICT RTD development (according to the results of Delphi survey).**

- ⇒ The amount of skepticism shown by a number of experts can be understood as „a realistic observation“ of the issue, based on their previous experience. To overcome the identified gap between attitude of ICT “branch” and the one of RTD “policy creators” towards realization of government plans, it is necessary to significantly intensify and widen the

dialogue between them. The convergence of their positions is the key for the success of future work and plans.

**Non-customized mirrored policy: Instead of creating national and sustainable ICT RTD policy, there is a potential threat of non-customized imported policy from the EU.**

⇒ Careful creating of national and sustainable ICT RTD policy is needed, that will support High Tech projects and the best national ICT RTD institutes, instead of closing them and leading the ICT RTD sector into technologically subordinated position.

**[END OF EXECUTIVE SUMMARY]**

# 1 SERBIA – RTD TECHNOLOGICAL AUDIT – Simplified Report

This section gives the review and presentation of the current ICT RTD policy environment and its main opportunities and barriers based on desk research methodology and analysis of relevant documents. Major suppliers of the information: Ministry of Telecommunication and Information Society, Ministry of Science and Technological Development, key national and international documents and papers. Key documents were selected on the basis of the criteria of having the most influence on ICT RTD. A new criterion for the selection of relevant documents was proposed.

## ***1.1 Review of studies and strategy papers***

The Serbian ICT RTD Legal and Policy Framework are in the early stage of development. All the processes initiated in this field were set up for the first time in 2005. The following adopted laws define ICT RTD legal environment: Law on Science and Research Activities, Law on Innovative Activity, Law on Telecommunications, Law on Digital Signature, Law on Digital Document, Law on e-Commerce, Law on Personal Data Protection, Law on Data Access, and Law on Intellectual Property. Draft Version of the Law on Consumer Protection has been presented nowadays. The regulatory vacuum has just begun to fill; the Strategy for Information Society Development and the Strategy for Science and Technological Development (2010-2015) are the key policy documents for continuing ICT RTD development in Serbia.

The main document defining the ICT RTD operational framework in Serbia is The Action Plan for Implementation of the Strategy for Science and Technological Development in Serbia 2010-2015. Unfortunately, this Action Plan was planned for adoption before the end of the year (2009) does not exist yet. However, if Serbia wishes to get closer to the EU, the progress in ICT RTD area has to be faster.

### **1.1.1 Key national documents**

Taking into account that there are many documents with different degrees of impact and importance on ICT RTD, it was necessary to select the most relevant documents for deeper analysis. All the documents were divided according to two criteria: (1) Document type and (2) Area covered by the document. The key national documents are presented in the table below.

Table 14 ICT RTD national documents – Legal and policy framework

Id	Document title Year, source of document	Type 1	Type 2	Impact level ICT RTD
<b>Law</b>				
1	<b>Law on Scientific Research Activities</b> 2005, Government of the Republic of Serbia, Official Gazette RS br. Xxxo	1	3	① ② ③ ④ ⑤ ⑥
2	<b>Law on Innovative Activity</b> 2005, Government of the Republic of Serbia, Official Gazette RS br. 87/2006	1	3	① ② ③ ④ ⑤ ⑥
3	<b>Law on Telecommunications</b> 2003 and 2006, Government of the Republic of Serbia, Official Gazette RS br. 44/2003; 6/2006	1	2	① ② ③ ④ ⑤ ⑥
<b>Strategy</b>				
1	<b>Strategy for the Scientific and Technological Development of the Republic of Serbia 2010-2015. (Adopted in March 2010)</b> 2009, Ministry for scientific and technological development, www.nauka.gov.rs	2	3	① ② ③ ④ ⑤ ⑥
2	<b>Strategy on Development of Telecommunication of Serbia, 2006-2010</b> 2006, Government of the Republic of Serbia, Official Gazette RS br. 99/2006	2	2	① ② ③ ④ ⑤ ⑥
3	<b>Strategy for Development of Information Society in Serbia</b> 2006, Government of the Republic of Serbia, Official Gazette RS br. 87/2006	2	1	① ② ③ ④ ⑤ ⑥
<b>Action Plan</b>				
1	<b>The Action Plan for Implementation of the Strategy for the Scientific and Technological Development of the Republic of Serbia 2010-2015. (Planned for adoption in March 2010)</b> 2009, Ministry for scientific and technological development, www.nauka.gov.rs	3	3	① ② ③ ④ ⑤ ⑥
2	<b>eSEE Agenda+ for Development of Information Society in SEE 2007-2012</b> 2007, Ministers' conference in Sarajevo	3	2	① ② ③ ④ ⑤ ⑥

**Legend:**

**Type 1** - Document type: (1) Law; (2) Strategy; (3) Action Plan.

**Type 2** - Focus Area: (1) Information Society; (2) Information and Communication technology (3) Research Technology Development

In the table below there is a list of additional relevant documents for ICT RTD in Serbia which are already adopted or planned for adoption.

Table 15 ICT RTD additional strategic documents – Adopted and planned

Id	Document title Year, source of document	Type 1	Type 2	Impact level ICT RTD
<b>Adopted</b>				
1	<b>Strategy to increase participation of domestic industry in the development of telecommunications in the Republic of Serbia (adopted in December 2009)</b>	2	3	① ② ③ ④ ⑤ ⑥
2	<b>Strategy for the development of broadband in the Republic of Serbia to 2012 (adopted in September 2009)</b>	2	2	① ② ③ ④ ⑤ ⑥
3	<b>Strategy for Switchover from Analogue to Digital Broadcasting of Radio and Television Programmes in the Republic of Serbia (adopted in July 2009)</b>	2	2	① ② ③ ④ ⑤ ⑥
4	<b>Law on Electronic Documents (adopted in July 2009)</b>	1	2	① ② ③ ④ ⑤ ⑥

Id	Document title Year, source of document	Type 1	Type 2	Impact level ICT RTD
<b>Planned for adoption</b>				
5	Law on electronic communications	1	3	① ② ③ ④ ⑤ ⑥
6	Action Plan for implementation Strategy of Science and Technological Development in Serbia 2010-2015	3	3	① ② ③ ④ ⑤ ⑥
7	Action plan for the effective use of the telecommunications infrastructure for the needs of public telecommunications operators and state organs	3	2	① ② ③ ④ ⑤ ⑥
8	Strategy of development of electronic communications in the Republic of Serbia in the period 2010 to 2014	2	3	① ② ③ ④ ⑤ ⑥
9	Policy development of electronic communications in the Republic of Serbia from 2010 to 2014	2	2	① ② ③ ④ ⑤ ⑥

### 1.1.2 Review of National Action Plans on RTD

*The Action Plan for Implementation of the Strategy for Science and Technological Development in Serbia 2010-2015* is the main document defining the ICT RTD operational framework. Unfortunately, this Action Plan was expected to be adopted before the end of the year (2009) and currently does not exist.

*The Action Plan for eSEE Agenda+* is the only actual action plan aiming ICT RTD goals in Serbia. Accepting eSEE Agenda+, Republic of Serbia took responsibility for speeding up development of Information Society in the country.

*The Action Plan for Strategy on Development of Telecommunications of Republic of Serbia, 2006-2010.* The Strategy is followed by Action Plan which clearly defines goals and activities for speeding up development of telecommunication sector in Serbia for period 2006-2010.

Insufficient involvement of domestic industry with its ICT RTD capacities in the development of the telecommunication infrastructure as well as insufficient cooperation between MTIS (Ministry of telecommunications and Information Society) and MSRT (Ministry of Science) on defining the priority projects of national importance, both result in more investment in foreign and less in domestic vendor telecommunication equipment. However, the *Strategy on Increasing Participation of Domestic Industry in Development of Telecommunication in Serbia* was adopted recently. According to this Strategy, the part of the telecommunication industry which is involved in the development and production of equipment and material has to include domestic scientific and research institutions in its development projects based on long term programs.

Based on document analysis ICT RTD policy environment following opportunities and barriers are detected.

### 1.1.3 ICT RTD policy environment – Opportunities and Barriers

#### **Opportunities:**

***The Government is playing active role*** in strengthening Serbian capacities in ICT research for three main reasons: (1) research policy is created on the national level; (2) most ICT RTD activities are financed by the Government institutions and (3) most relevant research institutions are established by the state.

***Legal and policy framework harmonized with the EU:*** Although Serbia is late in harmonization of the legal and policy framework with the EU, laws and most required strategic documents in the ICT RTD area have been adopted. The Ministry of Telecommunication and Information Society has achieved significant progress, adopting regulatory documents in 2009.

***Ambitious plans expressed in strategy papers in the ICT RTD field:*** The legal and regulatory opportunities are related to big and ambitious plans expressed in strategic documents (regarding research and development as well as ICT RTD sector in particular). Recognizing the main weakness of the current investment of 0,3% GDP in R&D, plans to increasing investments to 1% GDP until 2014 are included in the Strategy for Science and Technological Development 2010-2015. Suppose a part of resources intended for the ICT RTD sector were at least in the same proportion as it had been so far, that would mean three times bigger funds in the future. Recognizing the significance of ICT RTD sector within the Strategy, EUR 300 million investment in research and development infrastructure is planned, EUR 50-80 million for ICT RTD.

***Creation and rapid adoption of Action Plan for the Strategy for Science and Technological Development:*** Implementation of the Strategy is of crucial importance for ICT RTD and it is expressed in the Action Plan to follow.

***New legal documents:*** The Law on Electronic Communications is harmonized with the EU regulatory framework 2002 and it will guarantee the acceleration of the liberalization process. The application of the Law on Innovative Activity enables creating suitable environment for increasing Serbia's capacity in this area.

***Strengthen cooperation and networking:*** at the regional and European level, particularly of policy makers. Participation of Serbian ICT RTD organizations in FP7 projects is of a high importance.



**Barriers:**

***The focus of the Government is moving from economic to political topics*** due to still present political instability in the country and region that will continue to be a latent threat until Serbia joins the EU. For that reason ICT topics will be put aside.

***Problematic implementation of ICT RTD strategic documents:*** Implementation of adopted but unrealized or partially implemented strategic documents is one of the most visible weaknesses in the ICT RTD area. The most characteristic examples are:

- ⇒ The Strategy for Scientific and Technological Development of the Republic of Serbia 2010 – 2015 will be adopted with a year of delay. The following Action Plan has not been announced yet.
- ⇒ The main shortcoming of the Law on Science and Research Activities is that the Law almost exclusively regulates the relationships within the science and research area of state-owned entities and their financing. “The third sector” (business, industry and SME) is not involved in ICT RTD (business sector is only tangentially involved) and is not statistically followed by the Government. The “third sector” does not participate in national ICT RTD projects (budget funding), but appear as co-financiers.
- ⇒ The Law on Innovative Activity inadequately regulates: the strengthening of innovative capacity, infrastructure development and transfer of results to business etc. Only accredited and registered organizations had access to budgetary resources. Some progress in innovation activities has been achieved but it is unsatisfactory.
- ⇒ The Strategy on Increasing Participation of Domestic Industry in Development of Telecommunication in Serbia, adopted in January 2010, only describes the current unfavorable situation, with no recommendations for substantial improvement.
- ⇒ The Strategy for Information Society Development and its Action Plan have been put aside.

***Lack of dedicated Government body in charge of ICT RTD:*** The authority on ICT RTD is unclearly split between two Ministries: the Ministry of Telecommunication and Information Society (MTIS) and the Ministry of Science and Technological Development (MSTD). Unofficially, ICT is under the authority of the MTIS and RTD under the MSTD.

***Insufficient political support in practice:*** The “one shelter” for ICT RTD that will enable coordination and synchronization of Serbian ICT RTD actors is missing in practice. According to experts’ answers from Delphi survey (Task 6) there are weak communication channels between the policy makers (the Ministry of Science and Development and the Ministry of Information and Telecommunication) and ICT RTD organizations.

***Mistrust in the promises of the policy makers*** (according to the results of Delphi survey) represents a serious threat to accomplishing the given goals in ICT RTD development. The level of confidence in realization of the key Government plans related to ICT RTD in Serbia was analyzed through answers to three questions where experts were asked to give the probability of realization in the range from 0% - unachievable to 100% - achievable. The given answers show a high level of mistrust of the interviewees regarding the realization of the presented Government goals.

***Non-customized mirrored policy:*** Instead of creating national and sustainable ICT RTD policy, there is a potential threat of non-customized imported policy from the EU. This way, instead of using the Serbian ICT RTD sector advantages, this sector could easily be put into subordinated position.

***Uncertain sources of funding:*** Increasing the budget for science and research is one of a few Government obligations for which the resources have not been provided. The lack of resources is planned to be compensated from the business sector. Unless this is achieved, the budget funds won't be sufficient for science development. National economy, which needs not ICT RTD, will not be competitive enough either in the region or in the EU.

#### **1.1.4 Recommendations on national level**

The Government is playing active role in strengthening Serbian capacities in ICT research, so the priority is given to recommendations on the Government level.

- ⇒ Rapid adoption of a reliable and concrete Action Plan for the Strategy for Development of Science and Research in Serbia (2010-2015), since it is the key document for realization and acceleration of progress in this area.
- ⇒ It is necessary to ensure support from all ICT RTD sectors. The results from an analysis of the two-round Delphi survey (Task 6) indicate that the current support is only partial. The amount of skepticism shown by a number of experts can be understood as „a realistic observation“ of the issue, based on their previous experience. To overcome the identified gap between attitude of ICT “branch” and ICT “policy” towards realization of Government plans, it is necessary to significantly intensify and widen the dialogue between them. The convergence of their positions is the key for the success of future work and plans.
- ⇒ It is recommended, before adopting the final Action Plan, that the Government in cooperation with ICT RTD experts concretizes/redefines ICT priorities according to the needs of the ones most interested. Government has just initiated defining the ICT RTD priorities in cooperation with experts.

- ⇒ According to recession and falling GDP, regulation (on an annual basis) of GDP expenditure is necessary to achieve the plan to increase investments in Research and Science.
- ⇒ Careful creating of national and sustainable ICT RTD policy is needed, that will support High Tech projects and the best national institutes, instead of closing them and leading the ICT RTD sector into technologically subordinated position.
- ⇒ The general perception of European researchers is that, with exceptions of some recognized cases of excellence, the level of Serbian research is low, particularly compared with the EU15. In order to change present stereotype about Serbia, either a lot of years or a very good "successful cases" marketing is needed, focused on a target group of European research organization.

## ***1.2 Review of activities and capabilities of entities in Serbia carrying out ICT RTD***

This section aims to give a review of activities and capabilities of entities in Serbia carrying out ICT RTD. Potential of these entities for the future achievements, primarily for the participation in following FP7 projects, was analyzed based on desk research methodology. Validation of these results was obtained through the live interviews within Deliverable 5 and through Delphi survey within Deliverable 6. Major suppliers of the information: Academic institutions, governmental bodies and commercial entities that carry out RTD in the field of ICT.

For the purpose of this analysis more than 40 relevant institutions were taken into account. 16 main stakeholders were selected on the basis of the criteria of having the most influence on ICT RTD. The analysis is based on desk research of public available information. Four groups appear to be best suited for setting the scene of main ICT RTD related activities: (1) Government institutions; (2) high education institutions; (3) research institutions; and (4) industry/ business.

The creation of a National RTD policy framework was started in 2005 and the relevant Government institutions were founded: National Council for Science and Technological Development (NC), Ministry of Telecommunication and Information Society (MTIS), Republic Agency for Telecommunication (RATEL), while Ministry of Science and Technical Development (MSTD) and National Information Technology and Internet Agency (NITIA) were transformed. However, ICT RTD progress is slow. The possible reasons might lie in frequent changes of Government. In period 2005-2009 there were three Governments and accordingly three different Ministers of Science which results in the delay of Strategy for Scientific and Technological Development adoption and a deceleration of ICT RTD.

### **1.2.1 Government institutions**

Government is the main relevant authority financing ICT RTD through the Ministry of Science and Technological Development (MSTD) and the Ministry for National Investment Plan (NIP). Budget is the main financing source of ICT RTD in Serbia. From the budget are financed programs of general interest of the Republic. The science share in 2003 reached 0.3% GDP and stands at that level for now. According to the (MSTD), with an annual growth of 0.15 percentage points the budget allocations in 2014 shall reach 1.05% GDP.

The financing of Serbian science is facing the problem of the small amount coming mainly from the one source and than split on number of projects (more than 1000 from which 471 projects in the area of technological development).

Table 16 The most relevant Government institutions for ICT RTD

No	INSTITUTIONS	Area IS	Area ICT	Area RTD	Total	Impact level ICT RTD
	Ponder (1-3)	1	2	3		
	Maximal Mark	3	3	3	18	
1	<b>Ministry of Science and Technological Development (MSTD)</b>	1	1	3	12	① ② ③ ④ ⑤ ⑥
2	<b>Ministry of Telecommunication and Information Society (MTIS)</b>	3	3	1	12	① ② ③ ④ ⑤ ⑥
3	<b>National Council for Scientific and Technological Development (NC)</b>	1	1	2	8	① ② ③ ④ ⑤ ⑥
4	<b>The Republic Telecommunication Agency (RATEL)</b>	1	3	1	10	① ② ③ ④ ⑤ ⑥
5	<b>National Information Technology and Internet Agency (NITIA)</b>	2	2	1	9	① ② ③ ④ ⑤ ⑥

**Legend:** Area of influence:

(1) IS Information Society; (2) ICT Information Communication Technology; (3) RTDICT Research Technology Development

### 1.2.2 Institutes

Institutes active in ICT RTD have achieved significant results and preserved a solid base of experts in spite of the "brain drain". Most of the ICT RTD projects are funded by the Government and not related directly to industry/business. However, there are visible efforts, results and potential in international and FP7 projects. ICT RTD sector is fragmented and there is no strategic course for development.

Despite awareness that international cooperation brings great advantages (financial, knowledge exchange, networking), there is an insufficient awareness of need to present its own potential in concrete, clear, actual and in detail (as much as possible) manner. Presentation of many institutions on English language or other foreign language is too often "not available" or "under construction" or present information is out of date. The consequence is that the possibility for international company to find potential partner in Serbia this way is hindered significantly.

Table 17 The most relevant institutes for ICT RTD

No	INSTITUTIONS	Area IS	Area ICT	Area RTD	Total	Impact level ICT RTD
	Ponder (1-3)	1	2	3		
	Maximal Mark	3	3	3	18	
1	<b>INSTITUTE MIHAILO PUPIN (IMP)</b>	1	2	3	14	① ② ③ ④ ⑤ ⑥
2	<b>INSTITUTE OF PHYSICS</b>	-	1	3	11	① ② ③ ④ ⑤ ⑥
3	<b>SERBIAN ACADEMY OF SCIENCE AND ART (SASA)</b>	3	1	3	14	① ② ③ ④ ⑤ ⑥
4	<b>IRITEL</b>	-	3	2	12	① ② ③ ④ ⑤ ⑥
5	<b>IMTEL Komunikacije A.D.</b>	-	3	2	12	① ② ③ ④ ⑤ ⑥

**Legend:** Area of influence:

(1) IS Information Society; (2) ICT Information Communication Technology; (3) RTDICT Research Technology Development

### 1.2.3 High Education Sector

Number of activities seems to come from a single or small group of individuals, which invest their knowledge, expertise, authority and energy – with no or insufficient government support. However, several hundred ICT related science and research projects held in Faculties, indicate that scientific and research potential and results are exceed the actual possibilities and interest of Serbian society to make use of them. The result is an increasing lagging of the Serbian economy and IS development compared with EU countries.

The need for qualified ICT human recourses base has been recognized by Faculties for ICT education. University curricula are constantly improving and the number of public and private Faculties connected to ICT is increasing as is the number of graduate students. Right after graduating, most of the students easily find employment on the local market and abroad. A variety of graduate studies is available as well as high-quality MSc and PhD studies.

On the other side - there is no long term strategy on education which will include industry needs. Additionally, serious analysis of the current situation in this area is not possible as required data are fragmented, insufficient and unreliable.

Table 18 The most relevant Faculties for ICT RTD

No	INSTITUTIONS	Area IS	Area ICT	Area RTD	Total	Impact level ICT RTD
	Ponder (1-3)	1	2	3		
	Maximal Mark	3	3	3	18	
1	<b>FACULTY OF ELECTRICAL ENGINEERING (ETF)</b>	1	3	3	16	①②③④⑤⑥
2	<b>FACULTY OF ORGANIZATIONAL SCIENCE (FON)</b>	2	3	2	14	①②③④⑤⑥
3	<b>FACULTY OF MATEMATICS</b>	1	2	3	14	①②③④⑤⑥
4	<b>ELCTRONIC FACULTY - UNIVERSITY OF NIS (ELFAK)</b>	1	3	3	16	①②③④⑤⑥
5	<b>FACULTY OF TECHNICAL SCIENCES NOVI SAD</b>	1	3	3	16	①②③④⑤⑥
6	<b>FACULTY OF NATURAL SCIENCE AND MATHEMATICS - NOVI SAD</b>	1	2	3	14	①②③④⑤⑥

**Legend:** Area of influence:

(1) IS Information Society; (2) ICT Information Communication Technology; (3) RTDICT Research Technology Development

### 1.2.4 Business sector

The Government almost exclusively follows up and regulates the relationships inside science and research area of state-own entities and their financing. The private sector in Serbia is only tangentially involved in ICT RTD. For Serbian Government private investment in ICT RTD sector practically does not exist (or it is not measured). This sector is not making sufficient use of research results, in spite Serbia is relatively advanced in RTD. However, visible are recent efforts undertaken by the Government to improve the cooperation between private enterprise

and public research institutions and rising awareness of need for increasing ICT budget both from government and private sector.

The role of ICT RTD business sector in Serbia is modest. According to public available data<sup>2</sup> only 108 of 8860 researchers came from business sector. Further more in technological and technical research area, where ICT belongs, this number is even less – only 67 researchers.

In this chapter some of the most active ICT providers in Serbia are presented. The local largest IT integrator companies capable of delivering complex and specific solutions: Saga, Informatika and Spinnaker; from the sector of telecommunications: Pupin Telecom Group and Pupin DKTS, as being the sector with the biggest investment during the past five years (more than 1 billion euro, representing 18% of total investment in Serbia) and Cim College and INI as most successful companies in Serbia in FP ICT Themes.

Selected profiles are not presented for their significance for ICT RTD but to indicate their potential for development. As these companies are at the first place business oriented and long to applied solutions – between these two steps there is hidden potential for ICT RTD.

Increasing the ICT budget from business sector, linkage with education and research institutions, growing participation of the domestic industry in the building of a telecommunication infrastructure and stimulation of innovations and patents in this sector should bring significant effects in the currency balance of the country as well as increasing employment.

### **1.2.5 SWOT Analysis of ICT RTD Sector**

Instead of barriers and opportunities a SWOT analysis of this segment is presented.

#### **ICT RTD Sector Strength**

***Strong surviving ability:*** Serbian ICT RTD sector shared the destiny of the whole society - almost two decades of economic, social and institutional crisis and difficult transition process resulted in lost capacities, both in financial and human resources, as well as in visible ICT RTD fragmentation. It is remarkable how this sector has not only survived, but is still achieving success. Despite the present state, Serbia has managed to preserve a solid number of experts in the ICT RTD area. ICT RTD sector is not a strong sector, but there are ingenious individuals and ICT expert teams, primarily on faculties and institutes. Business sector restricted its expertise to applied research and development whose valorization is enabled on the market.

***Solid number of preserved Serbian experts:*** Although the expert population is aging and the 'brain drain' continues, institutions that have been active and successful in ICT RTD area

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<sup>2</sup> Statistical Office of Serbia. Scientific, Research and Development organization, 2007. No 504.

preserved the solid number of researchers in Serbia, and their overall quality in terms of expertise and experience is good.

***ICT related Education system:*** ICT related Educational system in Serbia consists of several universities, more respected in the early nineties and before, and nowadays fighting for their positions among the world-class universities. The most respected universities in ICT area are in Belgrade, Novi Sad and Nis, but other technical faculties with ICT RTD related subjects (computer sciences, engineering, physics, mathematics contribute to transformation of the society, too. Although faced with the "brain drain", education system is still capable of producing highly educated experts with a perspective to achieve master and PhD degrees. Thanks to constant inflow of young talented people, faculties are preserving a solid quality level of science in ICT and students with a perspective to achieve master and PhD degrees. This quality is confirmed every day through highly renowned engineers, researchers and scientists in the country as well as in the world.

***Solid institutes' market orientation:*** Opposite to most East European countries, institutes in Serbia have diverted their research activities toward market requirements more than three decades ago. This resulted in incomes achieved mostly from the market. For example, income of the biggest Serbian institute in ICT area, the Institute Mihailo Pupin, was US\$ 40 million in 1988, one third of which was achieved through export of products and services. Some of the institutes like IRITEL were privatized with majority owned by the employees.

***Experienced experts in ICT business sector:*** Business sector has a number of ICT experts. The majority of private companies have decades of experience in cooperation with international companies.

### **ICT RTD Sector Weaknesses**

***Inadequate efficiency of ICT RTD system:*** There is an ICT RTD system in Serbia of inadequate efficiency. Serbia has necessary institutions in the Government, education, science and research, but their influence on the society and economy is insufficient. For now, there is no synchronized work. Links of these three groups as well as links within every single group are of the highest importance for ICT RTD development, important almost as the activities of these entities.

***Brain drain*** is a very complex barrier, which can be identified as an internal weakness of the organization, sector or country but also as an external threat coming from the outside. As an internal weakness, the "brain drain" is caused mainly by low salaries, undeveloped research infrastructure and limited opportunities for specialization.



**Lack of focusing:** "Focus and partnering" - the key words from the upcoming Strategy, show that the Government, as the key player, recognized and understood the importance of ICT RTD development and made serious decision towards its realization. Considering ICT RTD segment, there is still neither a visible focus on ICT RTD priorities defined in the Strategy, nor partnering, and there is no action plan. The way of financing remains the same.

**Low level national funding for ICT RTD:** The Government is the main relevant authority financing ICT RTD through the Ministry of Science and Technological Development (MSTD) and the Ministry for National Investment Plan (NIP). The financing of Serbian science is facing the problem of small amount of investment coming mainly from one source and then split into more than 1000 projects.

Apart from the bioengineering and agro industry with EUR 14.2 million allocated annually, no other field in the area of technological development gain more than EUR 5 million.

**Lack of official Centres of Excellence:** The Centres of Excellence (CoE) were established in Serbia in the middle of 2008 according to the Law on Research Activities and the following Rule Book. The specificity of the CoE which are defined by these documents illustrate very complicated accreditation procedure and insufficient financing, all strongly depending on the Government and thus - not suitable for the business and industry sector. Only institutes or High Education entities can become the CoE and that is after 5 years of achieving successful results in international cooperation.

**No transparent evidence of business participation:** The projects in category of technological development need participants from the industry and business sector. According to the Criterion's Act, business and industry participation in funding is mandatory, min. 20% of the total project value. Beside financial, participation can be obtained in labor, material or equipment. There is neither public evidence nor a list of participants of this type of projects. Participation of private companies is generally rare.

**Weak cooperation between industry and education:** The cooperation between industry and education is insufficient. Serbia has a weak economy and the ICT RTD infrastructure on a low level. The cooperation between industrial and education sector is on a significantly lower level than in the EU15, where the strong industry has a visible technological absorption.

**Weak interlinks in the "Knowledge triangle":** The comparison between Serbia and the EU countries shows some similarities: weak interlinks in the "triangle of knowledge": education - innovation - R&D. The consequences are duplicated efforts, the loss of critical mass, difficulties in solving common problems and decreased ROI (Return of Investment). Weak involvement of SME is also common both for Serbia and the EU.

***Insufficient political will, financial resources and expertise:*** The “famous” Serbian triangle of insufficient political will, financial resources and expertise represents a weakness that remains to be the main barrier. In addition, the value of ICT RTD project results is poor - after being completed, ICT RTD projects disappear without producing a real impact.

### **ICT RTD Sector Opportunities**

***Good price / quality ratio of Serbian products and services:*** One of the main competence advantages is the price/quality ratio of Serbian services, which means that the gross price of labor is at least 50% lower than one in EU. However, there is no reason for this price to be the lowest among the neighboring countries.

***Solid expertise in particular area:*** A significant competence advantage of Serbian researchers is a solid expertise in particular areas.

***Reorganization of Serbian Education system:*** For Serbia, investment in professional education is a shortcut to accelerate the way out of an untenable situation. The education must be treated as a main driving force of ICT RTD. Consequently, investments in this sector should be as big as possible, but only after a very careful reorganization of the present higher education system, which is inefficient and unrelated to industry and market needs.

***Implementation of the "Focus and partnering" Strategy:*** The key words in the upcoming Strategy show that the Government has understood the importance of ICT RTD development. The Action Plan for the Strategy is a big opportunity and it seems that the Government has made a serious decision towards its realization. However, the steps in implementation (the Action Plan) are still not visible.

***Exploit the hidden potential of ICT business sector:*** ICT Business sector hides a big potential. On the one hand, there are companies in this sector oriented toward development of applicative solutions and on the other hand there are reliable companies for implementation and system integration which have already proved themselves on the Serbian ICT market.

***International accomplishments:*** In the period from 2001 to 2009, Serbian researchers accomplished encouraging initial results in the domain of international scientific and technological cooperation. The basic programmes were the Sixth and the Seventh EU Programmes, COST, EUREKA, NATO SPS, including the cooperation with the International Atomic Energy Agency (IAEA), and bilateral cooperation programmes. Foreign international companies are present in Serbia and cooperation with these companies can contribute to Serbian ICT sector development. Microsoft, Ericsson, Siemens, Cisco, Nokia Siemens Network, Alcatel-Lucent, Huawei, IBM etc. are companies with positive experience in cooperation with the

Serbian ICT RTD sector. Although world economic crisis strongly influenced cooperation size and dynamics, the perspective for development is still optimistic.

***Meet Government needs for ICT solutions and services:*** A big advantage of universities, institutes and business in ICT sector in Serbia is that the state and society require their solutions, products and services in building an economy based on knowledge and Information Society (IS). Further development of IS requires new ICT solutions from science and technology. Strong links and a lot of work are necessary for Serbian ICT RTD to take advantage of the upcoming process of economy and society modernization in a number of sectors: Government, economy, public administration; development of e-Government, e-Commerce, e-Democracy. Serbian ICT RTD should not miss it.

***Serbia as a natural gathering and coordinating center*** for the West Balkan region. Due to its historic links with all the West Balkan countries, the language that is similar in all ex-YU countries and to its geographical location, Serbia is a natural place to become a gathering and coordinating center of the region.

### **ICT RTD Sector Threats**

***Serbia as a latecomer to international ICT RTD scene:*** One of the biggest Serbian threats is its late coming to the international market. There are several countries which are Serbian potential competitors in ICT RTD sector which joined the EU a few years ago or are on the way. The first competition circle is Hungary and Slovenia (joined the EU in 2004), the second - Romania and Bulgaria (joined the EU in 2007) and the third one is Croatia which is expected to join the EU a few years before Serbia. ICT RTD is one of the fastest growing and most changing sectors in Europe and the world. Because of that, the process of joining the EU through realization of priority areas from the Strategy is one of the biggest challenges, which requires to compensate the lost time and to achieve the competition of the neighboring countries.

***Brain drain:*** As an internal weakness, the "brain drain" is caused mainly by low salaries, undeveloped research infrastructure and limited opportunities for specialization. However, there will always be more developed environments that will offer better salaries and conditions to researchers as well as better opportunities for their specializations. This turns the "brain drain weakness" into an external threat. In addition, it is a long-term threat because of the exhaustion of the High Education system: the best students whose education was paid by the state leave right after the graduation or after working for a year or two on faculties and institutes. The country is at loss both financially and, what is more important, in the most qualified staff. On the other hand, the countries that "gain brain" got the best experts with no investing.

Realizing that the “brain drain” problem continues to threaten science and research development in Serbia, the Government has announced a plan (through the Strategy for Science and Technological Development) for stopping the ‘brain drain’ as well as for stimulating the return of the experts already abroad.

***Weak cooperation on ICT projects:*** Insufficient cooperation between ICT industry and business on the one hand and institutes and faculties, on the other, could lead to a collapse of the projected policy for financing scientific work in Serbia. Non-competitive industry will not be able to allocate resources to budget, private companies (officially unrecognized as R&D organizations) will not be qualified to gain resources from the national funds for research and development, and there will be no investments from business sector in R&D. As a result, the level of resources allocated to basic and applied research will remain at 0,5% GDP and with the present policy of financing basic and applied research “for the Government and not industry needs”, private sector will have no benefit from the research results.

**Long time present differences between Serbian and European researchers** on the organizational level, in type of infrastructure and in attitude towards the work, can lead to serious problems in cooperation with European ICT RTD sector.

***Stereotype image of Serbian research:*** The perception of European researchers is that, with exceptions of some recognized cases of excellence, the level of Serbian research is low, particularly compared with the EU15.

### **1.2.6 Recommendations**

Strengthen the education, science and research linkages as further development of Information Society (IS) in Serbia requires new ICT solutions from science and technology. ICT RTD organizations should not miss the advantages of upcoming process of economy and society modernization in the number of sectors: Government, economy, public administration; development of e- Government, e-Commerce, e-Democracy.

***Improve the cooperation*** between private enterprises and public research and education ICT institutions. Create measures for stimulation innovations and patents. Rise awareness of need for increasing ICT budget from private sector.

***Define national science and research priorities and policy for making clusters.*** Strengthen linkages among education and research ICT institutions. Create stimulation measures to increase number of projects related directly to industry/business.

***Education must be treated as a main driving force of ICT RTD.*** Consequently, investments in this sector should be as big as possible. Speed up realization of the plan for stopping brain drain.

### **1.3 Analysis of the participation of Serbia in the FP6-IST and FP7-ICT Theme**

The main goal of this section is to present Serbian participation in FP6-IST and FP7-ICT Theme and the key reasons for success and failure in submitting proposals. In addition, this section aims to contribute to definition of necessary steps in increasing participation of Serbia in upcoming FP7-ICT calls. Desk research was obtained on database from European Commission - DG INFSO. Available information cover the small number of Serbian entities and it was the limiter for relevant qualitative analysis. Qualitative analysis was obtained through live interview (within Deliverable 5) and Delphi survey (within Deliverable 6).

Serbian ICT RTD sector shared the destiny of the whole society for almost two decades of economic, social and institutional crisis and difficult transition process. It is remarkable how this sector has not only survived, but is still achieving success. Lost capacities, both in financial and human resources and in visible ICT RTD fragmentation, have all to be taken into consideration when exploiting the results of the Serbian Framework Programme trend participation analysis.

#### **1.3.1 Participation trends of Serbian proposals in the FP6-IST and FP7-ICT Theme**

Table 19 Success and failure rates of proposals in FP6-IST and FP7-ICT Theme.

	EU Proposals		Serbian Proposals		Ratio (%) of successful proposals		SERBIA - Proposals share	
	Total	Successful	Total	Successful	EU	SERBIA	Successful	Failure
FP6-IST Priority	8383	1123	125	16	13,4	<b>12,8</b>	<b>1,4%</b>	1,5%
FP7-ICTTheme	5586	840	77	12	15,0	<b>15,6</b>	<b>1,4%</b>	1,4%

Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)

In FP6-IST Priority EU countries achieved success rate of 13,4% (8383 submitted proposals and 1123 approved) and Serbia 12,8% (125 submitted proposals and 16 approved) showing slightly lower passing (success) rate of Serbian proposals than EU average. Serbian entities submitted their proposals to six of seven thematic categories showing the big dispersion of the proposals, while the accepted proposals were in only three thematic categories.

In the FP7-ICT Theme, the EU countries achieved success rate of 15,0% (with 5586 submitted proposals and 840 approved), while Serbia accomplished slightly higher passing rate of 15,6% (with 77 submitted and 12 approved proposals). In addition, this represents the growth of 2,8 percentage points compared to the Serbian success in FP6-IST Priority. Serbian entities submitted their proposals to all nine Challenges, continuing the wide dispersion of submitted proposals.

## Identification of Serbian FP7-ICT Objectives

The Competence and the Share ratio of identified Serbian FP7-ICT Theme Objectives are presented in the Table below. (Competence [%] = number of Serbian successful proposals / total number of FP7-ICT Theme successful proposals; Share [%]= number of Serbian proposals / total number of FP7-ICT Theme proposals).

The value of competence and the value of share of 2,5% are considered as the borderlines between the low and high competence and accordingly, between the low and high share (2,5% is estimated level for Serbia according to its potential as a country for FP7-ICT).

Table 20 Identification of Serbian FP7-ICT objectives - Competence/Share Matrix

High competence – low share:	High competence – high share:
<ul style="list-style-type: none"> <li>1.1 The Network of the Future</li> <li>2.1 Cognitive Systems and Robotics</li> <li>7.2 Accessible and Assistive ICT</li> <li>8.2 FET – Proactive</li> </ul>	<ul style="list-style-type: none"> <li>1.3 Internet of Things and enterprise environments</li> <li>3.4 Embedded Systems Design</li> <li>3.5 Engineering of Networked Monitoring and Control systems</li> <li>4.1. Digital Libraries and Digital Preservation</li> <li>4.2. Technology-Enhanced Learning</li> <li>5.3 Virtual physiological human</li> <li>6.3 ICT for Energy Efficiency</li> <li>9.1 International cooperation</li> </ul>
Low competence – low share:	Low competence – high share:
<ul style="list-style-type: none"> <li>1.2 Internet of Services, Software &amp; virtualization</li> <li>1.4 Trustworthy ICT</li> <li>1.5 Networked Media &amp; 3D Internet</li> <li>3.1 Nanoelectronics Technology</li> <li>3.7 Photonics</li> <li>4.3 Intelligent Information Management</li> <li>5.1 Personal Health Systems</li> <li>5.2 ICT for Patient Safety</li> <li>7.1 ICT &amp; ageing</li> </ul>	-

### 1.3.2 Participating Serbian entities in Framework Programme

In the Table below participating entities are ranked according to the number of successful proposals and objectives. With the largest total number of approved proposals within the FP6 and FP7 is CIM College (4), ETF (3), IMP (3), FTN(2), SASA (2), FON (2), BOS (3), etc. "International Cooperation" was the most interesting objective for Serbian applicants and in realization of this projects were ETF, BOS, IMP, SASA, MTID. Behind these projects are relatively modest financial resources and they are mainly of organizational type (SSA).

Entities from Serbia showed the greatest interest for "Network Embedded and Control Systems" (IMP, Faculty of Technical Sciences in Novi Sad, ETF, Victoria Oil AD DANUBE NET, Southeast LLC and Pupin Telecom DKTS. However, only 3 entities have succeed in this objective area.

Table 21 Successful Serbian entities per objectives in FP6-IST and FP7-ICT

#	NAME OF ENTITY	Short_ _NAME	Participation			OBJECTIVES
			Total	FP6-IST	FP7-ICT	
1	CIM COLLEGE DOO	CIM	4	3	1	FP7-ICT: 1.3 Internet of Things and Enterprise environments FP6-IST: 4.9 ICT Research for Innovative Government 5.5 Software and Services 6.5 International Co-operation
2	SCHOOL OF ELECTRICAL ENGINEERING, BELGRADE (ELEKTROTEHNIČKI FAKULTET, BEOGRAD)	BELG BU ETF	3	1	2	FP7-ICT: 2.1 Cognitive systems and robotics 3.4 Embedded Systems Design FP6-IST: 9.1 International cooperation
3	INSTITUTE MIHAILO PUPIN (INSTITUT MIHAJLO PUPIN)	IMP MIHAILO PUPIN INST MPI PUPIN	3	0	3	FP7-ICT: 6.3 ICT for energy efficiency 8.2 Pervasive adoption 9.1 International cooperation FP6-IST: --
4	FACULTY OF TECHNICAL SCIENCES, NOVI SAD (FAKULTET TEHNIČKIH NAUKA, NOVI SAD)	FTN FTN-UNS NOVI SAD	2	0	2	FP7-ICT: 3.4 Embedded Systems Design 6.3 ICT for energy efficiency
5	FACULTY OF ORGANIZATIONAL SCIENCES (FAKULTET ORGANIZACIONIH NAUKA)	FON FOS	2	1	1	FP7-ICT: 4.1 Digital Libraries and Digital Preservation FP6-IST: 1.9 Networked business and Governments
6	MINISTRY OF SCIENCE AND TECHNOLOGICAL DEVELOPMENT (MINISTARSTVO ZA NAUKU I TEHNOLOŠKI RAZVOJ)		3	3	0	FP7-ICT: - FP6-IST: 6.2 To prepare for future international co-operation in IST 4.9 ICT Research for Innovative Government 6.4 Accompanying actions in support of participation in Community ICT research 7
7	BELGRADE OPEN SCHOOL (BEOGRADSKA OTVORENA SKOLA)	BOS	3	2	1	FP7-ICT: 9.1 International cooperation FP6-IST: 6.2 To prepare for future international co-operation in IST 6.5 International Co-operation
8	MATHEMATICAL INSTITUTE OF SERBIAN ACADEMY OF SCIENCES AND ARTS (SANU - MATEMATIČKI INSTITUT)	MATHEMATICAL INSTIT# MIB MIS MISANU MI-SANU MISASA SANU	2	2	0	FP7-ICT: - FP6-IST: 4.4 Broadband for all 6.5 International Co-operation
9	ERICSSON DOO		1	0	1	FP7-ICT: 1.1 The Network of the Future
10	TELEKOM SRBIJA		1	0	1	FP7-ICT: 1.1 The Network of the Future

#	NAME OF ENTITY	Short_ _NAME	Participation			OBJECTIVES
			Total	FP6-IST	FP7-ICT	
11	INI DOO	INI	1	0	1	FP7-ICT: 4.1 Digital Libraries and Digital Preservation
12	MINISTRY OF TELECOMMUNICAT. AND INFORMATION SOCIETY (MINISTARSTVO ZA TELEKOMUNIKACIJE I ID)	MTID	1	0	1	FP7-ICT: 9.1 International cooperation
13	UNA SYSTEMS (UNA SISTEMI)	UNA	1	0	1	FP7-ICT: Accessible and Assistive ICT
14	UNIVERSITY OF KRAGUJEVAC (UNIVERZITET U KRAGUJEVCU)	UKG	1	0	1	FP7-ICT: 5.3 Virtual Physiological Human
15	VICTORIAOIL AD	VICTORIAOIL	1	0	1	FP7-ICT: 3.4 Embedded Systems Design
16	CACTUS SHA	CACTTUS	1	0	1	FP7-ICT: 9.1 International cooperation
17	REPUBLIC OF SERBIA - AUTONOMOUS PROVINCE OF VOJVODINA - THE EXECUTIVE COUNCIL OF THE AUTONOMOUS PROVINCE OF VOJVODINA - ADM AND TEHNICAL SERVICES OFFICE (AP VOJVODINA - TEHNIČKA SLUŽBA)		1	1	0	FP6-IST: 9.1 International Co-operation
18	MILUTIN BOJIC LIBRARY (BIBLIOTEKA MILUTIN BOJIĆ)		1	1	0	FP6-IST: 1.12 Technology-enhanced learning and access to cultural heritage
19	THE EUROPEAN CENTER FOR PEACE AND DEVELOPMENT (EVROPSKI CENTAR ZA MIR I RAZVOJ)		1	1	0	FP6-IST: 6.2 To prepare for future international co- operation in IST
20	EVOLUTION ONLINE		1	1	0	FP6-IST: 9.1 International Co-operation
21	INFORMATION SOCIETY OF SERBIA INFORMACIONO DRUŠTVO SRBIJE)		1	1	0	FP6-IST: 9.1 International Co-operation
22	PUBLIC PROCUREMENT OFFICE REPUBLIC OF SERBIA (UPRAVA ZA JAVNE NABAVKE SRBIJE)		1	1	0	FP6-IST: 9.1 International Co-operation
23	MINISTRY OF FINANCE, CUSTOMS ADMINISTRATION (MINISTARSTVO FINANSIJA, UPRAVA CARINA)		1	1	0	FP6-IST: 9.1 International Co-operation
24	BELGRADE OLD TOWN MUNICIPALITY (OPŠTINA STARI GRAD)		1	1	0	FP6-IST: 9.1 International Co-operation
25	PEXIM SOLUTIONS		1	1	0	FP6-IST: 9.1 International Co-operation
26	PROZONE		1	1	0	FP6-IST: 9.1 International Co-operation
27	BELGRADE UNIVERSITY COMPUTING CENTER (RAČUNARSKI CENTAR UNIVERZITETA U BEOGRADU)		1	1	0	FP6-IST: 6.2 To prepare for future international co-operation in IST
28	TANJUG - NATIONAL NEWS AGENCY OF SERBIA		1	1	0	FP6-IST: 9.1 International Co-operation
	TOTAL		42	24	18	

Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)



### 1.3.3 Success and Failure Rates of the applicants

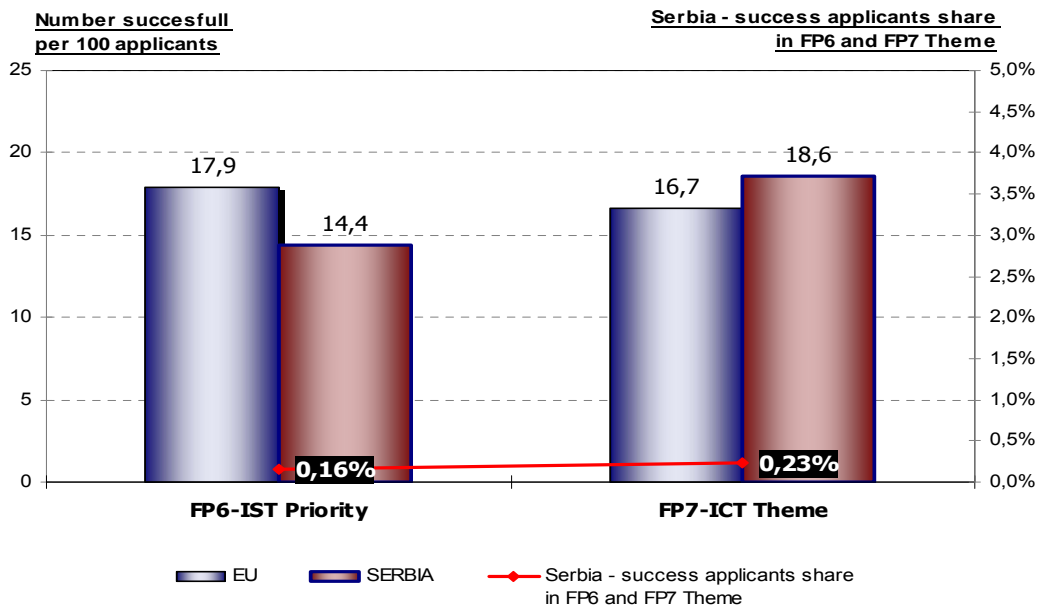
Table 22 Success and failure rates of applicants in FP6-IST and FP7-ICT Theme.

	EU Applicants		Serbian Applicants		Ratio (%) of successful applicants		SERBIA - Applicants share	
	Total	Successful	Total	Successful	EU	SERBIA	Success	Failure
FP6-IST Priority	85359	15303	167	24	17,9	<b>14,4</b>	<b>0,16%</b>	0,20%
FP7-ICTTheme	47847	7977	97	18	16,7	<b>18,6</b>	<b>0,23%</b>	0,20%

Key observations from the table above:

- ⇒ In FP7-ICT Theme, Serbian entities increased their share in total EU successful participations (applications) to 0,23% from 0,16% in respective share in FP6-IST Priority. Despite detected growth, Serbia is still among the countries with the lowest number of participants.
- ⇒ With 18 successful applicants in FP7-ICT Theme Serbia achieved 18,6 successful applicants per 100 (Serbian) applicants. At the same time, all EU countries achieved 16,7 successful applicants per 100 EU applicants (7977 successful applicants from 47847 total number of applicants). Serbian rate of successful applicants (18,6%) is among the top ten in the Europe.

Figure 10 Success rates of applicants in the FP6-IST and FP7-ICT for EU and Serbia



Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)

The unsuccessful proposals were in only one thematic category, while the highest number of submitted proposals was in the area of Cognitive systems, interaction, robotics (11). Accepted proposals are covering one Objective per Challenge in average.

From 110 entities which submitted 264 proposals to the FP6-IST and FP7-ICT Theme, only 28 entities (25,5%) were successful. Only 8 entities had more than one successful proposal. Four of the 7 leading entities (ETF, FON, SANU and IMP) have big S&T capacity in ICT area, but there is an impression that their success rate is significantly below their potentials.

On the other side the share of Serbian participations in total EU successful participations (applications) raised to 0,23% from 0,16% in FP6-IST Priority. Despite detected growth Serbia is still among the countries with the lowest number of participants. With 18 successful applicants in FP7-ICT Theme Serbia achieved 18,6 successful applicants per 100 (Serbian) applicants compared to 16,7 of EU countries. Serbian rate of successful applicants (18,6%) is among the highest in the Europe.

Serbia is a latecomer in FP projects and for that reason majority of Serbian entities is still exploring the FP7-ICT Theme area by participating in a wide range of objects in order to get experience and find the most suitable topic. Furthermore, Serbian entities are inexperienced in partner search for successful consortia. Low number of entities with ICT RTD capacities (institutes in the first place) seems to have a reliable picture of their capabilities in those areas where more proposals are present (which results in the respectable success of participations). It is important to mention that Serbian ICT RTD sector participate in FP7-ICT not as monolithic structure but as an individual entities with variety of motivations, capacities and competences, which sometime gives contradictory results.

### 1.3.4 Comparison of Serbian applicants to EU27 and AC

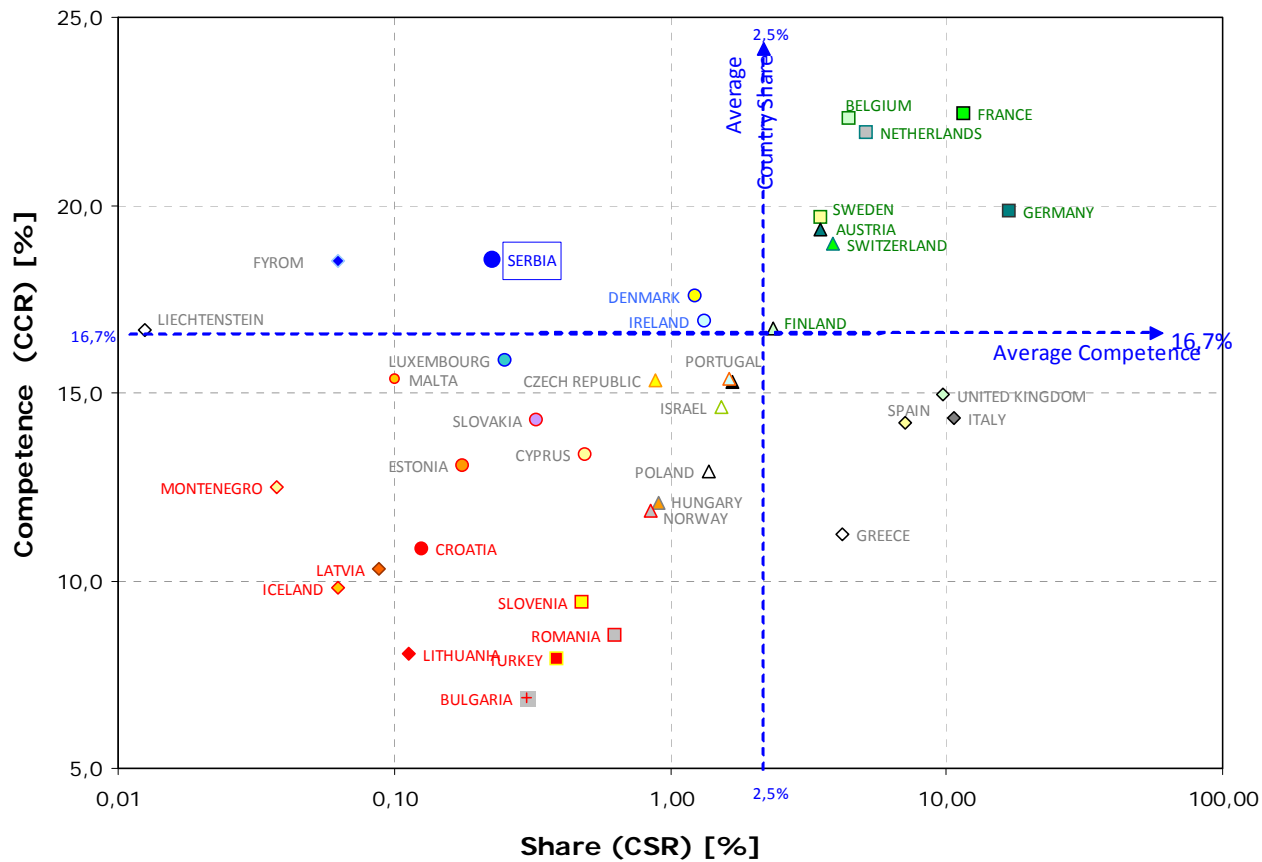
Table 23 Comparison of applicants' success rates EU12, EU15, EU27 and AC

	FP7-ICT Theme					
Applicants	FP7-ICT	EU27	EU15	EU12	AC	SERBIA
Success rates of applicants [%]	16,7	16,7	17,3	11,5	15,4	18,6
Successful applicants share [%]	100%	89%	83%	6%	7%	0.23%

Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)

- ⇒ In the FP7-ICT Theme, the EU countries achieved success rate of applicants 16,7% (with 42481 total applicants and 7101 successful),
- ⇒ Serbia accomplished higher passing rate of 18,6% (with 97 applicants and 18 successful). In addition, this represents the growth of 4,2 percentage points compared to the Serbian success rate in FP6-IST Priority.

Figure 11 EU27 and AC applicants in FP7-ICT Theme – Individual Countries Positions



Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)

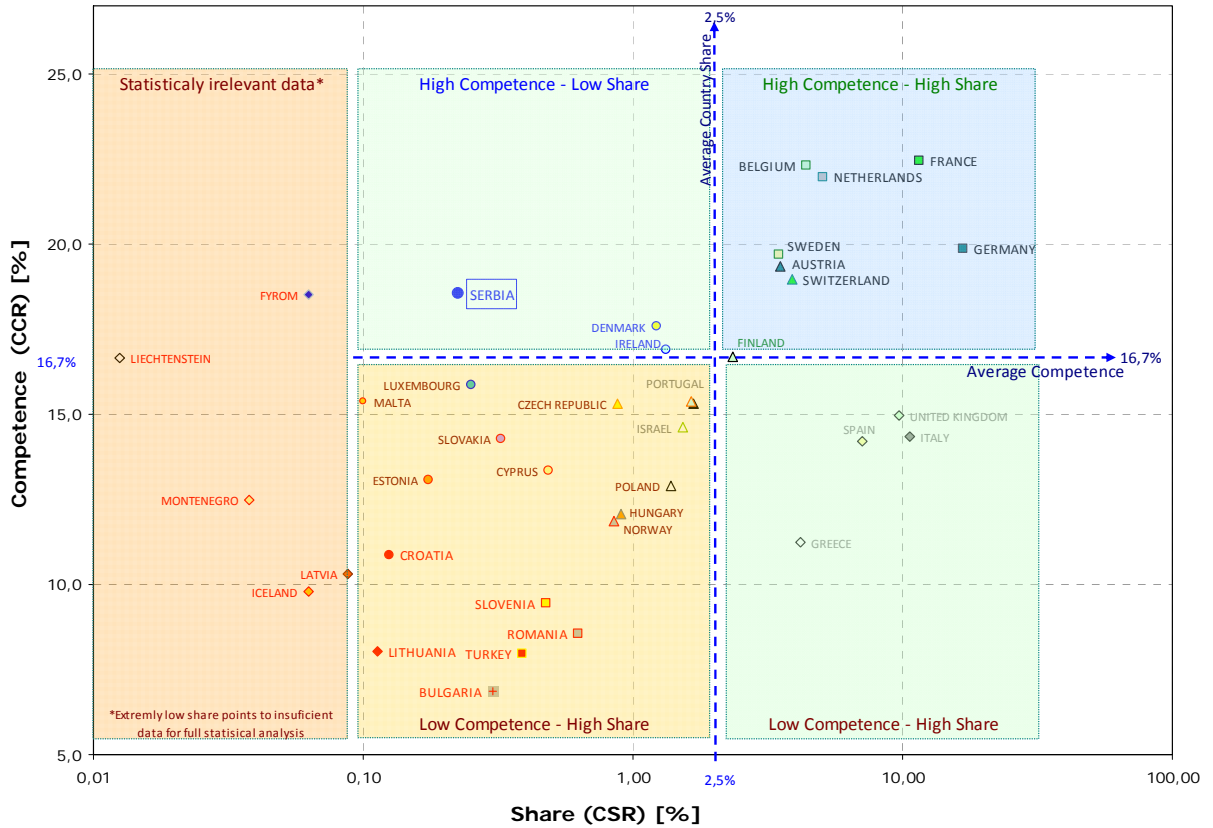
Figure above presents the Competence/Share Matrix of EU27 and AC applicants in FP7-ICT Theme. In this figure Serbia is positioned in the “high competence - low share” quadrant, with the highest competence in this quadrant. There is a visible contradiction between impressive successes of Serbian applicants (among the 38 most influential countries, Serbia is on the eight place) and a small share in number of projects (among the 38 most influential countries, Serbia is 28th). This indicates either lack of critical mass of researchers or their modest interest in FP7-ICT participation.

Explanation: The Country Share Ratio (CSR) and individually Country Competence Ratio (CCR) for each of 40 countries (EU27 and AC) are presented.

- ⇒ CSR [%] = number of Country’s successful applicants / number of all successful applicants in FP7-ICT;
- ⇒ CCR [%] = number of Country’s successful applicants / total number of Country’s applicants.

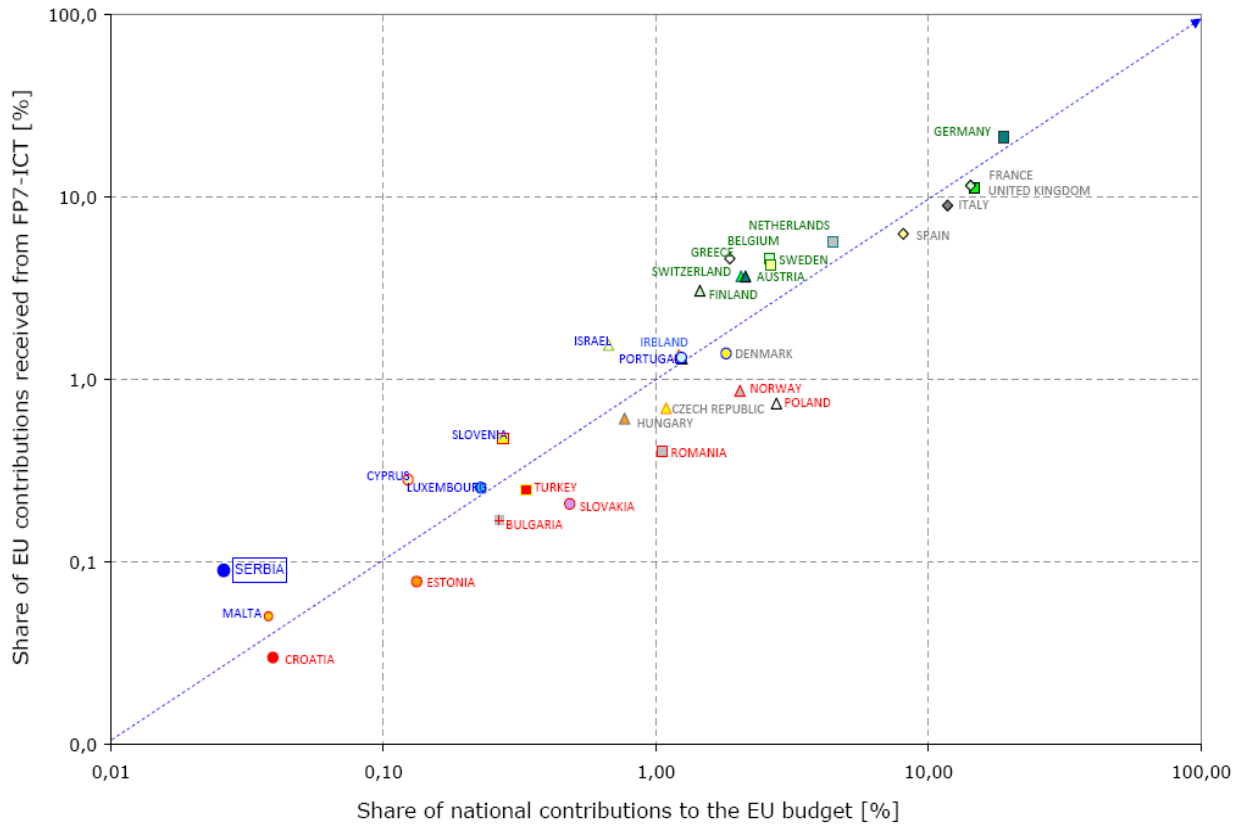
The average value of Share (2,5%) is emphasized. This line represents the borderline between the big and small share. Similarly, for the Competence, the average competence of all countries, 16,7% separates the more from the less successful countries.

Figure 12 EU27 and AC applicants in FP7-ICT Theme - Competence / Share Matrix



Source: EC-DG INFSO (FP7-ICT Theme Call 4 inclusive)

Figure 13 EU27 and AC „juste-retour“ comparison for FP7 INFSO call



In figure 12 the share of national contribution to the total FP7-ICT budget (x-axis) and share EU contributions received from FP7-ICT (y-axis) are presented.

- ⇒ Based on the main trend (blue line), two groups of countries can be distinguished: (1) above the main trend line and (2) below that line.
- ⇒ Serbia is positioned in the first group characterized by bigger money withdrawal than its budget participation. In addition, it is noticeable that Serbia both invests small amounts and withdraws small amounts of money.

### **1.3.5 FP7-ICT participation – Opportunities**

- ⇒ Success rates of Serbian participants are above EU average.
- ⇒ There is a solid competence of Serbian entities expressed in FP7-ICT Theme evaluation marks.
- ⇒ Programs of Serbian research entities are in solid line with FP7-ICT Theme which is of high importance for raising participations in FP7-ICT Theme.
- ⇒ There is significant room for increasing Serbian participation situated within two categories of applicants, i.e. their capacities/competences and willingness.
- ⇒ Experts absolutely recognize the exceptional benefit from participation in FP7-ICT projects.
- ⇒ Serbian experts have a very positive attitude towards FP7-ICT projects and experts are familiar with the FP7-ICT opportunities. Also, Serbian entities are well informed regarding participation in FP7-ICT projects.
- ⇒ Few leading entities have the big S&T capacity in ICT area but the impression is that their success rate is significantly below their potentials.
- ⇒ Existing Serbian evaluators for FP7 projects can transfer their knowledge and experience to High education institutions.
- ⇒ Targeted regional calls and objectives are stimulation for Serbian entities and their success is obvious in objectives targeted to West Balkan region.
- ⇒ Regional conferences and events dedicated to demonstrations of the success stories and best practices will raise awareness of the FP participation benefits.
- ⇒ Harmonization of thematic areas, initiatives and goals in ICT area with FP7-ICT Theme will significantly improve the Serbian participation.
- ⇒ Joining the programs for realization of increasing participation of domestic industry and programs in the areas of FP7-ICT Theme can create visible synergy.

- ⇒ Participation in FP7-ICT projects can increase number of PhDs and contribute the raising of critical mass of ICT researchers.
- ⇒ Inclusion of private companies, industry, SME ('third sector') as relevant stakeholders and partners in FP7-ICT Theme.

### **1.3.6 FP7-ICT participation – Barriers and ways to overcome them**

**Serbia is the new player in Framework Programs**, that came after many years of sanctions and standing aside of European research area and world RTD science.

- ⇒ It is suggested to create actions on EU level to promote and encourage Serbian RTD science through brokerage events, knowledge exchange and networking.

**Low participation of Serbian entities indicates the absence of the ICT RTD critical mass and insufficient interest of academic elite for participation in FP7-ICT.** In general, the focus of Serbian researchers is not on FP7-ICT projects, putting the total number of Serbian participants among the lowest in Europe – only 14 Serbian successful applicants (representing 0,24% of total EU applicants). Low participation could in turn bring Serbia to negative balance in the following FP cycle. As a consequence, the share of Serbian contribution to the EU budget could exceed the amount that Serbian entities will be able to pool based on their results.

- ⇒ The actions considered of having the most influence on increasing participation of Serbian entities in FP7-ICT Theme are: EDUCATION and MOTIVATION programs. For entities that have participated in the FP6-IST and FP7-ICT Theme but did not have success (have willingness, but low capacity) **educational programs** (training) are proposed. For number of entities in Serbia that have not participated in previous FP cycles although have the required ICT RTD capacity for successful participation (have capacity but not willingness) **motivation programs** are proposed.
- ⇒ The preparation of proposals for FP7-ICT requires high expertise and other skills and it should be properly evaluated in the meaning of scientific ranking. Due to high evaluation criteria and generally low success rate in FP7-ICT Theme, the suggestion is to include the participation and successfulness in FP7 projects in the existing evaluation criteria of science and research work.

**Difficulties in reaching the big EU15 consortia:** In the time between the starting of the FP initiative and the moment when Serbia joined the FP (after almost two decades), big and successful consortia had already been established in the EU15, even before the EU12 extension. Rigidity of these consortia for new partners joined by weak connections of Serbian ICT RTD

entities with EU research institutions create one of the main barriers to Serbian bigger participation in the FP-ICT Theme.

- ⇒ Targeted regional calls for common Western Balkan ICT R&D priorities are suggested for improving the regional cooperation, experience exchange and speeding up solving the common problems and barriers. It is recommended to focus on demand/application-oriented issues.
- ⇒ Apart from targeted calls on regional priorities, the support actions for other (EU) priorities that are underdeveloped in the region are recommended.

**The high demanding administration activities and weak Serbian administration capacities for FP7-ICT requirements** have been observed as one of the main barriers. The proposal writing/preparation is a complex and time-consuming work. Opposite to Serbia, in the EU15 this complex process of preparation is successfully distributed to well trained and experienced consortia partners, which brings them significant advantage.

- ⇒ Consider capacity-building actions for improving skills of Serbian ICT researchers, particularly in FP7 application procedures, project planning and management (including financial management). In collaboration with National Contact Points and the EC establish the National organization dedicated to training courses on FP7-ICT topics.
- ⇒ It is suggested to enable FP7 participants to outsource their administration activities by establishing of the centers with capacity for administration, financial reporting and project management support.
- ⇒ Consider establishing regional administrative center for FP7-ICT to enable ICT RTD organizations in the region to outsource these activities.

**Negative “cash flow” is frequent appearance in Serbia.** For organizations with weak financial capacity and with the team of researchers dedicated to the FP7 project, period of 3 years with the lack of capital can become a serious problem.

- ⇒ Government should consider possibility of giving guaranties for organizations with approved FP7 projects if they need financial support from banks (loans or other financial options). This would help organizations that participate in FP7 to cover their expenses in the period from project approval to the real pay off by the EC.

**Average EU FP7 financial support for Serbian ICT RTD is small.** It is estimated that FP7-ICT projects contribute to Serbian ICT RTD sector with about EUR 2 million per year. The results from Delphi survey show that the extent to which the budget for local participants in FP7-ICT is sufficient is low (evaluated with the average mark 4.6 out of 10).

- ⇒ In the years to come Serbia will have to increase more than three times its participation according to future bigger national contribution amount. There is a perception that contracted monthly payments of Serbian researchers are not seen as stimulation for further increasing participation.
- ⇒ It is suggested to Ministry of Science and Technological Development to consider actions for increasing the amounts for monthly payments of Serbian ICT RTD researchers, which are currently significantly lower than EU average.

### **1.3.7 Conclusions and Recommendations**

The results of this analysis show that Serbian entities have higher success rate than the EU average. On the other hand, the number of participants is among the lowest. Serbia is expected to raise the number of participations and to maintain the growth of success rate with this rising number, which is possible. The limit is defined by the real size of Serbian ICT RTD capacity. Only 2 successful applicants per 1000 researchers indicate that focus of Serbian researchers is not on the FP7-ICT Theme. This is understandable in the light of the fact that FP7-ICT proposal preparation have no scientific ranking according to Serbian criteria for evaluation of science and research work. Consequently, it is hard to expect from Serbian researchers to spare huge amount of time, which requires FP7 – ICT proposal preparation, with uncertain result. It is suggested to consider the way to evaluate successful FP7-ICT projects (similar to SCI list) to motivate Serbian researchers.

Serbia is a latecomer in FP projects and for that reason majority of Serbian entities is still exploring the FP7-ICT Theme area by participating in a wide range of objects in order to get experience and find the most suitable topic. Furthermore, Serbian entities are inexperienced in partner search for successful consortia. Low number of entities with ICT RTD capacities (institutes in the first place) seems to have a reliable picture of their capabilities in those areas where more proposals are present (which results in the respectable success of participations). It is important to mention that Serbian ICT RTD sector participate in FP7-ICT not as monolithic structure but as individual entities with variety of motivations, capacities and competences, which sometime gives contradictory results.

However, the overall impression is that Serbian position and role in Framework Programme is getting mature. There is a visible shift from Specific Support Actions (SSA) to concrete science and research actions (STREP). Serbia's integration in FP7-ICT Theme is the cumulative process with avalanche effect – it takes time and continuous effort. This process has to be sped up to make up for more than 15 years of Serbian lagging behind, primarily by stimulating the participation of Serbian entities.



***Focusing on the main drivers and inhibitors***, the Serbian Government is the one that can most efficiently increase the participation of Serbian entities in future FP7-ICT Calls. In order to maximize Serbian participation in the Framework Programmes for ICT RTD, Ministry in charge of ICT RTD is recommended to follow up and measure the key indicators. At the first place, the key indicators have to be defined having on mind that they change over time and have to be adjusted to the new situation. SWOT parameters can be used as the initial key indicators to be measured and follow up, with the goal to enhance the Strengths and Opportunities and to reduce the Threats and Weaknesses. It is even better, if possible, to convert Threats and Weaknesses into Strengths or Opportunities. Following are suggested initial key indicators:

- ⇒ Strength: Above EU average Success Rates of Serbian participants
- ⇒ Weakness: Serbia is latecomer to the FP
- ⇒ Opportunity: Use capacity of leading Serbian ICT RTD entities
- ⇒ Threat: Difficulties in reaching the big EU15 consortia

Following are recommended initial actions (regarding W): overcome Serbia's lagging behind (detect areas of expertise and particularly stimulate participations in these areas); (regarding T): strengthen political and experts' lobbying and improve the image of the country's science and development.

## **1.4 Present and planned infrastructure in Serbia for ICT-RTD**

The scope of this section is to identify the current and planned research infrastructures related to ICT RTD activities in Serbia and appraise correspondingly and to explain whether the current and planned ICT RTD infrastructure meets with the needs of Serbian Researchers for an effective participation in the FP7 – ICT Theme. If these needs are not met the goal was to specify what actions must be taken (regarding ICT Infrastructures) to meet these needs.

Desk research methodology was the basis of this analysis for Deliverable 4. Validation of the results was obtained through live interviews (within Deliverable 5) and Delphi survey (within Deliverable 6). Major suppliers of the information: Public sources, Web, governmental bodies and all subjects involved in FP6 and FP7 projects.

### **1.4.1 Current ICT RTD infrastructure**

**Current Serbian infrastructure** for ICT RTD activities is covering e-Infrastructure, specialized equipment for ICT RTD activities, knowledge layer and public telecommunications infrastructure. As there is no "distributed" or "virtual" infrastructure in Serbia, the focus was on the common infrastructure necessary for academic community in general and thus also for FP7-ICT Theme participation: academic network AMRES, Grid initiative and supercomputing center.

**The Academic Network of Serbia** (AMRES) is one of the most important national-research and educational resources and for sure - the most important resource for ICT RTD infrastructure. Without the "light from the dark fiber" of AMRES there is no national nor international Serbian cooperation in ICT R&D field. Without cooperation - there is no ICT development and finally - there is no Information Society in Serbia. Academic and Educational **Grid Initiative of Serbia** (AEGIS) seeks to unify High Performance Computing in Serbia integrating it into robust national, regional and pan-European infrastructures. In addition, Institute for Physics in Belgrade has become a regional centre for supercomputing. The first strategic project was 'The Blue Danube', which has duration of 7 years.

The estimation based on desk research analysis shows that **current infrastructure for ICT RTD activities in Serbia is undeveloped** due to the low and irregular investments, **inadequate** – due to the short amortization period of this type of equipment and discontinuity in upgrades or renewing and **only partially meets the real needs of Serbian science** and research. With the respect to all above, the general estimation is that current infrastructure is sufficient and does not present significant obstacle for present Serbian participation in FP7-ICT Theme. However, with some exceptions, the existing infrastructure will hardly meet the needs for the *future* FP7-ICT Theme.

**Proposed actions, which have to be taken regarding current ICT infrastructure**, are classified as following: (1) Actions to improve the local infrastructure in organizations/companies together with actions aimed to rise the level of specialized equipment in laboratories to reach the EU standards; (2) Actions to improve end-user knowledge and education (for better use of existing infrastructure: resources, services and applications); (3) Actions to improve infrastructure between Serbia and neighboring countries and among ICT RTD players in Serbia (Serbian WAN ICT RTD infrastructure) and (4) Actions to improve public telecommunication infrastructure.

#### **1.4.2 Planned ICT RTD infrastructure**

Considering **planned infrastructure** for ICT RTD activities the main Government plans are project for investment in Serbian R&D infrastructure, SEE Light project, National Supercomputing and Data Storage Center Project – Blue Danube. For sure, the most important is the Serbian R&D infrastructure investment initiative.

The **SEELight project** tackles the materialization of the South-East European Lambda Network Facility for the regional research, academic and education communities. The project envisages leasing optical telecommunication systems for a period of 15 years and the purchase of equipment for the academic network in Serbia. The project is expected to be completed by 2011.

The **South-East European e-Infrastructure** initiatives are committed to ensuring equal participation of the less-resourced countries of the region in European trends. SEE-GRID-SCI is a 2 year project co-funded by the European Commission, started on 1 May 2008. SEEREN initiative has established a regional network for Serbia and other SEE countries.

**Serbian R&D infrastructure investment initiative** is a part of of the “Science and Technological Development Strategy of the Republic of Serbia 2010 – 2015” prepared by Ministry of Science and Technological Development and adopted by Serbian Government on February 25, 2010.

Increasing and diversifying R&D expenditure, as well as investing EUR 300 million in infrastructure, are preconditions for the success of this strategy. The goal is to reach total budgetary R&D expenditures of 1% of GDP by 2015 (previously aimed at in 2007 and 2014). Key infrastructure projects for S&T and level of investments in Serbia:

1. Development of information and communication technology infrastructure (50 to 80 million)
  - ⇒ The campus of faculties in the area of ICT Sciences, University of Belgrade
  - ⇒ Infrastructure for supercomputing initiative “Blue Danube”

2. Upgrading existing capacities (EUR ~ 70 million)
3. Development of human capital (EUR ~33 million)
4. Development of centers of excellence and academic research centers (EUR ~60 million)
5. Creation of a knowledge based economy (~30 million euro)
6. Basic infrastructure projects (~80 million euro)

**The estimation is that planned infrastructure *mainly satisfies* the need of Serbian researcher for an effective participation in the FP7 – ICT Theme.** However, as the equipment include instruments, computer equipment, networks and other equipment that lie on the boundary of acceptable technical and technological level, consistent realization of the planned investment in infrastructure for ICT RTD is necessary.

### **1.4.3 SWOT analysis of ICT RTD infrastructure**

Based on available information on present and planned infrastructure, instead barriers and opportunities, SWOT analysis of this segment was performed.

#### **Infrastructure Strength:**

- ⇒ The Academic Network of Serbia is considered to be the most advanced non-profit network in the country with over 155 connected institutes/faculties in 20 cities and more than 100.000 active users.
- ⇒ Existing of Academic and Educational Grid Initiative of Serbia (AEGIS) that seeks to unify High Performance Computing in Serbia and integrate it into robust national, regional and pan-European infrastructures.
- ⇒ The project, funded by the National Investment Plan (NIP), for investment in capital equipment for scientific research was realized in period 2007 – 2008. The project budget of 21.5 million euro was spent on the purchase of 400 different devices.

#### **Infrastructure Weaknesses:**

- ⇒ Current infrastructure for ICT RTD activities in Serbia is undeveloped due to the low and irregular investments, inadequate – due to the short amortization period of this type of equipment and discontinuity in upgrades or renewing and only partially meets the real needs of Serbian science and research.
- ⇒ Lack of large-scale R&D equipment is evident. ICT incubators and Innovation centres are not developed enough. Government funding is intended to limited number of registered Science and Research Organizations.

- ⇒ According to public sources investment in R&D in Serbia is 14 euro per capita, round 55 euro per employee and 11.930 euro per FTE researcher in 2008, annually, which is several times less than in European countries.

### **Infrastructure Opportunities:**

- ⇒ The Government Project for infrastructural investments, worth 300 million Euros should start in January 2010 and last till the end of 2014. Among the key infrastructure projects for science and technology is the development of information and communication technology infrastructure. The budget planned for this purpose is between 50 and 80 million Euros.
- ⇒ The Strategy and Action plan for development of broadband access in the Republic of Serbia up to year 2012 provides activities that should provide broadband access to public institutions, like schools, libraries, public health facilities.
- ⇒ The Institute for Physics has become a regional centre for supercomputing. The Laboratory for the use of computers in science of this Institute is one of the 18 members of the European supercomputing centre, and aside from Poland is the only laboratory in Eastern and South East Europe.
- ⇒ In this moment, the EPS SDH/DWDM network is used only for the EPS purpose, but network has a huge potential to provide alternative backbone optical infrastructure for e-Government projects, public operators and service providers, and immediately introduce competition in this area.

### **Infrastructure Threats:**

- ⇒ With few exceptions, obsolete existing infrastructure: For many years in the past, researchers carried out their research in laboratories with (obsolete) equipment and they got used to it. The same approach in the future would lead to such differences so that national infrastructure became incompatible with the EU ICT RTD infrastructure.
- ⇒ There are no private faculties connected to AMRES at the moment. If this situation does not change in the near future, although formally equal, the private education sector will increasingly fall behind in terms of ICT equipment and infrastructure.

#### **1.4.4 Recommendations and proposed actions regarding present and planned infrastructure**

Serbia's yearly budget spent on ICT RTD infrastructure is estimated on EUR 2 million (0,005% GDP), which is similar to the yearly budget of a solid university or institute from EU15. This situation has lasted for more than twenty years. Extremely low investments in ICT RTD area are detected as the main barrier in all obtained analysis (policy environment, main stakeholders,

infrastructure, interviews...). Considering present very challenging finances of the Government, it may look like inappropriate and not actionable to put the most of financial burden on it and require increasing of investments in ICT RTD. However, knowing that the Government spends every day few times bigger amount (then the yearly ICT RTD budget) on "fire-extinguishing" of actual economic problems, it is unacceptable and there is no excuse for, up to now, practically no investment in ICT RTD infrastructure.

To overcome this situation Government planned EUR 300 million investment in RTD infrastructure, according to the Strategy of Science and Technological Development in Serbia (2010-2015). EUR 50-80 million is intended for ICT infrastructure. ***Few observations are coming out of this plan:***

- (1) Investment of EUR 300 million is a unique opportunity for developing of modern ICT RTD infrastructure in the past two decades. Probably, there will be no opportunity for correcting the mistakes.
- (2) As the Government has already secured the resources for ICT RTD investments, mostly from the international loans (200 million EUR from EIB), it is of high importance to spend this amount carefully and to have the clear, transparent, public available plan.
- (3) ICT RTD intended resources of EUR 50-80 million are "ad hoc" and are not expected to continue.
- (4) Range of investments (EUR 50-80 million) is wide, considering present yearly budget for ICT RTD infrastructure of EUR 2 million.
- (5) The investment absorption of Serbian ICT RTD sector is modest. There is a risk that large investments will "flood" the sector.

With respect to all above as well as to importance and size of this investment, the first and most urgent proposed actions are:

**Enable clear procedure and criteria on spending the amount of EUR 300 million in R&D infrastructure and make it transparent and public available. This has to be done in a short time period as the contract with European Investment Bank (EIB) is already signed in March 2010.**

The lack of transparency, public available procedures and criteria are the barriers that can throw in the shade all other barriers as well as the planned results. For that reasons the actions proposed should throw light on solving other connected problems.

To achieve visible and permanent effects from planned investments, the following actions are proposed:

- (1) Track with accuracy all places and stakeholders of ICT RTD investment. Include the high detailed central evidence.
- (2) Consider implementation process in carefully defined and controlled stages (by tracking the Return of Investments) due to the low absorption ability of the ICT RTD sector.
- (3) Increase significantly investments in infrastructure required for FP7-ICT projects. Invest in project proposals with FP7 evaluation marks above 12.5 that are not financed by the EU. Particularly invest in projects which results are applicable in cooperation with domestic industry.

***Fast implementation of the Strategy on Science and Technological Development (2010-2015) and adoption of corresponding Action Plan*** that would define the concrete actors, responsibilities and deadlines are necessary. Adoption of the Strategy was planned for September 2009 and realized in February 2010, and there is no Action Plan yet.

#### **Actions on stake-holder's level**

Additional presented actions rely not so firmly on existing Government plans and consequently have significantly lower impact than the two ones proposed above. These actions are basically regarding increasing involvement ***of ICT companies, Faculties and institutes*** in RTD and thus have indirect impacts on ICT RTD infrastructure.

- ⇒ ***Government*** is suggested to reorganize the current funding for R&D projects intended to limited number of organizations and institutions registered as SRO (Science & Research Organizations).
- ⇒ ***ICT RTD companies*** are recommended to make ICT RTD association and (try) to influence policy makers; to track EU ICT R&D priorities, invest in these areas and increase significantly their investments in infrastructure and capacity building; to search and make connections to ICT related faculties and institutes.
- ⇒ ***Faculties and institutes*** are suggested to intensify the establishment of spin off companies related directly or indirectly to their activities and improve their ICT infrastructure. Government should consider stimulation measure for Faculties and institutes to invest part of their incomes in infrastructure.
- ⇒ ***Each local community should consider creating „ICT meeting points“*** such as technological parks, spin off companies, ICT incubators or innovation centres.
- ⇒ ***Facilitate and accelerate mobile operators' investments in broadband infrastructure*** through the abolition of additional tax of 10% on mobile phone use.

- ⇒ ***It is recommended that Statistical Office of the Republic of Serbia starts up the statistical follow up of the investment in ICT RTD area*** to overcome the limitations of currently available public data and their accuracy and reliability.
- ⇒ Actions specified in the Action Plan of Strategy for Telecommunications Development in Serbia (2009-2014) include establishment of the legal entity for AMRES and realization of the SEELight project for development of AMRES optical infrastructure. Actions in the Strategy and Action Plan for Development of Broadband Access in Republic of Serbia up to year 2012 are considering broadband access to public institutions and broadband network that would include (AMRES) and SEELight project and built an integral Educational network of Serbia (EMRES).

### **Actions on EU level**

Proposed international financial support through donations, programs, ICT RTD projects and loans:

- (1) Continued foreign donations are condition *sine qua non* for ICT RTD infrastructure development in Serbia.
- (2) International scientific and technological cooperation has to be one of the main priorities of Serbian researchers.
- (3) International financial institutions should be the most important financial resources for Serbian ICT RTD capital expenditures in the next few years.

Big international technological companies should consider Serbia as a place for realizing a part of their development programmes through investing in Serbian existing research infrastructure and capacities or by forming new ones.



## ***1.5 Analysis of the ICT-RTD capabilities in Serbia and the measures to maximize the Serbia's potential in the FP7-ICT***

Further research is focused on detection centers of excellence in both private and public sector, in order to identify the key players with potential for FP7–ICT Theme Challenge and Objectives. Finally, this section provides conclusions followed by recommendations of the actions needed to be taken at national and European level in order to increase the participation of both private and public sector carrying out ICT RTD in Serbia. Desk research methodology was used to identify the main public and private organizations involved in ICT RTD in Serbia. Live interviews with identified organizations were conducted and lists of identified centers of excellence and potential centers of excellence were composed. Major suppliers of the information: main public and private organizations involved in ICT RTD in Serbia.

For the scope of the analysis 72 organizations, were selected: ICT RTD organizations, faculty departments and research units. 45 persons and 37 organizations were interviewed in detail, taking into consideration that in participants' demography the biggest part comes from the most important ICT RTD entities and the presence of different types of organizations (high education, institutes and business sector).

### **1.5.1 Centers of ICT RTD excellence**

The Centre of Excellence (CoE) was established in Serbia in the middle of 2008 according to the Law on Research Activities and following Rule Book, more than 5 years late in comparison to EU12 countries. For example, in the 5th Framework Programme the Commission of the EU supported the development of 34 centres of excellence in 11 candidate countries to help restructure their science and technology sectors. The EU provided more than EUR 24 million to establish a network of centres.

As in Serbia this type of entity has just begun to develop, it will take significant amount of time and money to achieve its full implementation in the following 3-5 years. For now, the existing CoE are still not recognized as real leaders of RTD activities in Serbia, which should happen in the time to come.

It happens to be that only institutes or High Education entities can become CoE and that is after 5 years of achieving successful results in international cooperation. Currently there are 9 Centers of Excellence (CoE) in priority RTD areas with two among them officially accredited by the MSTD and the seven are the EU CoEs.

Table 24 List of existing CoE in Serbia

#	CENTRE OF EXCELLENCE Main Institution	URL address Contact - Leader
<b>CoE officially accredited by the MSTD</b>		
1	<b>Centre for Mathematical Research of Nonlinear Phenomena</b> Department of Mathematics and Informatics, Faculty of Science, Univ. of Novi Sad	<a href="http://www.dmi.rs/projects/CMRNP/">http://www.dmi.rs/projects/CMRNP/</a> dr Stevan Pilipović
2	<b>Center for Solid State Physics and New Materials</b> Institute of Physics -Belgrade	<a href="http://www.solid.ipb.ac.rs/">http://www.solid.ipb.ac.rs/</a> dr Zoran Popović
<b>EU Centre of Excellence</b>		
3	<b>Web4Web - Web Technologies for West Balkan countries</b> Institute Mihajlo Pupin - Beograd	<a href="http://www.web4web.org">http://www.web4web.org</a> dr. Sanja Vraneš
4	<b>VINCENT (National Centrum for Knowledge based materials)</b> Institut Vinča - Beograd	<a href="http://www.vincent.org.rs/">http://www.vincent.org.rs/</a> dr Vojislav Spasojević
5	<b>SCL - Scientific Computing Laboratory</b> Institute of Physics -Belgrade	<a href="http://scl.ipb.ac.rs">http://scl.ipb.ac.rs</a> dr. Aleksandar Belić
6	<b>Centre for Non-equilibrium Processes</b> Institute of Physics -Belgrade	<a href="http://mail.ipb.ac.rs">http://mail.ipb.ac.rs</a> dr. Zoran Petrović
7	<b>QUPOM – Center for Quantum and Optical Metrology</b> Institute of Physics -Belgrade	<a href="http://photonics.ipb.ac.rs">http://photonics.ipb.ac.rs</a> dr. Branislav Jelenković
8	<b>OPSA - Optical Spectroscopy Applications</b> Institute of Physics -Belgrade	<a href="http://www.solid.phy.bg.ac.rs/OPSA/">http://www.solid.phy.bg.ac.rs/OPSA/</a> dr.Zoran V. Popovic
9	<b>C3N - Centre for nanostructures, nanoelectronics and nanophotonics.</b> Elektrotehnički fakultet - Beograd	<a href="http://nobel.etf.bg.ac.rs/centri/?p=c3n">http://nobel.etf.bg.ac.rs/centri/?p=c3n</a> prof. Milan Tadić

### 1.5.2 Potential Centres of Excellence (CoE)

Identification of potential CoE was performed under two main restrictions. The first restriction is considering the choosing of the criteria for identification of potential CoE, as the official criteria (the Law on Research Activities and the Rule Book on the criteria and standards for CoE) were too restrictive. For that reason the selection is based on the parameters that are reliable, obvious, and relevant and indicate understandable and acceptable level of qualifications for potential CoE.

The second reason lies in modest quality and size of public available data on ICT RTD in Serbia. Only 9 research organizations from ICT area (see list below) have been statistically followed up. The work on this data was additionally hampered with unsystematic data on goods, services, filed of work and professions (NACE classes).

List of 9 research organizations from ICT area according to official statistic:

1. SCHOOL OF ELECTRICAL ENGINEERING (ETF)
2. FACULTY OF ORGANIZATIONAL SCIENCES (FON)
3. FACULTY OF TECHNICAL SCIENCES, NOVI SAD (FTN)
4. FACULTY OF ELECTRONIC ENGINEERING, UNIVERSITY OF NIŠ (ELFAK)
5. FACULTY OF MATHEMATICS, UNIVERSITY OF BELGRADE (MAT BG)

6. FACULTY OF SCIENCE, NOVI SAD (PMF NS)
7. INSTITUTE MIHAILO PUPIN (IMP)
8. IRITEL AD BEOGRAD
9. INSTITUTE FOR MICROWAVE TECHNIQUES AND ELECTRONICS (IMTEL)

The adopted criteria for identifying the potential CoE is based primarily on total number of ICT RTD researchers in particular research unit (not the whole organization) combined with achieved success in FP7-ICT projects. Whenever it was possible (based on public available data or good estimation) the number of realized projects and number of published scientific works were taken into account. Beside this, the high expertise and/or market approval in ICT area of the entities were considered.

The chosen approach disables incorrect or inadequate application of the too formal and too restrictive criteria proposed by the Law, but allows practical identification of potential CoEs. The first step toward composing the list of potential centres was to detect if each entity satisfies the conditions of any of three selected categories: a) centres of competence, b) centres of potential for FP7-ICT and c) centres of best practice.

Where:

(a) Centres of competence are entities with significant number of published scientific works and realized projects, and have a number of researchers with PhD. In this group, the majority come from relevant state owned organizations (faculties' departments and institutes).

(b) Centres of potential for FP7-ICT are entities which have been successful in the FP7-ICT Theme (all entities related to FP7-ICT are from evidence for FP7-ICT Theme Call 3 inclusive).

(c) Centres of best practice – are exclusively ICT companies (from the business and industry sectors) which have a good market reputation and a strong reference list and have been "recognized and well known by specific expert community" or "recommended from the person of authority (in specific area)", but have not participated in the FP7-ICT Theme or have been unsuccessful.

The list contains 72 organizations. Each entity could be classified into no more than two categories. In order to obtain a consolidated list of CoEs and a consolidated list of potential CoEs quantitative and qualitative criteria were defined and then applied.

### **1.5.3 Consolidated List of Identified Centres of Excellence (CoE)**

For the requirements of this analysis the quantitative and qualitative criteria were defined and then applied to obtain the consolidated list of CoE and consolidated list of potential CoE. The first quantitative criterion is based on data analysis from Annex I Who is Who in ICT Research, *Section Research areas of main expertise according FP7-ICT Challenge and Objectives*. The

main idea was to form the Competence/Share Matrix (CSM) of identified CoE, presented in Figure 13. For each research unit the data on its expertise according to FP7-ICT objectives is considered (from Annex I – Who is Who). For each research unit the sum of declared expertise is presented as a number in a column “Total”.

Explanation: CSM presents two parameters compound for each research unit: Centre Competence Ratio (column CCR in Table below) and Centre Share Ratio (column CSR).

- ⇒ CCR [%] is ratio of number of expertise for particular research unit and a number of Challenges from which these expertise are coming combined with ratio of number of researchers of that particular research unit and total number of researchers (of all consolidated research units).
- ⇒ CSR [%] is ratio of number of expertise for particular research unit and the total number expertise (of all consolidated research units).

As the second quantitative criterion the number of researchers (Ph.D, M.Sc. and B.Sc) and the number of employees in development sector (Senior and Junior R&D staff) were used.

Qualitative evaluation of the questionnaires was obtained for every research unit. The quality of answers, information, competences and references were evaluated from 0 (the worst) to 10 (the best).

**Identified CoE** are organizations and research units with necessary critical mass of knowledge, resources and infrastructure, thus capable for achieving research results. For identifying the CoE the threshold of at least 3 FP7-ICT expertises and minimum of 9 researchers (Ph.D, M.Sc. and B.Sc) was set. Selection of 17 entities is presented. Among them three research units, all of them institutes, have significantly bigger number of researchers than average and three research units have significantly bigger number of expertise than average. Only two organizations from consolidated list of CoEs came outside High Education Sector and Institutes: one from industry sector and one from SME.

Table 25 Consolidated list of identified centres of excellence

Short name	Research unit	NoE	NoR	Expertise by FP7-ICT Challenge and Objective								Total	CC1	CSR [%]	CCR [%]
				1	2	3	4	5	6	7	FET				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
IMP	INSTITUTE MIHAILO PUPIN	437	205	[1.2] [1.3]	[2.1] [2.2]	[3.4] [3.5] [3.6]	[4.2] [4.3]	-	[6.1] [6.2] [6.3] [6.4] [6.5]	[7.2] [7.3]	2	<b>18</b>	2,6	7,1	43,0
IPB	INSTITUTE OF PHYSICS BELGRADE	180	140	[1.1] [1.2] [1.6]	-	[3.1] [3.2] [3.5] [3.6] [3.7]	[4.1] [4.2]	-	[6.3] [6.4]	-	5	<b>17</b>	3,4	6,7	38,8
FON.1	FACULTY OF ORGANIZATIONAL SCIENCES (FOS), UoB, Chair for e-Business and System Management	9	9	[1.1] [1.2] [1.3] [1.4] [1.5] [1.6]	-	-	[4.1] [4.2] [4.3]	-	[6.1] [6.2] [6.3] [6.4] [6.5]	[7.1] [7.2] [7.3]	-	<b>17</b>	4,3	6,7	3,1
ETF.1	SCHOOL OF ELECTRICAL ENGINEERING, UoB, Department of Electronics	21	18	[1.1]	-	[3.2] [3.3] [3.5] [3.6] [3.9]	-	[5.2]	[6.1] [6.2] [6.3] [6.5]	-	2	<b>13</b>	2,6	5,1	3,8
ETF.2	SCHOOL OF ELECTRICAL ENGINEERING, UoB. Chair of Automatic Control	24	24	-	[2.1]	[3.4]	-	[5.1] [5.2] [5.3]	[6.1] [6.2] [6.3]	[7.1] [7.2]	2	<b>12</b>	2,0	4,7	3,9
CIM	CIM COLLEGE (CIM GROUP)	25	20	[1.2] [1.3] [1.6]	-	-	[4.3]	[5.2]	[6.1] [6.3] [6.4] [6.5]	[7.3]	2	<b>12</b>	2,0	4,7	3,3
ETF.3	SCHOOL OF ELECTRICAL ENGINEERING, Department of Telecommunications	28	28	[1.1] [1.2] [1.4] [1.6]	-	[3.4] [3.5] [3.6]	-	-	[6.2]	-	2	<b>10</b>	2,5	3,9	5,7

Consolidated list of identified centres of excellence – Objective’s expertise – Continued Table 22.

Short name	Research unit	NoE	NoR	Expertise by FP7-ICT Challenge and Objective								Total	CC1	CSR [%]	CCR [%]
				1	2	3	4	5	6	7	FET				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
FON.2	FACULTY OF ORGANIZATIONAL SCIENCES (FOS), UoB. GOOD OLD AI	100	20	[1.2] [1.3] [1.6]	[2.1] [2.2]	-	[4.1] [4.2] [4.3]	-	-	[7.2]	-	9	2,3	3,5	3,7
ETF.4	SCHOOL OF ELECTRICAL ENGINEERING, UoB. Chair Of Computer Engineering and Information Theory	24	24	[1.2] [1.5]		-	[4.2] [4.3]	[5.1] [5.2]	[6.1] [6.2]	[7.3]	-	9	1,8	3,5	3,5
FTN.1	FACULTY OF TECHNICAL SCIENCES, University of NOVI SAD Chair of Communications and Signal Processing	25	24	-	[2.1] [2.2]	-	[4.3]	-	-	[7.1] [7.2]	2	7	1,8	2,8	3,4
PMF	FACULTY OF MATEMATICS UNIVERSITY OF BELGRADE Department of Computing and Informatics	35	21	[1.1] [1.2] [1.3]	[2.2]	-	[4.1] [4.2] [4.3]	-	-	-	-	7	2,3	2,8	4,0
ELFAK.1	Faculty of Electronic Engineering, University of Niš, Laboratory for Electronic Design Automation (LEDA)	12	11	-	-	[3.2] [3.4]	[4.2]	-	[6.3] [6.5]	-	1	6	1,5	2,4	1,3
IMTEL	Institute for Microwave Techniques and Electronics (IMTEL)	49	22	[1.6]	[2.1]	[3.4] [3.5] [3.9]	-	-	-	-	-	5	1,7	2,0	3,0
ETF.5	SCHOOL OF ELECTRICAL ENGINEERING, UoB. Chair of General Electrical Engineering	13	13	[1.6]	-	[3.2] [3.9]	-	-	[6.2] [6.4]	-	-	5	1,7	2,0	1,8
ELFAK.2	Faculty of Electronic Engineering, University of Niš Chair Of Telecommunications	26	26	-	[2.1] [2.2]	[3.4]	-	-	[6.2]	-	-	4	1,3	1,6	2,8
IRITEL	IRITEL AD BEOGRAD	195	85	[1.1]	-	[3.4] [3.5]	-	-	-	-	-	3	1,5	1,2	10,4
DKTS	PUPIN TELECOM DKTS	165	40	-	-	[3.4]	-	-	[6.3] [6.5]	-	-	3	1,5	1,2	4,9
	TOTAL	1368	730	30	11	28	18	7	33	12	18	157			

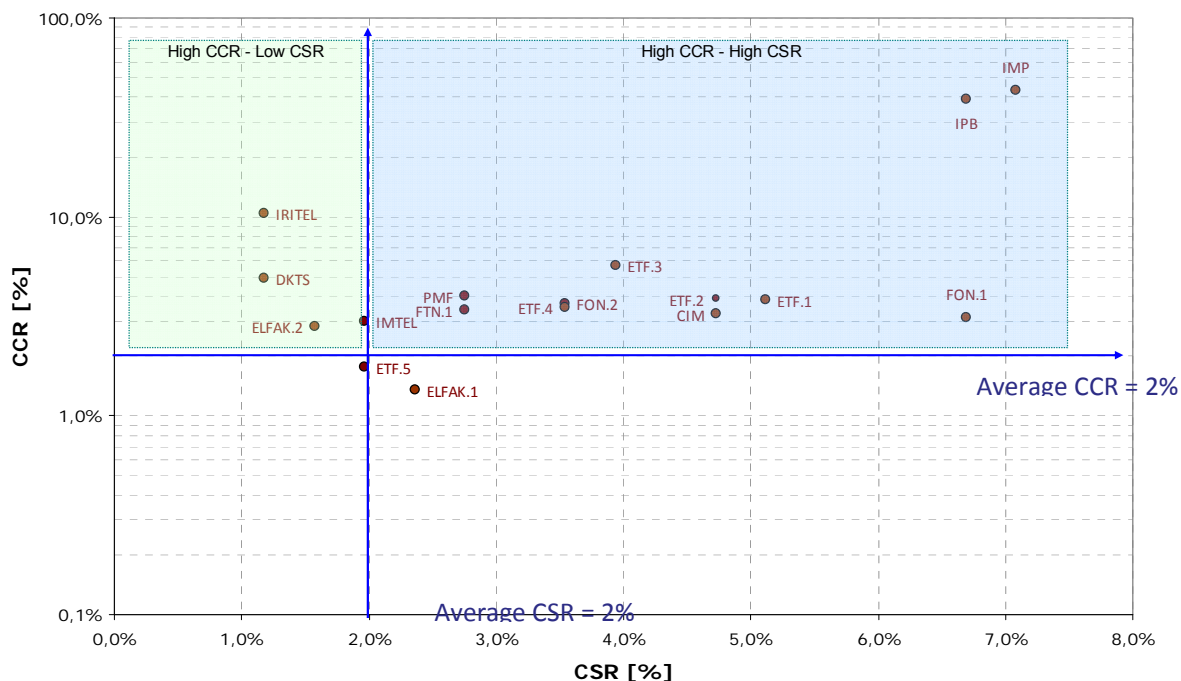
**Legend:**

- |   |  |
|---|--|
| 1 - Pervasive and Trustworthy Network and Service Infrastructures | 5 - Towards sustainable and personalized healthcare      |
| 2 - Cognitive Systems, Interaction, Robotics                      | 6 - ICT for Mobility                                     |
| 3 - Components, systems, engineering                              | 7 - ICT for Independent Living, Inclusion and Governance |
| 4 - Digital Libraries and Content                                 | FET - Future and Emerging Technologies                   |

Key observations from the Table above:

- ⇒ The results of Competence/Share Matrix as well as the number of researchers for Serbian ICT research units are presented in Table above for identified CoE s, Average identified and consolidated CoE has round 20 researchers and 9 expertise in ICT RTD fields related to FP7 – ICT Theme (Challenges, Objectives).
- ⇒ Three research units, all of them institutes, have significantly bigger number of researchers than average: Institute Mihailo Pupin (205), Institute of Physics Belgrade (140) and IRITEL (85). Institute of Physics Belgrade is involved in basic research, while other two are in the field of applied technological research in ICT area.
- ⇒ Three research units have significantly bigger number of expertise than average: Institute Mihailo Pupin (18), Institute of Physics Belgrade (17) and Faculty of Organizational Sciences (FOS) - Chair for e-business and System Management (17).
- ⇒ Only two organizations from consolidated list of CoE came outside High Education Sector and Institutes: Pupin Telecom DKTS as industry sector representative and CIM College as the only Serbian SME.

Figure 14 Competence/Share Matrix of identified CoE in Serbia



- ⇒ Figure above presents the Competence/Share Matrix of identified CoE and shows that Centre Competence Ratio (CCR) of all research units (with exception of two) is higher than adopted criterion for becoming CoE. Two entities (ETF.5 and ELFAK.1) are below this border, which is

the result of missing the critical mass of researchers and sufficient matching with FP7-ICT objectives.

⇒ This diagram can be considered as a good base as well as an instrument for monitoring CoE.

The number of expertise is significantly more depending on mapping of unit's research area with FP7-ICT Theme Challenges and Objectives than on the number of researchers. The best example for this conclusion is the IRITEL with 85 researchers and only 3 expertises - on one side and (FOS) - Chair for e-business and System Management with 9 researchers and even 17 expertises - on the other. This is also a good illustration of the reasons for success and failure of Serbian entities in FP7-ICT Theme. Whatever the critical mass and competence have the organization – if its research area does not fit to Challenges and Objectives of FP7-ICT Theme – there will be no effects in FP7 participation. In addition, the organizations with research areas that strongly fit to Challenges and Objectives of FP7-ICT Theme easily engage their capacity by choosing the most profitable jobs which is usually not the FP7-ICT.

### 1.5.4 Consolidated List of Identified Potential Centres of Excellence

Identified potential CoE are organizations and research units with potentially sufficient critical mass of knowledge, resources and infrastructure and perspective to manage achieving research results in the near future. For identifying the potential CoE the threshold of at least one FP7-ICT expertise and minimum of four senior researchers (Ph.D, M.Sc. and B.Sc) was set. Selection of 23 entities is presented.

Figure 15 Competence/Share Matrix of identified potential CoE in Serbia

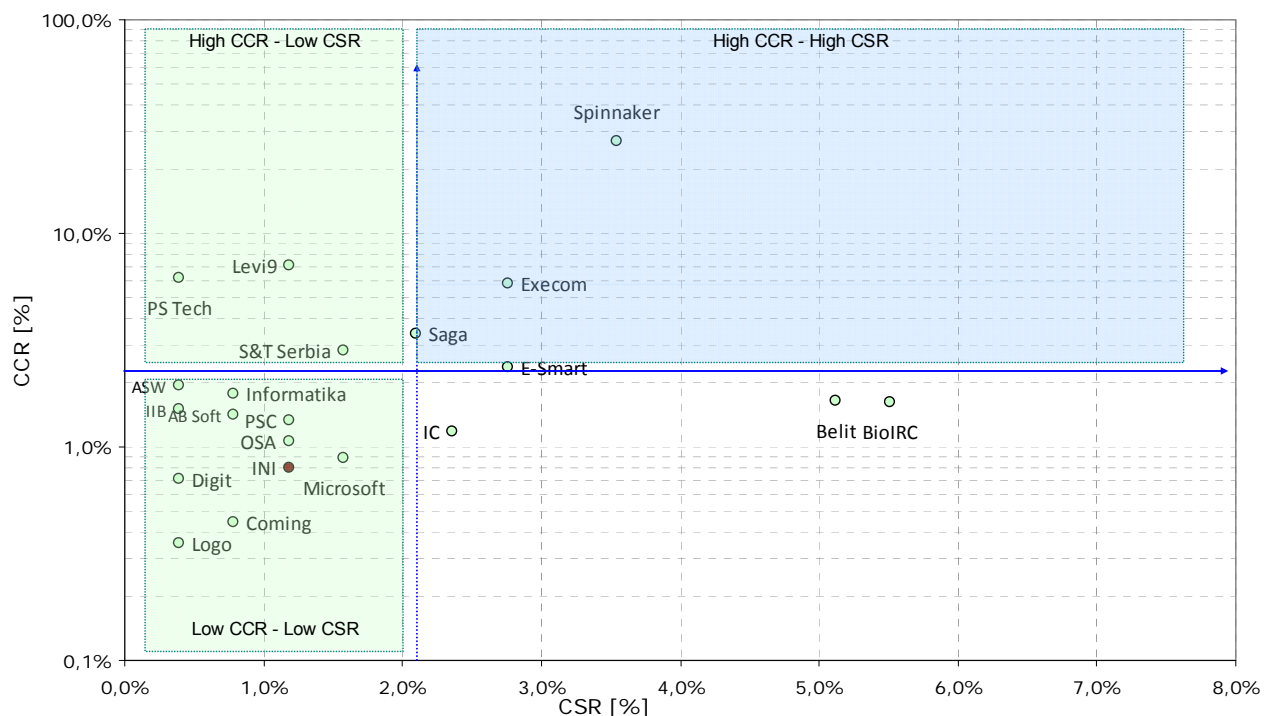




Table 26 Consolidated list of identified potential centres of excellence

Research unit	NoE	NoR	Expertise by FP7-ICT Challenge and Objective								Total	CC1	CSR	CCR	
			1	2	3	4	5	6	7	FET					
BioIRC, Bioengineering Research and Development Center, Kragujevac	15	10	-	2.1 2.2	3.6 3.9	4.3	5.1 5.2 5.3 5.4	6.1	7.1		3	14	2,0	5,5%	1,6%
Belit Ltd. - Belgrade Information Technologies	17	10	1.2 1.3	2.2	3.5	4.1 4.2 4.3	5.1 5.2	6.1 6.4 6.5	-		1	13	1,9	5,1%	1,6%
SPINNAKER NEW TECHNOLOGIES Ltd.	212	136	1.2 1.3	-	-	4.1 4.3	5.1 5.2 5.3	-	7.2 7.3			9	2,3	3,5%	27,2%
E-SMART SYSTEMS DOO	48	19	1.2 1.3	-	3.4	-	5.1	6.1 6.3	7.3			7	1,4	2,8%	2,4%
EXECOM d.o.o	41	28	1.2 1.3	-	-	-	5.1 5.2	-	7.1 7.2 7.3			7	2,3	2,8%	5,8%
Innovation Center, School of ETF	14	11	1.6	-	3.5	-	5.1 5.2	6.3	7.3			6	1,2	2,4%	1,2%
SAGA d.o.o.	290	23	1.1 1.2 1.3	2.2	-	-	-	-	7.3			5	1,7	2,0%	3,4%
RCUB			1.1 1.2 1.4 1.5 1.6	-	-	-	-	-	-			5	5,0	2,0%	0,0%
S&T Serbia	86	16	1.2 1.3	-	-	4.1 4.3	-	-	-			4	2,0	1,6%	2,8%
Microsoft Software Ltd.	19	5	-	2.2	-	4.1 4.2 4.3	-	-	-			4	2,0	1,6%	0,9%
INI	20	6	1.2	-	-	4.2 4.3	-	-	-			3	1,5	1,2%	0,8%
OSA Racunarski Inzenjering	29	8	1.1	-	-	4.1 4.3	-	-	-			3	1,5	1,2%	1,1%
PSC doo	42	15	-	-	-	4.3	-	-	7.3	1		3	1,0	1,2%	1,3%
Levi9 Global Sourcing Balkan	102	80	-	-	3.6	4.3	-	6.2	-			3	1,0	1,2%	7,1%
Coming Computer Engineer.	30	5	1.2	-	3.5	-	-	-	-			2	1,0	0,8%	0,4%
AB Soft	40	16	1.3	-	-	4.1	-	-	-			2	1,0	0,8%	1,4%
INFORMATIKA AD	200	10	-	-	3.4 3.6	-	-	-	-			2	2,0	0,8%	1,8%
IIB d.o.o.	25	17	1.3	-	-	-	-	-	-			1	1,0	0,4%	1,5%
ASW INZENJERING ltd.	42	22	1.3	-	-	-	-	-	-			1	1,0	0,4%	2,0%
PSTech d.o.o.	75	70	1.2	-	-	-	-	-	-			1	1,0	0,4%	6,2%
Digit	76	8	1.3	-	-	-	-	-	-			1	1,0	0,4%	0,7%
LOGO d.o.o.	74	4	1.4	-	-	-	-	-	-			1	1,0	0,4%	0,4%
INTENS d.o.o Novi Sad	42	4		-	-	-	-	-	-			1			0,0%
	1539	523	28	5	9	18	14	8	10	5		98	12,3	38,2%	

**Legend:**

1 - Pervasive and Trustworthy Network and Service Infrastructures

2 - Cognitive Systems, Interaction, Robotics

3 - Components, systems, engineering

4 - Digital Libraries and Content

NoE – Number of employees

5 - Towards sustainable and personalized healthcare

6 - ICT for Mobility

7 - ICT for Independent Living, Inclusion and Governance

FET - Future and Emerging Technologies

NoR – Number of researchers,

Key observations from the Table above:

- ⇒ On this list Business sector is almost exclusively present. The only exceptions are Innovation Center of ETF and RCUB. Majority of research groups is active in only one or two research areas (Challenges) which differ from the previous list where the research groups are active in three and more.
- ⇒ Research groups in Business sector are (almost as a rule) in the area of lower technological level in comparison to High Education Sector and Institutes. In the case of research groups from business sector, development and implementation are represented mostly, while the research component is slightly visible.
- ⇒ The average identified potential CoE in Serbia has round 10 experts in development and round 4 declared expertise in the ICT RTD field in accordance with the FP7 – ICT Theme terminology (Challenges, Objectives).
- ⇒ Three research units, all of them very active on international IT market, have significantly bigger number of researchers than average: (136), Levi9 (80) and PSTech (70). Spinnaker New Technologies as a part of one of the biggest IT companies in the region (ComTrade Group) works on local, regional and international level, while two other companies are very active on outsourcing market oriented to the clients from the West countries.
- ⇒ Three research units have significantly bigger number of declared expertise than average: BioIRC (14), Belit Ltd. (13) and Spinnaker New Technologies (9).
- ⇒ Only one organization (INI) was successful in FP7-ICT Theme and only two have participated unsuccessfully. This sector hides a big potential for FP7-ICT consortia collaborating. On the one side there are companies from this sector oriented toward development of applicative solutions and on the other side there are reliable companies for implementation and system integration which have already proven them selves on Serbian ICT market.

Table 27 Identification of FP7-ICT objectives of Serbian entities

		Research areas of main expertise according FP7-ICT Challenge and Objectives	Expertise		Competence Share Matrix	
			No. of research units	No of researchers	CCS	CCR
<b>1</b>	<b>A.0</b>	<b>Pervasive and Trustworthy Network and Service Infrastructures</b>		1004		
[1.1]	A.1	The Network of the Future	9	332	27,1%	37
[1.2]	A.2	Internet of Services, Software and Virtualisation	18	780	63,6%	43
[1.3]	A.3	Internet of Things and Enterprise environments	15	570	46,5%	38
[1.4]	A.4	Trustworthy ICT17	4	41	3,3%	10
[1.5]	A.5	Networked Media and 3D Internet	3	33	2,7%	11
[1.6]	A.6	Future Internet experimental facility and experimentally driven research	9	263	21,4%	29
<b>2</b>	<b>E.0</b>	<b>Cognitive Systems, Interaction, Robotics</b>		364		
[2.1]	E.1	Cognitive Systems and Robotics	7	305	24,9%	44
[2.2]	E.2	Language-Based Interaction	9	318	25,9%	35
<b>3</b>	<b>B.0</b>	<b>Components, systems, engineering</b>		731		
[3.1]	B.1	Nanoelectronics Technology	1	140	11,4%	70
[3.2]	B.2	Design of Semiconductor Components and Electronic Based Miniaturised Systems	4	182	14,8%	46
[3.3]	B.3	Flexible, Organic and Large Area Electronics	0	0		
[3.4]	B.4	Embedded Systems Design	11	462	37,7%	42
[3.5]	B.5	Engineering of Networked Monitoring and Control systems	9	524	42,7%	58
[3.6]	B.6	Computing Systems	7	491	40,0%	70
[3.7]	B.7	Photonics	1	140	11,0%	70
[3.8]	B.8	Organic Photonics and Other Disruptive Photonics Technologies	0	0		
[3.9]	B.9	Microsystems and Smart Miniaturised Systems	4	63	5,1%	16
<b>4</b>	<b>F.0</b>	<b>Digital Libraries and Content</b>		804		
[4.1]	F.1	Digital Libraries and Digital Preservation	10	381	31,1%	38
[4.2]	F.2	Technology-Enhanced Learning	10	451	36,8%	45
[4.3]	F.3	Intelligent Information Management	16	609	49,6%	38
<b>5</b>	<b>D.0</b>	<b>Towards sustainable and personalized healthcare</b>		300		
[5.1]	D.1	Personal Health Systems	8	262	21,4%	33
[5.2]	D.2	ICT for Patient Safety	9	281	22,9%	31
[5.3]	D.3	Virtual Physiological Human	3	170	13,9%	57
[5.4]	D.4	International Cooperation on Virtual Physiological Human	1	10	0,8%	10
<b>6</b>	<b>G.0</b>	<b>ICT for Mobility, Environmental Sustainability and Energy Efficiency</b>		690		
[6.1]	G.1	ICT for Safety and Energy Efficiency in Mobility	9	339	27,6%	38
[6.2]	G.2	ICT for Mobility of the Future	9	401	32,7%	45
[6.3]	G.3	ICT for Energy Efficiency	10	497	40,5%	50
[6.4]	G.4	ICT for Environmental Services and Climate Change Adaptation	6	397	32,4%	66
[6.5]	G.5	Novel ICT Solutions for Smart Electricity Distribution Networks (Joint call between the ICT and Energy Themes)	7	313	25,5%	45
<b>7</b>	<b>C.0</b>	<b>ICT for Independent Living, Inclusion and part. Governance</b>		568		
[7.1]	C.1	ICT & Ageing	5	95	7,7%	19
[7.2]	C.2	Accessible and Assistive ICT	7	446	36,3%	64
[7.3]	C.3	ICT for Governance and Policy Modelling	10	490	39,9%	49

### 1.5.5 Who is Who in ICT RTD in Serbia

Serbian Competence Data Base (SCDB) "Who is who in ICT RTD in Serbia" was created based on direct contacts (in the period from October 15 until December 03, 2009) with the key research units and organizations. Solution proposed for SCDB had to satisfy the requirements for data entry, search and analysis obtained through questionnaires within "Who is Who" interviews (Annex I) in the optimal and efficient manner. The given requirements for database were: (1) General requirements: flexible for creation; open; widespread software platform; easy to manage and updating; suitable for common use; low initial costs. (2) End user requirements: easy to use. (3) Analyst/Operator requirements: data entry tool; search engine; data editing; storage; analysis tools and reporting and appropriate selection of search fields (intuitive selection).

Present SCDB 40 profiles of research units and organizations in ICT area in Serbia from High Education sector, Institutes, Business sector and Others. In accordance to structure from Annex I the current base is listed on 442 A4 pages. SCDB contains detailed profiles of all three institutes in ICT area which are officially followed up by Republic Agency for Statistics: IMP, IRITEL and Intel Komunikacije. Beside them, the profile of Institute for Physics is available. Although it is in the area of basic research in the field of physics, this institute is very active and successful in FP7 projects.

All faculties in ICT area that are followed up by official statistics are presented in SCDB: the School of Electrical Engineering (ETF); the Faculty of organizational Science (FON); the Electronic Faculty in Nis (ELFAK); the Faculty of Technical Science of Novi Sad (FTN); the Faculty of Mathematics University of Belgrade and the Faculty of Science University of Novi Sad (PMF). All faculties are presented firstly on the level of the whole organization (as level A). The next level is presenting the particular profiles of research units (departments/chairs and laboratories) which are relevant in the ICT area (as level B).

Table 28 Research units in Serbian Competence Database (SCDB)

#	Main institution	No of Empl	No. of Resear	Type of organization	a	b	c	URL address Contact - Leader
SCHOOL OF ELECTRICAL ENGINEERING (ETF), UNIVERSITY OF BELGRADE								
1	Telecommunications	28	28	High Education	•			www.etf.rs Aleksandra SMILJANIĆ
2	Automatic Control	24	24	High Education	•	•		www.etf.rs Željko ĐUROVIĆ
3	Computer Engineering and Information Theory	24	24	High Education	•			www.etf.rs Veljko MILUTINOVIĆ
4	Electronics	21	18	High Education	•			www.etf.rs Miodrag POPOVIĆ
5	General Electrical Engineering	13	13	High Education	•			www.etf.rs Antonije ĐORĐEVIĆ
FACULTY OF ORGANIZATIONAL SCIENCES (FON), UNIVERSITY OF BELGRADE								

6	Good Old Ai	100	20	High Education	• •	www.fon.rs http://goodoldai.org Vladan DEVEDŽIĆ
7	e-Business and System Management	9	9	High Education	•	www.fon.rs Božidar RADENKOVIĆ
FACULTY OF TECHNICAL SCIENCES, UNIVERSITY OF NOVI SAD (FTN)						
8	Communications and Signal Processing	25	24	High Education	•	www.ftn.uns.ac.rs Vlado DELIĆ
FACULTY OF ELECTRONIC ENGINEERING, UNIVERSITY OF NIŠ (ELFAK)						
9	Laboratory for Electronic Design Automation (LEDA)	12	11	High Education	•	www.elfak.ni.ac.rs Vančo LITOVSKI
10	Telecommunications	26	26	High Education	•	www.elfak.ni.ac.rs Bratislav MILOVANOVIĆ
FACULTY OF MATHEMATICS, UNIVERSITY OF BELGRADE (MAT BG)						
11	Department of Computing and Informatics	32	21	High Education	•	www.matf.bg.ac.rs Dušan TOŠIĆ
FACULTY OF SCIENCE, UNIVERSITY OF NOVI SAD (PMF NS)						
30	Information Systems			High Education	•	www.pmf.uns.ac.rs Mirjana IVANOVIĆ
31	Computer Science			High Education	•	www.pmf.uns.ac.rs Zoran BUDIMAC
INSTITUTES						
12	INSTITUTE MIHAILO PUPIN (IMP)	437	205	Institute	• •	www.institutepupin.com Sanja VRANEŠ
13	Institute of Physics Belgrade	180	140	Institute	•	www.ipb.ac.rs Aleksandar BELIĆ
14	IRITEL AD BEOGRAD	195	85	Institute	•	www.iritel.com Siniša DAVITKOV
15	Institute for Microwave Techniques and Electronics (IMTEL)	49	22	Institute	•	www.insimtel.com NEŠIĆ Aleksandar
OTHERS						
16	Innovation Center, School of Electrical Engineering in Belgrade	14	11	Others	•	www.icef.etf.rs Dušan DRAJIĆ
17	RCUB			Institute	•	www.rcub.bg.ac.rs Slavko GAJIN
BUSINESS SECTOR						
18	AB Soft	40	16	Business		www.absoft.rs Ana BRKIĆ
19	ASW INZENJERING ltd.	42	22	Business		www.asw.eu Nenad AVLIJAŠ
20	Belit Ltd. - Belgrade Information Technologies	17	10	Business		www.belit.co.rs Dušan POZNANOVIĆ
21	BioIRC, Bioengineering Research and Development Center, Kragujevac	15	10	Business, R&D		www.bioirc.ac.rs
22	CIM COLLEGE (CIM GROUP - CIM GRUPA as of November 2009)	25	20	Business	• •	www.cimgrupa.eu www.cimcollege.rs Bratislav STOILJKOVIĆ
23	Coming Computer Engineering d.o.o.	30	5	Business		www.coming.rs Nemanja MILUTINOVIĆ
24	Digit Ltd.	76	8	Business		www.digit.co.rs Dušan KRSTAJIĆ
25	E-SMART SYSTEMS DOO	48	19	Business		www.e-smartsys.com Goran VELJOVIĆ
26	EXECOM d.o.o	41	28	Business		www.execom.eu Aleksandra POPARA
27	IIB d.o.o.	25	17	Business		www.iib.rs Miloš BOŠNJAK
28	INFORMATIKA AD	200	10	Business		www.informatika.com Filip SREČKOVIĆ
29	INI	20	6	Business	• •	www.ini.rs Viktor POCAJT

30	INTENS d.o.o Novi Sad	42	4	Business				• www.intens.rs Branislav ĐUKIĆ
31	Levi9 Global Sourcing Balkan doo	102	80	Business				• www.levi9.com
32	LOGO d.o.o.	74	4	Business				• www.logo.rs Miodarag VELJKOVIĆ
33	Microsoft Software ltd.	19	5	Business				• www.microsoft.com/scg Svjetlana BREKIĆ
34	OSA Racunarski Inzenjering	29	8	Business				• www.osa.rs Željko TOMIĆ
35	PSC doo	42	15	Business				• www.psc.rs Vladimir DŽODŽO
36	PSTech d.o.o. (Power Symbol Technology d.o.o.)	75	70	Business				• www.pstech.rs Branka RADOVANOVIĆ
37	Pupin Telecom DKTS	165	40	R&D, manufacturing, engineering				• www.dkts.co.rs Slobodan LAKETA
38	S&T Serbia	89	16	Business				• www.snt.rs Predrag VRANEŠ
39	SAGA d.o.o.	290	23	Business				• www.saga.rs Nebojša MISKOVIĆ
40	SPINNAKER NEW TECHNOLOGIES ltd.	212	136	Business				• www.spinnaker-nt.com www.comtradegroup.com Nebojša MOMČILOVIĆ

Profiles of round 20 ICT companies from business sector show the size of the ICT RTD potential of this sector which is currently invisible for the official statistic.

### 1.5.6 Policy Network Analysis

This section presents Policy Network Analysis (PNA) for Serbian ICT RTD sector. Main objective of PNA is to illustrate the most visible internal (national) and external (international) relations of main detected Serbian ICT RTD entities. Considered relations are linkages to financial institutions, domestic and foreign universities, research institutes, business companies etc.

Figure below shows the nodes representing the key Serbian ICT RTD entities and relations between them. ICT RTD entities which represent research units are from the list of potential Centres of Excellence (Table 2, Deliverable 5) in total of 72. The numbers presented in the graph correspond to the serial numbers of entities in Table 2 (for example, 3 correspond to an entity with serial number 3 in this table, i.e. Automatic Control Laboratory on ETF). Some research units from HES and Institutes are presented as a part of bigger legal entity composed of several research units (for example ETF is composed of 6 research units).

#### Node types

Node types represent identified entities according to the sector to which they belong: High Education Sector (HES), Institutes (INS), Business (BUS) and Government (GOV). Considering the size of the companies from the business sector (small enterprises up to 50 and medium up to 250 employees), this sector can be considered as the SME. Ministry for Science and Technological Development (MSTD), Ministry for Telecommunication and Information Society (MTIS) and Ministry of Finances (MFIN) are presented as the most important ICT RTD entities in Government sector.

Graphic presentation of nodes:

- ⇒ Red colored and filled – FP7-ICT participants;
- ⇒ Blue colored and filled – all 17 entities from the list of consolidated identified CoE (Table 7 Deliverable 5) and all 23 entities from the list of consolidated potential CoE (Table 8 Deliverable 5);
- ⇒ Grey colored circle – list of not consolidated potential CoE (Table 2 Deliverable 5);
- ⇒ Green colored circle – Government sector;
- ⇒ Red colored circle – International institutions.

### **Relation types**

**Financial relations** are relations between ICT RTD entities and funding sources. According to origin *national* and *international sources* are distinguished. As *primary national financial* sources are identified relations toward national budget and as the secondary toward business sector, where three main national investors: EPS, NIS and Telekom Srbija are particularly underlined.

As *primary international sources* are identified relations toward FP7-ICT projects and as *secondary* - relations toward other financing programs (EUREKA, COST,CIP...) as well as toward financial institutions (EIB, EBRD, WB and IPA).

The base for PNA relations was SCDB, so the existence of other relations is not excluded.

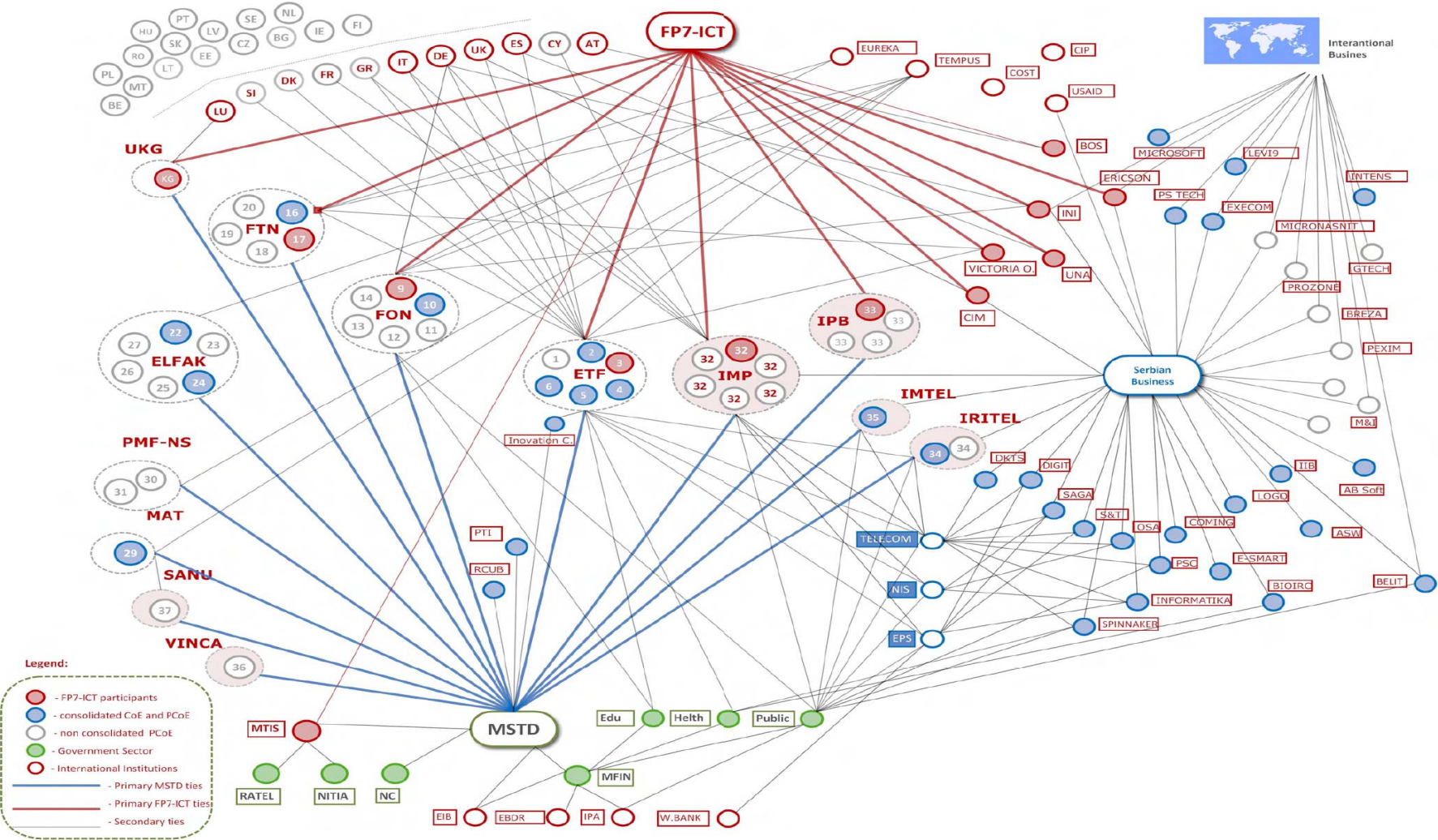
**Cooperation relations** which connect ICT RTD entities are relations considering cooperation expressed through information from available databases (for example coordinating role from EC-DG INFSO FP7-ICT project database and cooperation from SCDB Who is who).

### **Main findings**

#### **Financial sources**

- ⇒ Highest level nodes (nodes with the biggest number of relations) are MSTD - as national, and FP7-ICT - as international hub. At the same time, relations toward these hubs represent the primary national financial relations (blue colored) toward MSTD and primary international financial resources (red colored) toward FP7-ICT.
- ⇒ Ties from MSTD go exclusively to HES and Institutes. Deeper analysis show that all research units from presented faculties (total of 31) participate in MSTD projects.
- ⇒ FP7-ICT node is linked to 4 research units from HES, 2 institutes, 5 business entities and 2 entities from "Others". Here is the variety of relations according to organization type much more visible than in MSTD node case, but the number of projects is significantly lower.

Figure 16 Policy Network Analysis – Relations to funding sources and research cooperation relations





- ⇒ Secondary financial relations are connections between ICT RTD entities and business sector. The majority of these relations lead to Serbian End Users as a natural hub, and in a lower manner to international business. It has to be stressed that Serbian Business sector in this diagram is consisting of ICT RTD End Users.
- ⇒ Telekom Serbia, NIS and EPS (from End User sector), which are all established by the state, with their (related) connections, make a specific subsystem with the following main characteristics:
  - Telekom Serbia as the major particular ICT RTD investor presents hub for 3 institutes, 2 faculties and almost all Serbian system integrators from business sector;
  - Two connected trends are visible in this ICT RTD subsystem. The RTD trend diverges from national to international domain. As the consequence, the applied ICT becomes more and more dominate;
  - In addition, as the state ownership in these three companies decreases (through further privatization), the ICT RTD function of this subsystem diminishes.
- ⇒ There is no tie from business sector ICT RTD entities to MSTD. According to present practice, business sector can take part in national ICT RTD budget funded projects only as co financier.
- ⇒ Secondary relations toward international programs (TEMPUS, EUREKA and COST) are based on Who is Who database, so the number of linkages is incomplete. However, the current picture points to the importance of this projects for national ICT RTD sector.
- ⇒ Summarized information on participations in international funds and programs are presented in Deliverable 5, section 2.1.1 which is considering financing (Relevant authorities financing ICT RTD, part 3, International programs, institutions, organizations and banks, pages 17-19).
- ⇒ There are no direct links of international funds (EBDR, IPA, EIB, W. Bank) with ICT RTD entities.

### **ICT RTD entities**

- ⇒ In relations that lead to ICT RTD entities visible is a great difference in number and importance, within as well as between particular sectors.
- ⇒ ICT RTD nodes with highest number of relations are ETF, FON and FTN in HES and IMP in institutes sector.
- ⇒ Relations toward financing sources are more frequent than relations to other ICT RTD entities, indicating the insufficient cooperation.

State owned entities (faculties and institutes) show significantly lower activity in FP7-ICT Theme in comparison to their existing potential. Only 12 from 72 potential CoE are linked to FP7 projects. This is indicating a huge potential for further participation.

### **Conclusions and recommendations**

- ⇒ On national level there are almost no links that indicate cooperation between ICT RTD entities inside each sector, as well as between different sectors.
- ⇒ Opposite to the national projects, although it is hard to give the general conclusion, due to a small number of FP7-ICT projects with Serbian participants, FP7-ICT projects encourage with established connections among ICT research entities.
- ⇒ The biggest potential for participation in FP7-ICT lies in faculties and institutes that were not successful in FP7-ICT projects (ELFAK, PMF-NS, MAT-FAK, Institute Vinca and SANU).
- ⇒ The "Third sector" (private and industry sector and SME) is only tangentially present in ICT RTD. The "Third sector" hides big potential for ICT RTD which Government should use better.
- ⇒ There is no sufficient level of collaboration between Business sector (SME) and other sectors - HES, INS and GOV, although there are positive examples (establishment of innovative centers and technological ICT incubators in HE in Novi Sad and Belgrade, ETF Innovative Center and Business Technology Incubator). There are no visible links between SME entities and INS sector. There are no ties from SME entities to GOV sector, except business connections of almost all Serbian system integrators with companies from public sector (TS, EPS), which are controlled by the Government.
- ⇒ The big international companies have recognized the potential of "third sector". Ericsson, Microsoft and Cisco, among others, have established their development centres in Serbia.
- ⇒ FP7 and other international programs can play a vital role in creating new relationships and cooperation among SME sector and other ICT RTD entities in Serbia.
- ⇒ Government is suggested to use better the opportunity for accelerating transfer of knowledge and most developed technologies in ICT RTD from cooperation with international leaders.

### 1.5.7 Measures to maximize the Serbian potential in the FP7-ICT

The main goal of conducting the live interviews with ICT RTD researchers was getting the qualitative picture on Serbian ICT RTD entities' readiness for participation in FP7 projects. The interviews were expected to help detection of Serbian ICT-RTD capabilities and the barriers following, so that, after analysis, the list of actions for maximizing Serbian's potential in FP7-ICT Theme can be proposed.

Actions need to be taken both at national level and at EU level and to overcome the problems and barriers which significantly inhibit the participation of Serbian entity in FP7 are presented separately.

#### The List of actions that need to be taken at national level

- ⇒ Government is highly suggested **to increase significantly investments in infrastructure required for FP7 –ICT Theme** or to cover part of the expenses for equipment purchased within FP7-ICT.
- ⇒ **The preparation of proposals for FP7-ICT requires high expertise** and other skills and it should be properly evaluated in the meaning of scientific ranking.
- ⇒ **Negative "cash flow" is frequent appearance in Serbia.** Government should consider possibility of giving guaranties for organizations with approved FP7 projects if they need financial support from banks (loans or other financial options).
- ⇒ **The high demanding administration activities** have been observed as one of the main barriers. It is suggested that Government enable FP7 participants to outsource these activities by encouraging the establishment of the centers with capacity for administration, financial reporting and project management support.
- ⇒ It is recommended **to create a public national database of R&D actors** and organizations and to improve processes for partner search both within the country and SEE region.
- ⇒ **Consider capacity-building actions for improving skills** of Serbian ICT researchers, particularly in FP7 application procedures, project planning and management (including financial management).
- ⇒ It is suggested **to harmonize thematic areas, initiatives and goals in ICT area** (National Strategy, regional initiatives) with FP7-ICT challenges and objectives.
- ⇒ It is recommended **to define policy/strategy for including the "third sector"** (industry, business and SME sector) with its hidden ICT RTD potential, which is currently invisible for Government

## List of actions that need to be taken at EU level

- ⇒ **Serbia is the new player in Framework Programs** after many years of sanctions and standing aside of European research area and world science (1992-2000). It is suggested to create actions on EU level to promote and encourage Serbian science through brokerage events, knowledge exchange and networking.
- ⇒ **Targeted regional calls for common West Balkan ICT R&D priorities** are suggested for improving the regional cooperation, experience exchange and speeding up solving the common problems and barriers.
- ⇒ Apart from targeted calls on regional priorities, **the support actions for other (EU) priorities that are underdeveloped in the region** are recommended.
- ⇒ **Average EU FP7 financial support for Serbian ICT RTD is small.** It is estimated that FP7-ICT projects contribute to Serbian ICT RTD sector with about EUR 2 million per year. The results from Delphi survey show that the extent to which the budget for local participants in FP7-ICT is sufficient is low (evaluated with the average mark 4.6 out of 10). Consider actions for increasing the amounts for contracted monthly payments of Serbian ICT RTD researchers – as it will significantly increase their motivation to participate in FP7.
- ⇒ **EU is encouraged to continue its financial support** by participating in further projects / actions for specific ICT RTD infrastructure.
- ⇒ It is suggested **to create awareness of the FP participation benefits through regional conferences and events** dedicated to demonstrations of the success stories and best practices. Consider transfer of knowledge and experience from EU to Serbian participants.
- ⇒ **Consider financing travel expenses for the EU experts** so they can present particular FP7 issues on regional conferences.
- ⇒ **Consider criteria for achieving grants for universities** and faculties such as access to renowned digital libraries (as IEEE and similar), as the COBSON, although amazing, does not cover sufficient number of ICT magazines.
- ⇒ **Consider benefits for FP7-ICT successful participant** for licenses for specialized software or access to specific data bases.
- ⇒ **Consider establishing regional administrative center for FP7-ICT** to enable ICT RTD organizations in the region to outsource this activity.
- ⇒ **Support actions on FP7 procedures and proposal development** are still important for the region.

### 1.5.8 Proposed action - Motivation / Education

The best illustration of the participation of the Serbian entities and their success and failure is given by the magic quadrant below. The quadrant is divided into four regions: vertical axis is the capacity to participate: low/high; horizontal axis is the willingness: wants/doesn't want to participate in Framework Programme.

Table 29 Magic quadrant. Motivation and Education

CAPACITY	High	N/A	26
	Low	-	76
		Doesn't want.	Wants
		WILLINGNESS	

To achieve success entities need to be competent and to have willingness. The space for increasing Serbian participation is between two categories of applicants, according to key indicators: their capacities/competences and willingness. For entities with willingness but with lack of capacity, educational programs (trainings) have to be considered. For entities with capacity but not willingness motivation programs have to be initiate. In addition, it is suggested to investigate the reasons for the lower participation than their real potential of these particular entities that have significant S&T capacity in ICT area.

## 1.6 Delphi survey to identify latent ICT-RTD potential in Serbia

As the live interviews cannot cover the whole ICT community in Serbia, the survey was extended to cover the maximum number of stakeholders using the Delphi survey process. In this respect a 2 rounds on-line Delphi survey was carried out.

The Delphi method is a systematic, interactive forecasting method which relies on a panel of independent experts. The Delphi Method seeks to achieve a consensus among group members through a series of questionnaires. Delphi survey is based on the principle that forecasts using a structured group of experts is more accurate than those using unstructured groups or individuals.

This part covers two rounds of Delphi process on selected group of experts in Serbia. The whole process is divided into three phases: (1) preparation phase, which covers the development of methodology, identification of the initial expert group and defining the plan (time schedule) for all activities; (2) questionnaire preparation and two rounds of interviews are conducted; (3) the analysis of all the answers and writing the report. The questions were prepared aiming to give as realistic picture as possible of present situation in Serbian ICT RTD area. The results of Delphi survey are presented below.

### 1.6.1 Participation in FP7-ICT projects

**Information level of Serbian entities on FP7-ICT projects:** Serbian entities have positive level of information regarding participation in FP7-ICT projects. 78% of experts were familiar with the FP7-ICT opportunities; 77% understand the rules and procedures for participation and 68% declared that FP7-ICT Themes are in the line with their research/business interest. The lower number of interviewed, 56% is familiar with all barriers for participation and 59% receive the information on projects on regular basis

Table 30 Participation of Serbian entities in FP7-ICT projects

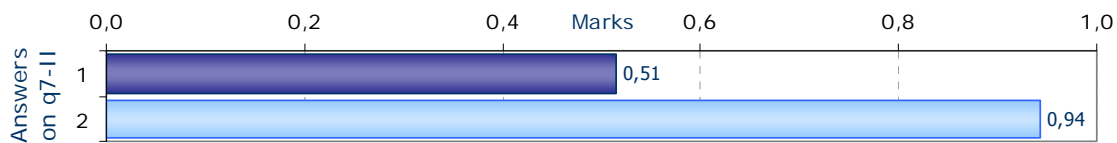
Please use YES or NO for the answers	Mean	YES answers	Total num. of answers	Confidence Level (95%)
1. Do you receive information on FP7-ICT projects on regular basis?	0,59	32	54	0,13
2. Do you follow up regularly upcoming Calls (before they are officially announced)?	0,46	25	54	0,13
3. Are you aware of the opportunities offered to you by the Framework Programmes of the EU?	0,78	42	54	0,11
4. Are you aware of any barriers that prevent participation in the Framework Programme?	0,56	30	54	0,13

5. Is the FP7-ICT Theme in line with your research priorities/ business interests? If not, which research areas should be included?	<b>0,68</b>	36	53	0,13
6. Do you understand the rules and the procedures for participating?	<b>0,77</b>	41	53	0,11

Source: Mineco (Delphi survey)

Serbian experts have highly positive attitude towards FP7-ICT projects which is visible through the fact that almost 94% (q2-II\_2) of the interviewed would like to receive the information on FP7 projects on regular basis.

Figure 17 Information of Serbian organizations on FP7-ICT projects



Source: Mineco (Delphi survey)

**Cooperation of Serbian entities in FP7- ICT projects:** Less than half of interviewed have experience in cooperation with partners from EU. 49,2% knows how to find EU partners, 42,4% have tried, and only 25,4% was successful in partner search.

Table 31 Serbian organizations and EU partners in FP7-ICT projects. Positive answers

	Yes	HES	Institutes	Business
1. Do you know how to find EU partners?	<b>49,2%</b>	69,6%	35,7%	28,6%
2. Have you ever tried?	<b>42,4%</b>	60,9%	28,6%	28,6%
3. Was the response positive?	<b>25,4%</b>	34,8%	21,4%	14,3%

Source: Mineco (Delphi survey)

**Participation of Serbian ICT RTD organizations in consortia:** Only 35,6% of experts have participated in consortia with other partners. The most experienced in consortia are the experts from institutes (50%), followed by high education ((34,8%), while experts from business sector are below average (28,6%).

Evident is the positive experience in consortia of some of the experts from Serbia. It is suggested to transfer this positive experience to the inexperienced ones through meetings, workshops and success stories.

**Support for preparation of project proposal:** Three quarters of interviewed need support for FP7-ICT project proposals, while 24% does not need any support as having the experience. Only 37% are aware of existing that kind of support in Serbia. All kinds of support (administrative and financial) need 45,7% of interviewed, 37,1% need support for administration and 31,4% financial support.

Results are good illustration of specificities and needs of particular sectors and should be used for Government funded efficient support.

Table 32 Type of support need for preparation of project proposal per sectors

	Yes	HES	Institutes	Business
1. Administrative	37,1%	57,1%	42,9%	18,2%
2. Financial	31,4%	50,0%	14,3%	18,2%
3. All kind	45,7%	28,6%	28,6%	72,7%

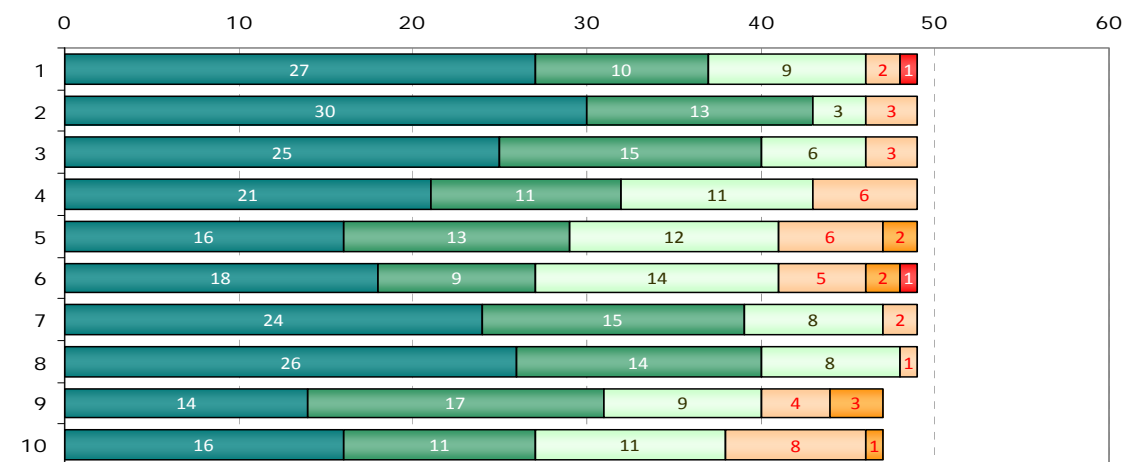
Source: Mineco (Delphi survey)

**Benefits from participation in FP7-ICT projects:** The interviewed experts absolutely recognize the exceptional benefit from participation in FP7-ICT projects. The highest benefits are seen in the following segments: Access to advanced technologies (mark 8.9 from maximal 10), Information on markets/ technologies (8,7), Application of international standards (8,5), Cooperation with key actors (8,5) and Development of advanced technologies (8,4). Recognized benefits show the great enthusiasm of the interviewed primarily for science and research work.

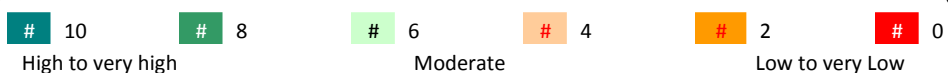
Table 33 Benefits from participation in FP7-ICT projects

0 – no benefit... 10 – maximal benefit Please use evaluation marks 0, 2, 4, 6, 8, 10	Mean	Mode	Median	Confidence Level (95%)
1. Development of advanced technologies	8,4	10	10	0,62
2. Access to advanced technologies	8,9	10	10	0,48
3. Cooperation with key actors	8,5	10	10	0,51
4. Cooperation with key end users	7,9	10	8	0,60
5. Facilitating financing in your company	7,4	10	8	0,66
6. Access to new markets	7,3	10	8	0,73
7. Application of international standards	8,5	10	8	0,49
8. Marketing and/or technological intelligence	8,7	10	10	0,46
9. Financing of planned activities during crisis	7,5	8	8	0,67
10. Education and training of the employees	7,4	10	8	0,67

Figure 18 Benefits from participation in FP7-ICT projects



Legend of Marks:



Source: Mineco (Delphi survey)



The lower marks for the following segments show that interest for "business aspect" (finances, new end users, new markets) is somehow in the second plan: Cooperation with key end users (7,9); Financing of planned activities during crisis (7,5); Access to new markets (7,3).

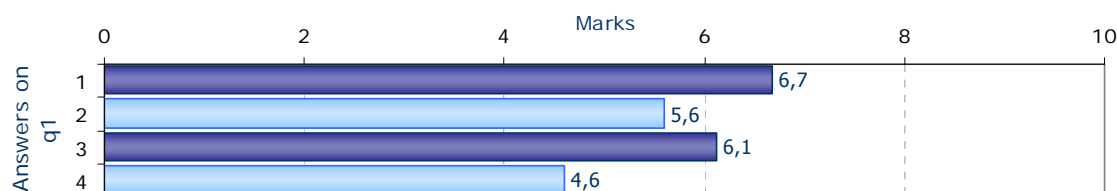
**Reasons for not participating in FP7-ICT projects:** The interviewed agreed on lack of the administration capacities mark (6,9) and that Budget for local participants is usually low (insufficient) (5,8). Unsuitable time to market was marked with 5.3.

Topics are mainly in line with current time schedule (5,6) – for institutes and faculties above average and for business sector – below average.

Table 34 Harmonization and readiness for FP7-ICT projects

	Mean	Mode	Median	Confidence Level (95%)
0 – lowest mark... 10 – highest mark; Please use marks 0, 2, 4, 6, 8, 10				
1. To what extent do FP7-ICT Themes fit to your present activities / programmes?	6,7	8	8	0,70
2. To what extent do FP7-ICT Themes fit to your present time schedule?	5,6	8	6	0,83
3. To what extent does your present infrastructure fit to requirements for FP7-ICT Theme?	6,1	6	6	0,83
4. To what extent is the budget for local participants in FP7-ICT projects sufficient?	4,6	4	4	0,77

Figure 19 Harmonization and readiness for FP7-ICT projects



Source: Mineco (Delphi survey)

## 1.6.2 Current situation, problems and actions

**Current situation:** Financial resources for ICT researches in Serbia are still inefficient for increasing participation in FP7-ICT projects (7,7of 10 for maximal agreement) and that Serbian participation in FP7-ICT is unsatisfactory (7,3). Government is playing active role in strengthening the Serbian capacities in ICT research (6,9). Political support for ICT RTD in Serbia is inefficient for increasing participation in FP7-ICT projects (6,8).

Table 35 Level of agreement on current situation in Serbian ICT RTD sector

Please give evaluation mark from 0-10 using marks 2,4,6,8,10 (0 is for maximal disagreement and 10 for maximal agreement)	Mean	Mode	Median	Confidence Level (95%)
1. Government is the key player in strengthening the Serbian capacities in ICT research for three main reasons: (1) research policy is created on the national level; (2) most of the ICT RTD activities are financed by the government institutions and (3) most of the relevant research institutions are established by the state	6,9	8	8	0,62
2. Considering, its present potential Serbian participation in FP7-ICT is unsatisfactory	7,3	10	8	0,63
3. Coordination between different funding mechanisms of ICT projects on the European, regional and national level is unsatisfactory	7,1	8	8	0,52
4. Political support for ICT RTD in Serbia is inefficient for increasing participation in FP7-ICT projects	6,8	8	8	0,71
5. Financial resources for ICT research in Serbia are still inefficient for increasing participation in FP7-ICT projects	7,7	10	8	0,55
6. The perception of European researchers is that, with exceptions of some recognized cases of excellence, the level of Serbian research is low, particularly compared with EU15	7,3	8	8	0,66
7. Thanks to the constant inflow of young talented people, education system is still capable of producing experts and preserving the quality of ICT science	6,5	8	8	0,69
8. Upcoming Strategy for Technological Development of Serbia for 2009-2014 - "Focus and Partnering" shows that the Government is recognizing the importance of ICT research and that it is decisive in its realization	5,9	6	6	0,75

Source: Mineco (Delphi survey)

The perception of European researchers that, with exceptions of some recognized cases of excellence, the level of Serbian research is low, particularly compared with EU15 stays as got the mark (7,3). Education system is still capable to produce experts and preserve the quality of ICT science, thanks to constant inflow of young talented people (6,5). Coordination between different funding mechanisms of ICT projects on European, regional and national level is unsatisfactory - got the mark (7,1).

**Problems and differences:** Identified problems on Serbian side are: insufficient knowledge of possibilities for cooperation with EU (7,0), insufficient involvement of actors from private sector in ICT researches (7,0) as well as insufficient involvement of actors from industry sector (7,6) because of hampering the usage of the research results. As for the EU side, there is a problem of excessive bureaucracy (7,3) and opposite to this one, EU coordination of programs and support measures (5,9), which indicates that this is not seen as an serious barrier.

Table 36 Barriers influence on Serbian participation in FP7 projects

(0 = no importance, 10 = maximal importance); Please use marks 0, 2, 4, 6, 8, 10	Mean	Mode	Median	Confidence Level (95%)
1. On Serbian side: Insufficient knowledge of possibilities for cooperation with EU	7,0	8	8	0,59
2. On Serbian side: Insufficient involvement of actors from private sector in ICT researches, which hampers the usage of the research results	7,0	8	8	0,65
3. On Serbian side: Insufficient involvement of actors from industry sector in ICT researches, which hampers the usage of the research results	7,6	10	8	0,63
4. On EU side: Programs and support measures are not enough coordinated	5,9	6	6	0,60
5. On EU side: Excessive bureaucracy is turning off the Serbian researchers from participating in FP7-ICT projects	7,3	10	8	0,63
6. Low participation of small organizations (SME and NGO) from Serbia in FP7-ICT projects	7,2	8	8	0,63
7. Cooperation with ICT researchers is not used enough for stimulating the development Human Resources in Serbia	7,9	8	8	0,48
8. "Brain drain" (low salaries and possibilities for professional development are considered as main reasons for brain drain)	8,0	10	9	0,64

Source: Mineco (Delphi survey)

From the general problems the most expressive one is regarding "Brain drain" marked (8,0) and following are Cooperation with ICT researchers not used enough for stimulating the development Human Resources in Serbia (7,9) and Low participation of small organizations (SME and NGO) from Serbia in FP7-ICT projects (7,2).

**Top3 recommendations and proposed actions on the national level:** Using the evaluation marks as criteria, the proposed actions are in the following order:

- ⇒ Rise the investment in professional education as this is the only way out from the unsustainable situation of Serbian economy (8,6);
- ⇒ Set up various financing models/programms for stimulating ICT research from the aspect of Serbian participation in FP7-ICT projects (8,4);
- ⇒ Significantly increase the investment in infrastructure for FP7-ICT projects (8,3);

### 1.6.3 Barriers in Serbian ICT RTD area

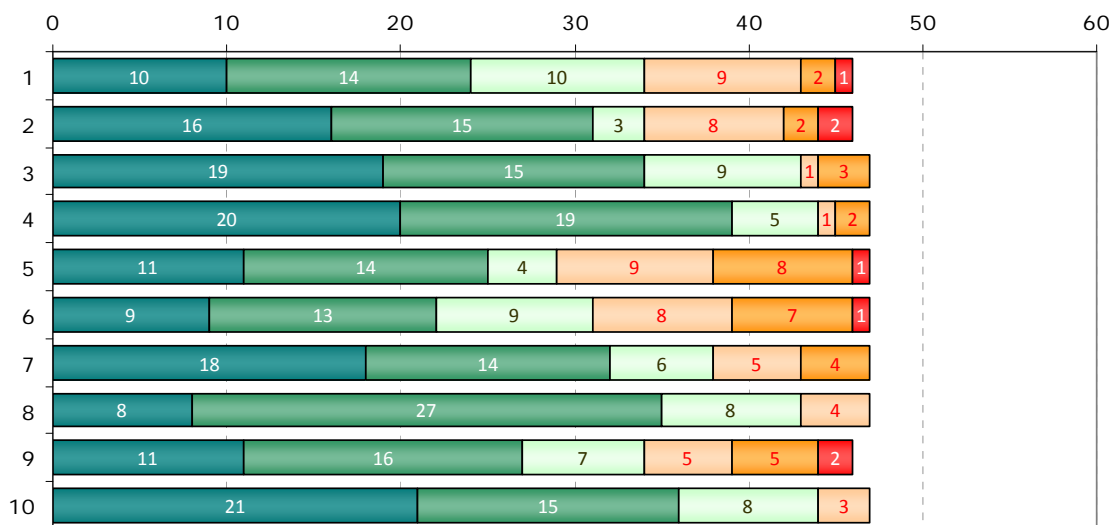
**Evaluation of the barriers in Serbian ICT RTD area:** Most important detected barriers are two financial barriers: lack of investments from the business sector in R&D (8,3) and low level of national financial funds for RTD in ICT sector (8,0).

Table 37 Barrier evaluation in Serbian ICT RTD sector

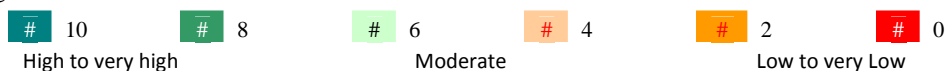
Please use evaluation mark from 0-10 using marks 2,4,6,8,10 (0 is for no importance and 10 for maximal importance)	Mean	Mode	Median	Confidence Level (95%)
1. Lack of defined Government policy for ICT research	6,8	8	8	0,74
2. Weak communication channels with policy creators	7,3	10	8	0,84
3. Low level of national financial funds for RTD in ICT sector	8,0	10	8	0,65
4. Lack of investments from the business sector in R&D	8,3	10	8	0,57
5. Lack of interest of the most of academic leadership for participation in FP7 Projects	6,3	8	8	0,87
6. Insufficient number of PhD studies and programmes in ICT	6,3	8	6	0,81
7. Skilled researchers are leaving the country (brain drain)	7,6	10	8	0,74
8. Weak contacts among researchers and ICT RTD organizations from region and Europe	7,7	8	8	0,47
9. ICT private companies (not recognized officially as R&D organizations) are not eligible for national funding	6,7	8	8	0,85
10. Insufficient cooperation between ICT industry, research institutes and universities	8,3	10	8	0,53

Source: Mineco (Delphi survey)

Figure 20 Barrier evaluation in Serbian ICT RTD sector – answers grouping



Legend of Marks:



Source: Mineco (Delphi survey)

- ⇒ Key observations from the figure above:
- ⇒ Almost all answers were grouped around mark (8).
- ⇒ The highest number of low marks got (Q11\_5 and Q11\_6) which are for the lack of consensus repeated in Round 2.

**Education – academic barriers in ICT RTD sector – Delphi Round 2:** Interest of academic society to participate in FP7-ICT Theme and number of PhD studies in ICT area were marked medium low, between (4,6) and (5,1) which indicates that these issues are considered as modest barriers for Serbian ICT RTD sector.

Table 38 Education-academic barriers in Serbian ICT RTD sector

0 – lowest mark, 10 – highest mark; Please use marks 0, 2, 4, 6, 8, 10	Mean	Mode	Median	Confidence Level (95%)
5. How do you evaluate the interest of academic society to participate in FP7-ICT Theme projects?	5,1	6	6	0,71
6. How do you evaluate the number of PhD studies in ICT area?	4,6	4	4	0,78

Source: Mineco (Delphi survey)

**ICT RTD and Innovation comparison between Serbia and EU:**

- ⇒ In EU ICT **researches participate** with one quarter of all private research funding; ICT researchers make one third of all researchers and ICT patents one fifth of all patents. According to Statistical Office of Republic of Serbia, number of full time employed researchers (FTE) in Serbia in business sector is round 1% (108 from 8.806 in 2007). For 24 of 47 interviewed, this has been observed as a very important problem, for 21 as an important one and only in 2 cases this problem is of no importance.
- ⇒ **SME participation:** The reasons for not participating in FP7-ICT for EU SMEs are various: weaker approach to the market, innovations and finances and high regulatory pressure. 44 experts agree that the same reasons stay for the Serbian SMEs and only one – disagreed with explanation that the nature of Serbian SME is different – they are mostly oriented towards trade and assembling.
- ⇒ **Weak connection in "knowledge triangle:** In EU noticeable is the weak connection in "knowledge triangle"-innovation-R&D-education. Consequences are duplicating the efforts, losing the critical mass, difficulties in solving the common problems lower return of investments (ROI).

**Probability of Government plans realization:** The level of confidence in realization of the key Government plans related to ICT RTD in Serbia was analyzed through answers on the three questions where experts were asked to give probability of realization in the range from 0% - unrealizable to 100% - realizable. Given answers show the high level of suspicion (mistrust) of the interviewed regarding realization of the presented Government goals.

Table 39 Estimation of realization probability of Government plans

0% – unrealizable..... 100% – realizable	Mean	Mode	Median	Confidence Level (95%)
1. The level of investment in science and research in Serbia is round 0,3% GDP, which is among the lowest in Europe. In Draft Version of Strategy on Science and Technological Development for period 2009-2014, it is planned to increase the investments to 1% GDP until 2014.	40,0%	50%	30%	11,3%
2. 300 million EUR investment in science and research infrastructure is planned till the end of 2012	41,6%	30%	30%	11,3%
3. Government has announced the plan for stopping the “brain drain” as well as for stimulating the return of scientist already abroad.	27,5%	20%	25%	7,3%

Source: Mineco (Delphi survey)

Probability that the level of investment in science and research in Serbia will rise from the current 0,3% GDP to 1% GDP until 2014 was evaluated 40%. Probability that 300 million EUR will be invested in science and research infrastructure the end of 2012 – with similar 41.6%. The lowest trust the experts showed to the Government plan for stopping the “brain drain” as well as for stimulating the return of scientist already abroad – evaluated with only 27,5% probability.

#### 1.6.4 Barriers for FP7-ICT participation and the ways to overcome them

Following are main suggestions and recommendations coming out as the results of the Delphi survey analysis as well as the explicit suggestions from the interviewed experts.

- ⇒ **The readiness of Serbian experts shown through highly positive attitude towards FP7-ICT projects** should be used for preparation and realization of educational programs as the actions for increasing participation of Serbian entities in FP7-ICT Theme.
- ⇒ **The lower follow up of upcoming calls may indicate insufficient motivation for FP7-ICT participation**, suggesting motivational programs as actions for increasing participation of Serbian entities in FP7-ICT Theme.
- ⇒ **Evident is the positive experience in consortia of some of the experts from Serbia.** It is suggested to transfer this positive experience to the inexperienced ones through meetings, workshops and success stories.
- ⇒ **It is recommended to consider the topics that came out from the list of barriers and are not explicitly supported in the program:** Internet router design, Topics from the field of radio communications (although they represent the most propulsive ICT technology field) and Development of Infrastructure for wireless and mobile communications for “Wireless-Society”.

## **The interviewees proposed measures for achieving more efficient policy and Government role:**

- ⇒ Ensure the higher competence in corresponding Government entities;
- ⇒ Ensure the adequate control of resource spending and realizations;
- ⇒ Set up measures to influence decreasing of flow most talented;
- ⇒ Ensure the flexibility of the research policy;
- ⇒ Raise the PhD in ICT area.

## **Interviewees' suggestions regarding better and higher financing of the ICT projects:**

- ⇒ Ministry for Science and Technological Development (MSTD) to co-finance FP7 projects with 25% and not 10% as it is presently;
- ⇒ Abrogation on taking 40% of incomes of faculties and budget funded research centres;
- ⇒ Paying off the bonuses for succeed FP7 projects which is promised by MSTD;
- ⇒ Raising the amounts planned for attracting our scientists from abroad.

## **Interviewees' recommendations and proposed actions on the national level**

- ⇒ Rise the investment in professional education as this is the only way out from the unsustainable situation of Serbian economy (8,6);
- ⇒ Set up various financing models/programms for stimulating ICT research from the aspect of Serbian participation in FP7-ICT projects (8,4);
- ⇒ Significantly increase the investment in infrastructure for FP7-ICT projects (8,3);
- ⇒ Create the national base of (Serbian) ICT researchers and set up activities for improving their skills in project planning and management (8,2);
- ⇒ Specifically foster inclusion of 'third sector' (private companies, industry, SME) as relevant stakeholders and partners in FP7-ICT Theme. (8,1);
- ⇒ Set up stimulations for return of the Serbian scientists abroad (7,6);
- ⇒ Harmonize all thematic areas, initiatives and goals in ICT with FP7-CT Themes (Draft Version of the Strategy, regional initiatives...) (7,1).

## **Interviewees' additional recommendations regarding research organizations:**

- ⇒ Introducing of capable and responsible people to the key positions;
- ⇒ Create better research and development conditions and scientists that have left the Serbia will start to come back from abroad;
- ⇒ Required diploma recognition from the ones returned from aboard is not stimulating;

⇒ Leave the room for cooperation with USA, Russia and Asian countries and evaluate more the concrete final research results;

**Deeper analysis of the showed mistrust to the Government plans is recommended** with the goal to overcome the identified gap between “branch” and “policy” attitude towards realization of government plans.



## ***1.7 Opportunities and barriers for increasing the contribution of Serbia to the FP7-ICT Theme***

Task 7 provides a comprehensive overview of ICT RTD sector in Serbia today. Major suppliers of the information: main public and private organizations involved in ICT RTD in Serbia. To accomplish the SWOT analysis of the objective defined as "Successful participation and integration of Serbian ICT RTD in the FP7 – ICT Theme", the following perspectives in identification and analysis of the opportunities and barriers were considered four major aspects:

- ⇒ **ICT RTD legal and regulatory environment** - To enable ICT RTD to be treated as one of the priorities in joining the EU, the Government has to create legal and regulatory environment, since this is of strategic importance for society's development.
- ⇒ **ICT RTD infrastructure** compatible with European infrastructure, which will efficiently connect ICT RTD entities and the ICT sector in particular with outer and inner environment, is required.
- ⇒ **ICT RTD sector** - general status including high education, institutes, business and industry sub-sectors.
- ⇒ **Serbian ICT RTD Sector in FP7-ICT Theme** - Participation and integration of Serbian ICT RTD in the FP7 – ICT Theme including opportunities and barriers of Serbian ICT RTD Sector in FP7-ICT Theme.

Each section is examined through a SWOT analysis lens, i.e., by examining related strengths, weaknesses, opportunities and threats and presented within previous chapters.

The final SWOT table is presented below.

Table 40 SWOT Analysis Summary

Strengths	Weaknesses
<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>• Present ICT RTD L&amp;R Environment is in process of harmonization with EU</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>• Advantage of existing research infrastructure of Academic Network of Serbia (AMRES) can be measured by number of connected entities and users as well as services and applications provided for these users</li> <li>• The existence of the Academic and Educational Grid Initiative of Serbia (AEGIS)</li> <li>• NIP investment in capital equipment for scientific research</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>• Despite the economic, social and institutional crisis and a difficult transition process, the Serbian ICT RTD sector has survived</li> <li>• A solid number of preserved Serbian experts</li> <li>• ICT related Education system</li> <li>• Solid institutes market orientation</li> <li>• Experts experienced in the ICT business sector</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>• Above EU average Success Rates of Serbian participants</li> <li>• Solid competence of Serbian entities</li> <li>• Programs of institutes and faculties are in line with the FP7-ICT Theme</li> </ul>	<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>• Insufficient political support in practice</li> <li>• Lack of one dedicated Government body in charge of ICT RTD</li> <li>• Problematic implementation of ICT RTD strategic documents</li> <li>• Weak communication of the ICT RTD sector with the policy creators</li> <li>• Government attitude towards the “third sector”</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>• Current infrastructure for ICT RTD activities in Serbia is undeveloped</li> <li>• Lack of large-scale R&amp;D equipment</li> <li>• Low investments in infrastructure</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>• Inadequate efficiency of the Serbian ICT RTD system</li> <li>• The brain drain (internal causes)</li> <li>• Neither visible focus on ICT RTD priorities defined in Strategy, nor partnering</li> <li>• Low level of national funds for ICT RTD</li> <li>• Lack of official Centres of Excellence</li> <li>• No transparent evidence of business participation</li> <li>• Weak cooperation between industry and education</li> <li>• Insufficient political will, financial resources and expertise</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>• Serbia is a latecomer to the FP programs (2002)</li> <li>• Insufficient experience in search for consortium partners</li> <li>• Limited Serbian lobbying ability</li> <li>• Insufficient interest of academic researchers to participate in FP7-ICT</li> <li>• Lower follow up of upcoming calls</li> <li>• Missing public national ICT RTD database</li> <li>• Weak administration capacities for FP7-ICT requirements</li> <li>• Insufficient support in project proposal preparation</li> </ul>

Table 41 SWOT Analysis Summary - Continued

Opportunities	Threats
<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>• Ambitious plans expressed in strategy papers in the ICT RTD field</li> <li>• Creation and rapid adoption of Action Plan for the Strategy for Science and Technological Development</li> <li>• New legal documents</li> <li>• Strengthen cooperation and networking</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>• 50-80M Euro of 300 M Euro Investment initiative</li> <li>• Development of Broadband Access (AMRES/EMRES)</li> <li>• Establishment of a regional centre for supercomputing</li> <li>• Improvement of the SEE-GRID-SCI (SEE-GRID eInfrastructure for regional eScience)</li> <li>• Huge potential of the EPS optical network</li> <li>• More advanced and competitive public telecommunication sector</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>• Good price / quality ratio of Serbian services</li> <li>• Solid expertise in particular FP7-ICT areas</li> <li>• Reorganization of Serbian Education system</li> <li>• Implementation of the “Focus and partnering” Strategy, which is expected to come soon</li> <li>• Exploit the hidden potential of the ICT business sector</li> <li>• Rising compatibility with international ICT RTD sector</li> <li>• Meet the Government needs for ICT solutions and services</li> <li>• Serbia as a natural gathering and coordinating regional center</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>• Room for increasing participation</li> <li>• Use capacity of leading Serbian entities</li> <li>• Fully recognizing of benefits from participation in FP7-ICT</li> <li>• Positive attitude towards FP7-ICT</li> <li>• Experts’ familiarity with FP7-ICT opportunities</li> <li>• Transfer of evaluators’ knowledge and experience</li> <li>• Targeted regional FP7 calls</li> <li>• Regional conferences, events and support actions</li> <li>• Harmonize Serbian thematic areas with the FP7-ICT Theme</li> <li>• Work on raising the critical mass of ICT researchers</li> </ul>	<p><u>A ICT RTD Legal and Regulatory Environment</u></p> <ul style="list-style-type: none"> <li>• Still present political instability in the country/region</li> <li>• Low level of investments in science and research (around 0.3% GDP)</li> <li>• Uncertain sources of funding</li> <li>• Non-customized mirrored policy</li> <li>• Mistrust in the promises of the policy makers</li> </ul> <p><u>B ICT RTD Infrastructure</u></p> <ul style="list-style-type: none"> <li>• With few exceptions, obsolete existing infrastructure</li> <li>• Lack of the connection between private faculties and the AMRES</li> </ul> <p><u>C ICT RTD Sector</u></p> <ul style="list-style-type: none"> <li>• Serbia as a latecomer to the international ICT RTD scene (2001)</li> <li>• The brain drain (external causes)</li> <li>• Weak cooperation on ICT projects</li> <li>• Long time present differences between Serbian and European researchers</li> <li>• Stereotype image of Serbian research</li> </ul> <p><u>D ICT RTD Sector in FP7-ICT Theme</u></p> <ul style="list-style-type: none"> <li>• Difficulties in reaching the big EU15 consortia</li> <li>• Low participation of Serbian entities</li> <li>• Negative “cash flow”</li> <li>• Generally low FP7-ICT financial support for Serbian ICT RTD</li> <li>• Insufficient Government funding for FP7-ICT projects</li> <li>• Complex proposal writing/preparation</li> <li>• Excessive bureaucracy</li> <li>• Lack of evaluation and scientific ranking of projects</li> <li>• Missing the real impact of FP projects</li> </ul>

## 2 Conclusions

To get a clear picture of the situation in the ICT RTD sector of Serbia, several things have to be taken into consideration. Serbian society has changed its course as a result of transition - which is discontinuity in the established order. On the other hand, the majority of the experts through transition have kept their positions with regard to influencing and creating policies and strategies – which is the continuity of the expert personnel. As it is very hard to evaluate whether transition should be followed by continuity or discontinuity of the personnel, it is even harder to define who is changing what or vice versa, does the system shape people or do the people shape system.

***What is visible is a great inertia*** toward changing the way of thinking and developing society. It might look like nothing is going to change from the roots. However, if Serbia does not wake up on time it will be almost impossible to catch up with the EU countries in which ICT RTD reforms are far ahead.

The serious risk of this research could be that in spite of the ***great amount of effort invested in presenting a situation which is actually modest***, the result can deter interest in further activities and investments in the Serbia ICT RTD sector. In other words, to induce potential investors to find business opportunities in more developed countries in the region. However, it is believed that those investors who are counting on the speeding up of the development in the Serbian ICT RTD scene will make opportunities and business success for themselves.

### 2.1.1 ICT RTD Legal and Policy Environment

Legal and policy framework is harmonized with the EU and Government is playing active role in strengthening Serbian ICT RTD environment capacities. The Strategy for Information Society Development and the Strategy for Science and Technological Development (2010-2015) are the key policy documents for continuing ICT RTD development in Serbia. The main document defining the ICT RTD operational framework in Serbia is The Action Plan for Implementation of the Strategy for Science and Technological Development in Serbia 2010-2015. Unfortunately, this Action Plan, planned for adoption before the end of the year (2009) does not exist yet.

Mistrust in the promises of the policy makers (according to the results of Delphi survey) represents a serious threat to accomplishing the given goals in ICT RTD development. The amount of skepticism shown by a number of experts can be understood as „a realistic observation“ of the issue, based on their previous experience. To overcome the identified gap between attitude of ICT “branch” and the one of RTD “policy creators” towards realization of

government plans, it is necessary to significantly intensify and widen the dialogue between them. The convergence of their positions is the key for the success of future work and plans. Unrealized or partially realized implementation of adopted strategic documents is one of the most visible weaknesses in the ICT RTD area.

### **2.1.2 Review of activities and capabilities of entities carrying out ICT RTD**

Although Serbia has necessary institutions in government, science and research, their influence on society and economy is insufficient. For now, there is no synchronized work. However, linkages among and between every single group are of the highest importance for ICT RTD development, important almost as their activities.

#### **ICT RTD Sector Strengths:**

- ⇒ For almost two decades Serbian ICT RTD sector shared the destiny of the whole society. Remarkable is this sector's strong ability not only to survive but to still achieve the success.
- ⇒ There is a solid number of experts in ICT RTD area with good overall quality considering their expertise and experience.
- ⇒ Most respected ICT related universities are still capable to product high educated experts and preserve a solid quality level of science in ICT, thanks to constant inflow of young talented people.
- ⇒ Majority of private companies' experts have decades of experience in cooperation with international companies.

#### **ICT RTD Sector Weaknesses:**

- ⇒ There is an ICT RTD system of inadequate efficiency in Serbia. Serbia has necessary institutions in the government, education, science and research, but their influence on the society and economy is insufficient.
- ⇒ "Brain drain" identified as internal weakness is caused mainly by low salaries, undeveloped research infrastructure and limited opportunities for specialization.
- ⇒ "Focus and partnering" - are the key words from the upcoming Strategy. Considering ICT RTD segment, there is still neither a visible focus on ICT RTD priorities defined in the Strategy, nor partnering, and there is no action plan.
- ⇒ The financing of Serbian science is facing the problem of the small amount coming mainly from the one source and than split on more than 1000 projects. Apart from the

bioengineering and agro industry with EUR 14.2 million allocated annually, no other field in the area of technological development gain more than EUR 5 million.

- ⇒ There is a lack of official Centres of Excellence due to very complicated accreditation procedure and the insufficient financing.
- ⇒ There is no transparent evidence of business participation. There is neither public evidence nor a list of participants of this type of projects. Participation of private companies is generally rare.
- ⇒ The comparison between Serbia and the EU countries shows some similarities: weak interlinks in the "triangle of knowledge": education - innovation - R&D. The consequences are duplicated efforts, the loss of critical mass, difficulties in solving common problems and decreased.
- ⇒ Insufficient political will, financial resources and expertise. In addition, the value of ICT RTD project results is poor - after being completed, ICT RTD projects disappear without producing a real impact.

#### **ICT RTD Sector Opportunities:**

- ⇒ One of the main competence advantages is the price/quality ratio of Serbian products and services, which means that the gross price of labor is at least 50% lower than in EU.
- ⇒ Action Plan for fast implementation of the Strategy "Focus and partnering", which is expected to come soon.
- ⇒ Exploitation of the ICT business sector hidden potential.
- ⇒ Existing international accomplishments. In the period from 2001 to 2009, Serbian researchers accomplished encouraging initial results in the domain of international scientific and technological cooperation.
- ⇒ Serbian state and society require ICT RTD solutions, products and services in building an economy based on knowledge and Information Society (IS).
- ⇒ Serbia is a natural gathering and coordinating center for the Western Balkan region.

#### **ICT RTD Sector Threats**

- ⇒ Serbia is a latecomer to the international ICT RTD scene, practically after 2001. (due to international sanctions, NATO bombing and economical crisis during '90ties).
- ⇒ Existence of more developed environments offering better salaries and conditions for researchers turns the "brain drain weakness" to become an external threat.

- ⇒ Insufficient cooperation between ICT industry and business, on one side, and institutes and faculties, on the other, could lead to collapse of projected policy for financing scientific work in Serbia.
- ⇒ The general perception of European researchers that level of Serbian research is low particularly compared to the EU15.
- ⇒ Organizations and national governmental actors, despite having obtained the knowledge, do not implement the results of R&D projects (services/tools).

### **2.1.3 Analysis of the participation of Serbia in the FP6-IST and FP7-ICT Theme**

The results of this analysis show that Serbian entities have higher success rate than the EU average. On the other hand, the number of participants is among the lowest. Serbia is expected to raise the number of participations and to maintain the growth of success rate with this rising number, which is possible.

Serbia is a latecomer in FP projects and for that reason majority of Serbian entities is still exploring the FP7-ICT Theme area by participating in a wide range of objects in order to get experience and find the most suitable topic. Furthermore, Serbian entities are inexperienced in partner search for successful consortia. Low number of entities with ICT RTD capacities (institutes in the first place) seems to have a reliable picture of their capabilities in those areas where more proposals are present (which results in the respectable success of participations). It is important to mention that Serbian ICT RTD sector participate in FP7-ICT not as monolithic structure but as an individual entities with variety of motivations, capacities and competences, which sometime gives contradictory results.

However, the overall impression is that Serbian position and role in Framework Programme is getting mature. There is a visible shift from Specific Support Actions (SSA) to concrete science and research actions (STREP). Serbia's integration in FP7-ICT Theme is the cumulative process with avalanche effect – it takes time and continuous effort. This process has to be sped up to make up for more than 15 years of Serbian lagging behind, primarily by stimulating the participation of Serbian entities.

### **2.1.4 Present and planned infrastructure in Serbia for ICT-RTD**

#### **Current infrastructure**

Analysis based on desk research shows that **current infrastructure** for ICT RTD activities in Serbia is *undeveloped* due to the low and irregular investments, *inadequate* – due to the short amortization period of this type of equipment and discontinuity in upgrades or renewing and *only partially meets* the real needs of Serbian science and research. With the respect to all

above, the general estimation is that *current* infrastructure is not the significant obstacle and that is sufficient for current Serbian participation in FP7-ICT Theme. However, it is not expected from present Serbian infrastructure to have positive influence on effectiveness of Serbian participation. In addition, the existing infrastructure, with some exceptions, will hardly meet the needs for the *future* FP7-ICT Theme.

### **Planned infrastructure**

Considering **planned infrastructure** for ICT RTD activities the main Government plans are connected to the Government project for investment in Serbian R&D infrastructure, SEE Light project, National Supercomputing and Data Storage Center Project – Blue Danube. For sure, the most important is the Serbian R&D infrastructure investment initiative.

The Government Project for investments in infrastructure, worth EUR 300 million should start in March and last till the end 2015. **Budget planed for ICT infrastructure is between EUR 50 and 80 million.** Main targets are advanced infrastructure and new human resources in this area: ***campus of faculties in the area of ICT Sciences, University of Belgrade and infrastructure for supercomputing initiative "Blue Danube"***.

The estimation is that planned infrastructure ***mainly satisfies*** the need of Serbian researcher for an effective participation in the FP7 – ICT Theme. However, as the equipment include instruments, computer equipment, networks and other equipment that lie on the boundary of acceptable technical and technological level, consistent realization of the planned investment in infrastructure for ICT RTD is necessary.

Serbia's yearly budget spent on ICT RTD infrastructure is estimated on EUR 2 million (0,005% GDP), which is similar to the yearly budget of a solid university or institute from EU15. This situation has lasted for more than twenty years. Extremely low investments in ICT RTD area are detected as the main barrier in all obtained analysis (policy environment, main stakeholders, infrastructure, interviews...). Considering present very challenging finances of the Government, it may look like inappropriate and not actionable to put the most of financial burden on it and require increasing of investments in ICT RTD. However, knowing that the Government spends every day few times bigger amount (then the yearly ICT RTD budget) on "fire-extinguishing" of actual economic problems, it is unacceptable and there is no excuse for, up to now, practically no investment in ICT RTD infrastructure.

To overcome this situation Government planned EUR 300 million investment in RTD infrastructure, according to the Strategy of Science and Technological Development in Serbia (2010-2015). EUR 50-80 million is intended for ICT infrastructure. ***Few observations are coming out of this plan:***



1. Investment of EUR 300 million is a unique opportunity for developing of modern RTD infrastructure in the past two decades. Probably, there will be no opportunity for correcting the mistakes.
2. As the Government has already secured the resources for ICT RTD investments, mostly from the international loans (200 million EUR from EIB), it is of high importance to spend this amount carefully and to have the clear, transparent, public available plan.
3. ICT RTD intended resources of EUR 50-80 million are "ad hoc" and are not expected to continue.
4. Range of investments (EUR 50-80 million) is wide, considering present yearly budget for ICT RTD infrastructure of EUR 2 million.

The investment absorption of Serbian ICT RTD sector is modest. There is a risk that large investments will "flood" the sector.

### **2.1.5 Analysis of the ICT-RTD capabilities in Serbia and the measures to maximize the Serbia's potential in the FP7-ICT**

For the scope of the analysis 72 organizations were selected: ICT RTD organizations, faculty departments and research units. 45 persons and 37 organizations were interviewed in detail, taking into consideration that in participants' demography the biggest part comes from the most important ICT RTD entities and the presence of different types of organizations (high education, institutes and business sector).

The Centre of Excellence (CoE) was established in Serbia in the middle of 2008 according to the Law on Research Activities and following Rule Book, more than 5 years late in comparison to EU12 countries. As in Serbia this type of entity has just begun to develop, it will take significant amount of time and money to achieve its full implementation in the following 3-5 years. For now, the existing CoE are still not recognized as real leaders of RTD activities in Serbia, which should happen in the time to come. Currently there are 9 Centers of Excellence (CoE) in priority RTD areas with two among them officially accredited by the MSTD and the seven are the EU CoEs.

Identification of potential CoE was performed under two main restrictions. The first restriction is considering the choosing of the criteria for identification of potential CoE, as the official criteria (the Law on Research Activities and the Rule Book on the criteria and standards for CoE) were too restrictive. For that reason the selection is based on the parameters that are reliable, obvious, and relevant and indicate understandable and acceptable level of qualifications for potential CoE.

The chosen approach disables incorrect or inadequate application of the too formal and too restrictive criteria proposed by the Law, but allows practical identification of potential CoEs. The first step toward composing the list of potential centres was to detect if each entity satisfies the conditions of any of three selected categories: a) centres of competence, b) centres of potential for FP7-ICT and c) centres of best practice.

Where:

(a) Centres of competence are entities with significant number of published scientific works and realized projects, and have a number of researchers with PhD. In this group, the majority come from relevant state owned organizations (faculties' departments and institutes).

(b) Centres of potential for FP7-ICT are entities which have been successful in the FP7-ICT Theme (all entities related to FP7-ICT are from evidence for FP7-ICT Theme Call 3 inclusive).

(c) Centres of best practice – are exclusively ICT companies (from the business and industry sectors) which have a good market reputation and a strong reference list and have been "recognized and well known by specific expert community" or "recommended from the person of authority (in specific area)", but have not participated in the FP7-ICT Theme or have been unsuccessful.

The list contains 72 organizations. Each entity could be classified into no more than two categories. In order to obtain a consolidated list of CoEs and a consolidated list of potential CoEs quantitative and qualitative criteria were defined and then applied.

### **Measures to maximize the Serbia's potential in the FP7-ICT**

The main goal of conducting the live interviews with ICT RTD researchers was getting the qualitative picture on Serbian ICT RTD entities' readiness for participation in FP7 projects. The interviews were expected to help detection of Serbian ICT-RTD capabilities and the barriers following, so that, after analysis, the list of actions for maximizing Serbian's potential in FP7-ICT Theme can be proposed.

Actions need to be taken both at national level and at EU level and to overcome the problems and barriers which significantly inhibit the participation of Serbian entity in FP7 are presented separately.

## 3 List of Final Recommendations

### 3.1 Recommendations on national level

#### 3.1.1 Measures to maximize the Serbia's potential in the FP7-ICT

- ⇒ **Government is highly suggested to increase significantly investments in infrastructure required for FP7 –ICT Theme** or to cover part of the expenses for equipment purchased within FP7-ICT.
- ⇒ **The preparation of proposals for FP7-ICT requires high expertise** and other skills and it should be properly evaluated in the meaning of scientific ranking.
- ⇒ **Negative "cash flow" is frequent appearance in Serbia.** Government should consider possibility of giving guaranties for organizations with approved FP7 projects if they need financial support from banks (loans or other financial options).
- ⇒ **The high demanding administration activities** have been observed as one of the main barriers. It is suggested that Government enable FP7 participants to outsource these activities by encouraging the establishment of the centers with capacity for administration, financial reporting and project management support.
- ⇒ **It is recommended to create a public national database of R&D actors** and organizations and to improve processes for partner search both within the country and SEE region.
- ⇒ **Consider capacity-building actions for improving skills** of Serbian ICT researchers, particularly in FP7 application procedures, project planning and management (including financial management).
- ⇒ **It is suggested to harmonize thematic areas, initiatives and goals in ICT area** (National Strategy, regional initiatives) with FP7-ICT challenges and objectives.
- ⇒ **It is recommended to define policy/strategy for including the "third sector"** (industry, business and SME sector) with its hidden ICT RTD potential, which is currently invisible for Government.
- ⇒ **Finally, the actions considered of having the most influence on increasing participation of Serbian entities in FP7-ICT Theme: EDUCATION and MOTIVATION programs are proposed.** For entities that have participated in the FP6-IST and FP7-ICT Theme but did not have success (have willingness, but low capacity) educational programs (training) are proposed. For number of entities in Serbia that have not participated in previous FP cycles although have the required ICT RTD capacity for

successful participation (have capacity but not willingness) motivation programs are proposed.

### **3.1.2 Recommendations on national level regarding participation of Serbian entities in FP7-ICT Theme**

- ⇒ **It is suggested to consider the way to evaluate successful FP7-ICT projects** (similar to SCI list) to motivate Serbian researchers.
- ⇒ **It is highly recommended to detect areas of Serbian expertise with existing critical mass**; results from Deliverable 2 and Deliverable 3 show only expertise that are already confirmed. Significantly bigger part of existing expertise is in database within Deliverable 5. These expertise have to be checked and confirmed. In addition, detection of new, currently hidden, expertise is recommended.
- ⇒ **Most Serbian proposals in FP6 and FP7 (53,6% in FP6-IST and 52,6% in FP7-ICT Theme) were given the evaluation mark 10 (below multiple thresholds)**. There were no proposals below the mark 9 in FP7-ICT. This is an excellent base which should be used for educational programs for increasing Serbian participation.
- ⇒ **Focusing on the main opportunities and barriers, the Serbian Government is the one that can most efficiently increase the participation of Serbian entities in future FP7-ICT Calls**. In order to maximize Serbian participation in the Framework Programmes for ICT RTD, Ministry in charge of ICT RTD is recommended to follow up and measure the key indicators.

At the first place, the key indicators have to be defined having on mind that they change over time and have to be adjusted to the new situation. SWOT parameters can be used as the initial key indicators to be measured and follow up, with the goal to enhance the Strengths and Opportunities and to reduce the Threats and Weaknesses. It is even better, if possible, to convert Threats and Weaknesses into Strengths or Opportunities. Following are suggested initial key indicators:

- ⇒ Strength: Above EU average Success Rates of Serbian participants
- ⇒ Weakness: Serbia is latecomer to the FP
- ⇒ Opportunity: Capitalize capacity of leading Serbian ICT RTD entities
- ⇒ Threat: Difficulties in reaching the big EU15 consortia

Following are recommended initial actions (regarding W): overcome Serbia's lagging behind (detect areas of expertise and particularly stimulate participations in these areas); (regarding T): strengthen political and experts' lobbying and improve the image of the country's science and development.

### 3.1.3 Recommendations on national level regarding ICT RTD sector

- ⇒ **ICT RTD organizations should not miss the advantages of upcoming process of economy and society modernization** in the number of sectors: Government, economy, public administration; development of e- Government, e-Commerce, e-Democracy.
- ⇒ **Insufficient cooperation between ICT industry and business, on one side, and institutes and faculties, on the other, could lead to collapse of projected policy for financing scientific work in Serbia.** Improve the cooperation between private enterprises and public research and education ICT institutions. Rise awareness of need for increasing ICT budget from private sector. Create measures for stimulation innovations and patents.
- ⇒ **Organizations and national governmental actors, despite having obtained the knowledge, do not implement the results of R&D projects (services/tools).** Define national science and research priorities and policy for making clusters. Create stimulation measures to increase number of projects related directly to industry/business.
- ⇒ **Education must be treated as a main driving force of ICT RTD.** Consequently, investments in this sector should be as big as possible. Speed up realization of the plan for stopping brain drain.

### 3.1.4 Planned infrastructure in Serbia for ICT-RTD

- ⇒ **As the Government has already secured the resources for ICT RTD investments, mostly from the international loans (200 million EUR from EIB), it is of high importance to spend this amount carefully and to have the clear, transparent, public available procedure and criteria.** This has to be done in a short time period as the contract with European Investment Bank (EIB) is already signed.
- ⇒ **Track with accuracy all places and stakeholders of ICT RTD investment.** Include the high detailed central evidence as the range of investments (EUR 50-80 million) is wide (considering present yearly budget for ICT RTD infrastructure of EUR 2 million).
- ⇒ **Consider implementation process in carefully defined and controlled stages** (by tracking the Return of Investments) as the investment absorption of Serbian ICT RTD sector is modest. There is a risk that large investments will “flood” the sector.
- ⇒ **Increase significantly investments in infrastructure required for FP7-ICT projects.** Invest in project proposals with FP7 evaluation marks above 12.5 that are not financed by the EU. Particularly invest in projects which results are applicable in cooperation with domestic industry.

- ⇒ Government is suggested to reorganize the current funding for R&D projects intended to limited number of organizations and institutions registered as SRO (Science & Research Organizations).
- ⇒ ICT RTD companies are recommended to make ICT RTD association and (try) to influence policy makers; to track EU ICT R&D priorities, invest in these areas and increase significantly their investments in infrastructure and capacity building; to search and make connections to ICT related faculties and institutes.
- ⇒ **Faculties and institutes** are suggested to intensify the establishment of spin off companies related directly or indirectly to their activities and improve their ICT infrastructure. Government should consider stimulation measure for Faculties and institutes to invest part of their incomes in infrastructure.
- ⇒ **Each local community should consider creating „ICT meeting points“** such as technological parks, spin off companies, ICT incubators or innovation centres.
- ⇒ **Facilitate and accelerate mobile operators' investments in broadband infrastructure** through the abolition of additional tax of 10% on mobile phone use.
- ⇒ **Actions proposed to improve the current ICT RTD infrastructure (AMRES and EMRES)** are considering insufficient utilization of the potential of Academic research network and Academic Grid Initiative (AEGIS).
- ⇒ **It is recommended that Statistical Office of the Republic of Serbia starts up the statistical follow up of the investment in ICT RTD area** to overcome the limitations of currently available public data and their accuracy and reliability.

### **3.1.5 Recommendations on national level regarding ICT RTD Legal and Policy Environment**

- ⇒ **Rapid adoption of a reliable and concrete Action Plan for the Strategy for Development of Science and Research in Serbia (2010-2015)**, since it is the key document for realization and acceleration of progress in this area.
- ⇒ **It is necessary to ensure support from all ICT RTD sectors.** The results from an analysis of the two-round Delphi survey (Task 6) indicate that the current support is only partial. The amount of skepticism shown by a number of experts can be understood as „a realistic observation“ of the issue, based on their previous experience. To overcome the identified gap between attitude of ICT “branch” and ICT “policy” towards realization of Government plans, it is necessary to significantly intensify and widen the dialogue between them. The convergence of their positions is the key for the success of future work and plans.

- ⇒ **It is recommended, before adopting the final Action Plan, that the Government in cooperation with ICT RTD experts concretizes/redefines ICT priorities according to the needs of the ones most interested.** Government has just initiated defining the ICT RTD priorities in cooperation with experts.
- ⇒ **Due to recession and falling GDP, regulation (on an annual basis) of GDP expenditure for ICT RTD is necessary** to achieve the plan to increase investments in Research and Science.
- ⇒ **Careful creating of national and sustainable ICT RTD policy is needed,** that will support High Tech projects and the best national institutes, instead of closing them and leading the ICT RTD sector into technologically subordinated position.
- ⇒ **The general perception of European researchers is that, with exceptions of some recognized cases of excellence, the level of Serbian research is low, particularly compared with the EU15.** In order to change present stereotype about Serbia, either a lot of years or a very good "successful cases" marketing is needed, focused on a target group of European research organization.

## ***3.2 Recommendations on EU level***

### **3.2.1 Measures to maximize the Serbia's potential in the FP7-ICT**

- ⇒ **Serbia is the new player in Framework Programs** after many years of sanctions and standing aside of European research area and world science (1992-2000). It is suggested to create actions on EU level to promote and encourage Serbian science through brokerage events, knowledge exchange and networking.
- ⇒ **Targeted regional calls for common West Balkan ICT R&D priorities** are suggested for improving the regional cooperation, experience exchange and speeding up solving the common problems and barriers.
- ⇒ **Apart from targeted calls on regional priorities, the support actions for other (EU) priorities that are underdeveloped in the region** are recommended.
- ⇒ **Average EU FP7 financial support for Serbian ICT RTD is small.** It is estimated that FP7-ICT projects contribute to Serbian ICT RTD sector with about EUR 2 million per year. The results from Delphi survey show that the extent to which the budget for local participants in FP7-ICT is sufficient is low (evaluated with the average mark 4.6 out of 10). Consider actions for increasing the amounts for contracted monthly payments of Serbian ICT RTD researchers – as it will significantly increase their motivation to participate in FP7.
- ⇒ **EU is encouraged to continue its financial support** by participating in further projects / actions for specific ICT RTD infrastructure.

- ⇒ **It is suggested to create awareness of the FP participation benefits through regional conferences and events** dedicated to demonstrations of the success stories and best practices. Consider transfer of knowledge and experience from EU to Serbian participants.
- ⇒ **Consider financing travel expenses for the EU experts** so they can present particular FP7 issues on regional conferences.
- ⇒ **Consider criteria for achieving grants for universities** and faculties such as access to renowned digital libraries (as IEEE and similar), as the COBSON, although amazing, does not cover sufficient number of ICT magazines.
- ⇒ **Consider benefits for FP7-ICT successful participant** for licenses for specialized software or access to specific data bases.
- ⇒ **Consider establishing regional administrative center for FP7-ICT** to enable ICT RTD organizations in the region to outsource this activity.
- ⇒ **Support actions on FP7 procedures and proposal development** are still important for the region.

### **3.2.2 Recommendations on EU level regarding participation of Serbian entities in FP7-ICT Theme**

- ⇒ **When there were more Serbian applicants per one proposal, Serbia achieved bigger success in average.** It is recommended to use this observation for increasing the modest share of Serbian applicants in the FP7-ICT Theme by stimulating the involvement of more Serbian participants per one consortium. More Serbian participants could not decrease the number of participants from any other country, as Serbian participation is extremely low (0,24%, 14 applicants in total of 5.754). Additionally, if Serbia does not double its participation (raise it 100%) in the short time, it will come to the negative balance (Serbian contribution to the EU budget will be bigger than budget received from FP7-ICT). Average consortium has 9,9 entities (5747 entities in 583 projects), 8,6 entities come from EU15 and 0,7 from AC.
- ⇒ **More Serbian participants per consortium would probably be realistic in the case the Serbia is the coordinator,** which is unlikely, as Serbia has only one coordinating role for now. In addition, the rigidity of EU15 consortia is hampering the situation. However, to enable Serbia to achieve coordinating role, regional calls are recommended. In addition, it is suggested to EU to consider the change the criteria to assure presence of all country types (EU15, EU12 and AC).

**Strengthen cooperation and networking at the regional and European level, particularly of policy makers.** Additionally, common problems of the CEE region can



be recognized much easier and the best practices as well as the solutions can be shared. It is suggested to establish regional coordinating, cooperating and networking center. Serbia is a natural place to become the gathering and coordinating center for the West Balkan region, due to its historic links, language and geographic location.

### **3.2.3 Recommendations on EU level regarding present and planned infrastructure in Serbia for ICT-RTD**

- ⇒ **Actions to improve infrastructure between Serbia and neighboring countries.**
- ⇒ **Continuous foreign donations** are condition sine qua non for ICT RTD infrastructure development in Serbia.
- ⇒ **International scientific and technological cooperation**, particularly FP7-ICT Theme, should be one of the main priorities of Serbian researchers, and thus stimulated.
- ⇒ **International financial institutions should become the most important financial resources** for Serbian ICT RTD capital expenditures in the next few years.
- ⇒ **Big international technological companies should consider Serbia as a place for realizing a part of their development programmes** through investing in Serbian existing research infrastructure and capacities or by forming new ones.

## 4 LEARN MORE

### General principles

This report is produced as the public version of the report "ICT RTD Technological Audit" in the form accessible to a broad public and decision making constituency.

This is nine of 9 reports from the project „ICT RTD TECHNOLOGICAL AUDIT“

Deliverable 1: Review of studies and strategy papers

Deliverable 2: Review of activities and capabilities of entities in Serbia carrying out ICT RTD

Deliverable 3: Analysis of the participation of Serbia in the FP6-IST and FP7-ICT Theme – Desk Research

Deliverable 4: Present and planned infrastructure in Serbia for ICT-RTD – Desk Research

Deliverable 5: Analysis of the ICT-RTD capabilities in Serbia and the measures to maximize the country's potential in the FP7-ICT Theme – Live Interviews

Deliverable 6: Delphi survey to identify latent ICT-RTD potential in Serbia

Deliverable 7: Opportunities and barriers for increasing the contribution of Serbia to the FP7-ICT Theme

Deliverable 8: Detailed Report

Deliverable 9: Simplified Report

#### 4.1.1 Subject and objectives of research

The main goal of this research is to explore the existing ICT RTD potential in Serbia. Detected national research potential will be presented considering its capability to become the part of European Research Area (ERA).

Review and presentation of the current ICT RTD policy environment and main opportunities and barriers is given as well as review and presentation of the current ICT RTD main stakeholder activities and their potential for the future achievements. Also, FP6-IST Priority and FP7-ICT Themes will be outlined with particular attention to: participation trends starting from FP6-IST Priority; listing of the all participation entities; presentation of success and failure rates in Serbian submitted proposals and completed with reasons.

Research will explore current and planned research infrastructures related to ICT RTD activities with the particular respect to infrastructures' capability to meet the Serbian needs for an effective participation in FP7-ICT Theme.

Further research will focus on detection centers of excellence in both private and public sector, in order to identify the key players with potential per FP7-ICT Theme Challenge and Objectives. Finally, this study will provide conclusions followed by recommendations of the actions needed

to be taken at national and European level in order to increase the participation of both private and public sector carrying out ICT RTD in Serbia.

As the live interviews cannot cover the whole ICT community in Serbia, the survey should be extended to cover the maximum number of stakeholders using the Delphi survey process. In this respect a 2 rounds on-line Delphi survey should be carried out.

To accomplish the SWOT analysis of the objective defined as "Successful participation and integration of Serbian ICT RTD in the FP7 – ICT Theme", the assessment considered various perspectives in identification and analysis of the opportunities and barriers.

Summarize and draw conclusions from the findings described in all previously described items. Last, but not least, ***the public version of the whole report in the form accessible to a broad public and decision making constituency, will be produced.***

#### 4.1.2 Task\_9 Methodology

**TASK 9:** Produce a public version of Deliverable 8 in a form accessible to a broad public and decision making constituency.

Table 42 TASK 9 and following activities. Produce a public version of Deliverable 8

	Activities	Description
9.1	Public version of Deliverable 8	Text preparation. Write-up Report

**Proposed methodology:** -

**Major supplier of the information:** - deliverable 8

**Deliverable 9/Task 9 – Report**

Table 43 TASK 9. Cycle of task realization process

1. Planning	2. Realization
Proposed plan of Task_9 realization - *.ppt presentation at the interim meeting - Adoption of schedule for realization of Task_9	Deliverable 9: Report on Result of Task_9 - Summarizing and drawing conclusions - Learn more
4. Evaluation	3. Measurement
Document covering the evaluation - List of those interested in receiving the report - Analysis of reactions to the report - Minutes on the evaluation	Document covering measurements -

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#### 4.1.5 Abbreviations

AC (or ASC)– Associated Countries, i.e. Serbia, Switzerland, Israel, Norway, Iceland, Croatia, Macedonia, Montenegro, Liechtenstein, Albania, Turkey

AEGIS - Academic and Educational Grid Initiative of Serbia

AMRES - Academic Network of Serbia

CCR - Compound Competence Ratio

CCS - Current Competence Share

COBSON - Serbian library consortium for the joint acquisition (KoBSON)

CoE - Centres of Excellence

COST - European Cooperation in Science and Technology

CSM - Competence/Share Matrix

CSR - Compound Share Ratio

EC-DG INFSO – European Commission, Directorate General Information Society and Media

EIB – European Investment Bank

ELFAK - Faculty of Electronic Engineering, University of Niš

EMRES - Educational Network of Serbia

EPS – Electric Power Industry of Serbia

ERA - European Research Area.

eSEE Agenda+ - electronic South-Eastern Europe Agenda +

ETF - School of Electrical Engineering, University of Belgrade

EU – The 27 member States (MSC) that are part of the European Union

EU15 – The 15 member States of the European Union, i.e. Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

EU12 – The 12 member States which joined the EU after 2004, i.e. Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia

EUREKA - pan-European research and development funding and coordination organization

ex-YU – countries of former Yugoslavia

FET - Future and Emerging Technologies

FON (or FOS) - Faculty of Organizational Science, University of Belgrade

FP – Framework Programme

FP6-IST - Framework Programme 6 - Information Society Technologies

FP7-ICT - Framework Programme 7 – Information and Communications Technologies

FTE – Full Time Employed Researchers

GDP – Gross Domestic Product

HES – High Education Sector

IAEA - International Atomic Energy Agency

ICT - Information and Communications Technology

ICT RTD - Information and Communications Technology Research and Technology Development

IMP - Institute Mihailo Pupin

IMTEL - Institute for Microwave Techniques and Electronics

IS – Information Society

MAT BG - Faculty Of Mathematics, University Of Belgrade

MSTD - Ministry of Science and Technological Development

MTIS - Ministry of telecommunications and Information Society

NACE - Statistical classification of economic activities in the European Community

NATO - North Atlantic Treaty Organization

NC - National Council for Science and Technological Development

NGO – Non-Government Organization

NIP - National Investment Plan

NITIA - National Information Technology and Internet Agency

NoE – Number of Employees

NoR – Number of Researchers

PMF – Faculty of Science, University of Novi Sad

R&D – Research and Development

RATEL - Republic Telecommunication Agency

RCUB – Computer Centre of University of Belgrade

ROI - Return of Investment

RTD - Research and Technology Development

S&T – Science and Technology

SANU (or SASA) - Serbian Academy of Science and Art

SCDB - Serbian Competence Data Base

SCI - Science Citation Index

SDH/DWDM – Synchronous Digital Hierarchy/ Dense wavelength division multiplexing

SEE - South-Eastern Europe

SEE-GRID-SCI - SEE-GRID eInfrastructure for regional eScience

SEEREN - South-Eastern Europe Regional Network

SME – Small and Medium Enterprise

SRO - Science & Research Organizations

SSA – Specific Support Actions

STREP – Specific Targeted Research Projects

SWOT – Strength, Weaknesses, Opportunity and Threat analyzes

UoB - University of Belgrade

WAN – Wide Area Network

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- [w20] INOVACIONI CENTAR ELEKTROTEHNIČKOG FAKULTETA, <http://www.icef.etf.rs>
- [w21] RACUNSKI CENTAR UNIVERZITETA U BEOGRADU (RCUB), <http://www.rcub.bg.ac.rs>
- [w22] POSLOVNO TEHNOLOŠKI INKUBATOR tehničkih fakulteta,
- [w23] INSTITUT ZA MULTIDISCIPLINARNA ISTRAŽIVANJA, <http://web.imsi.rs>
- [w24] INI Industrijski inženjering, <http://www.ini.rs>
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#### 4.1.7 Project Quality Control/QA Signature Sheet

Contract Number: 30-CE-0262079/00-10  
Project Title: SERBIA - RTD Technological audit  
Task Number: 9  
Task Title: SERBIA – RTD TECHNOLOGICAL AUDIT – Simplified Report  
Planned Delivery Date: 04.12.2009  
Actual Delivery Date: 14.07.2010

Tasks for this report	Status of validation
<ul style="list-style-type: none"><li>To produce a public version of Deliverable 8 in a form accessible to a broad public and decision making constituency</li></ul>	S

**Key:**

S Meets standards according to the contract, no revisions required  
D Discussion needed  
L Low degree of revision required  
M Moderate degree of revision required  
H High degree of revision required  
N/A Not applicable

**Evaluation & Quality Assurance Officer**

Name:

Signature:

Date:

Milovan Matijević



14.07.2010

#### 4.1.8 Project information page

<b>Project name</b>	<b>SERBIA – RTD TECHNOLOGICAL AUDIT</b>	
<b>Project N°</b>	30-CE-0262079/00-10	
<b>Country</b>	<b>SERBIA</b>	
	<b>Client</b>	<b>Contractor:</b>
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<b>Contributors</b>		Dragan Bogojević Nikola Marković
<b>Name of report</b>	Deliverable 9 SERBIA – RTD TECHNOLOGICAL AUDIT – Simplified Report	
<b>Period</b>	January - February 2010	
<b>Date</b>		14.07.2010.