



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

The ICT Research environment in Serbia



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Table of Contents

THE ICT RESEARCH ENVIRONMENT IN SERBIA.....	1
ABSTRACT	3
1 THE SERBIAN ICT POLICY FRAMEWORK.....	4
1.1 OVERALL ICT POLICY FRAMEWORK.....	4
1.2 THE ELEMENTS OF ICT RESEARCH POLICY MAKING	5
2 OVERVIEW OF ICT RESEARCH ACTIVITIES.....	8
2.1 ICT RESEARCH PROJECTS	8
2.2 KEY COMPETENCES IN ICT RESEARCH FIELDS	10
3 KEY DRIVERS OF ICT RESEARCH	12
3.1 MAIN ICT SECTOR TRENDS IN SERBIA.....	12
3.2 MAIN SOCIO-ECONOMIC CHALLENGES IN SERBIA	13
ANNEX I – LIST OF NATIONAL ICT PROJECTS.....	16

ABSTRACT

The present report was developed in March 2007 (and updated in September 2007) in the context of the EC funded project SCORE “*Strengthening the Strategic Cooperation between the EU and Western Balkan Region in the field of ICT research*”, and is part of the SCORE Consultation Document that served for consulting expert ICT stakeholders about the relevant ICT research priorities in each WB country for the period 2007 – 2013.

The report provides a brief overview of the ICT research environment in Serbia. It includes key facts and figures concerning policy framework, current trends as well as short overview of main drivers of ICT research in Serbia.

1 THE SERBIAN ICT POLICY FRAMEWORK

1.1 Overall ICT Policy Framework

The main document which defines the ICT policy framework is the **Strategy for Development of an Information Society of the Republic of Serbia**. The Strategy was adopted by the Government of Serbia in October 2006 (Official Gazette of Serbia, no. 87/2006). The process of defining and writing the Strategy started in the April 2005. Many interested parties (local and international, e.g. UNDP) and stakeholders took a part in broad public discussion.

The Strategy for Development of an Information Society of Serbia is a framework document which gives developmental directions and identifies key areas and activities in Information Society domain reflecting a vision and linking local/ national developmental aspirations and global IS streams.

The main objectives of the Strategy for Development of an Information Society of Serbia are:

- To improve the situation in broad field of Information and Communication technologies
- To clarify roles, build public-private partnerships, and facilitate participation by all stakeholders, including NGOs
- To focus scarce resources on exploiting ICT for national priorities, help sequence, and phase complementary investments
- To address the special needs and dynamics of promising segments of the ICT industry for export and economy-wide competitiveness
- To re-orient the national innovation system to meet the substantial and cumulative technological learning requirements of ICT (as a general-purpose technology)
- To address coordination failures, exploit network effects, and secure complementary investments to use ICT as empowerment and service delivery infrastructure.

The Strategy defines the following sections and according to them defines strategic priorities:

Section	Strategic Priority
Information Society Development Strategic Priorities and Initiatives	Perform E-Readiness Assessment
	Develop Sectorial E-Strategies
	Integrate ICT in sustainable development
Institutional Framework for the Information Society Development	Develop legislation framework and set up institution which will be in charge for implementation of the Strategy for Development of an Information Society of the Republic of Serbia
E-legislative	Create legislative framework for information society
Telecommunication and information infrastructure	Develop access to ICT infrastructure
eGovernment	Plan and organise eGovernment development
	Create an environment for eGovernment development

Section	Strategic Priority
	Develop eGovernment services
eEducation	Make citizens equal members of information society
	Build educational system adapted to the needs of information society
	Foster research and development
	Provide access to information about national cultural and historical heritage
eHealth	Develop Health Information System
eBusiness and eBanking	Create an environment for e- business
	Facilitate business processes and accept international standards
	Support the enterprise sector for e-Business implementation
ICT business sector	Develop software development strategy
Other	Ensure the relevance of Strategy for Development of an Information Society of the Republic of Serbia within regional and European Context
	Monitor information society development in Serbia (benchmark process)

Table 1 – Overview of Strategy for Development of Information Society

1.2 The Elements of ICT Research Policy Making

The ICT research policy of Serbia is not clearly defined and is not published as a coherent, public policy document, the same situation is with the most of other research policies. That does not mean that broad ICT research area is not supported by the government and other public funds, but there are no publicly available documents and transparent legal framework under which this support is distributed.

In the recently adopted Strategy for the Development of an Information Society of the Republic of Serbia, in the Section 7 named eEducation, the Fostering of Research and Development in ICT is stipulated as one of the strategic priorities in order to:

- Enhance competitiveness, facilitate development of SMEs and overall development of national research organisations
- Forster research capacities, improve the level of quality of research, enhanced level of knowledge and skills of research community and stop brain drain
- Support research and development and to enable national companies and research institutions to gain knowledge, experience and needed references for the competitiveness on the global market.

Although it is presented under the section eEducation, it covers the entire ICT field.

Currently the **Ministry of Science** is in charge for funding of majority of governmentally funded research activities, including ICT research projects through several sectors.

The main legal document which set up entire system and research framework in Serbia is the **Law on Science and Research**, adopted in 2005 (Official Gazette of Serbia, no. 110/2005 and corrected in 50/2006). All research activities (including ICT) in the Republic of Serbia, according to the Law on Science and Research, have to be funded according to priorities set up in the **Strategy of Scientific and Technological Development of the Republic of Serbia**, which has to be brought-in by the Government of Serbia, after proposal prepared by the Ministry which is at that moment in charge for the science and research. According to the Law of Science and Research the main aim of the Strategy is to set up scientific research as key driver for overall development. The Strategy should cover a 10 year period. The Law obliges the Government to adopt the Strategy “at latest 1 year after the Law comes to power” (Article 113) but it is still not brought-in.

In the same article the Law prescribes that in the meantime “the Policy for the Scientific and Technological Development of the Republic of Serbia (Official Gazette of Serbia, no. 17/94) will be implemented”. The **Policy for the Scientific and Technological Development of the Republic of Serbia**, was brought-in in 1994, and has wide-ranging and general approach to ICT. In the area of ICT, according to the Policy, government will strongly support those areas that are focused on: the renewing of conventional technology; developing of technological processes and products that will decrease import and that will result in products which will be competitive on the global market; modernisation and facilitation of social and economical development.

According to the Article 10 of the Law, specific programmes “of the general interest of the Republic” are listed, and among many more broad programmes, e.g. programmes of human resources development, centres of excellence or programmes of support for young and talented scientists, there are two specific programmes which are directly ICT related:

- Programme of research in the field of technological development, and
- Programme of development of information society.

These two (as well as all other listed programmes) have to be defined by the Minister in-charge for science and research, after the proposal prepared by the National Council for Scientific and Technological Development. Described Programmes have to be brought-in by the Minister for “every new cycle of research”. The National Council was established on 7 April 2006, according to publicly available information, but proposals for two above mentioned Programmes (research for technological development and information society), are not prepared yet so the Minister still did not bring-in the Programmes.

The **National Council for Scientific and Technological Development** (17 members from all fields of sciences and humanities) is assigned as the key body in charge to propose programmes of research to the Ministry in-charge for science and research. At least 3 members are directly or indirectly related with ICT.

At the moment, ICT research is directly funded by the Government through projects submitted by stated institutes and universities. Projects are also partly funded through the Sector of Basic Research and its funding programme for: Physics, Chemistry, Mathematics and Mechanics, Medicine, Biology and Geosciences. In all mentioned programmes ICT research is listed as cross-cutting issue.

Also ICT research projects are supported through the **Sector for Technological Development, Technology Transfer and Innovation System**.

In the field of technological development, the Sector for Technological Development, Technology Transfer and Innovation System supports those research activities that solve

concrete development problems of different fields and organisations in several research areas of which one is Information technologies. These research projects should facilitate economic development of the country, innovativeness and competitiveness.

Also in the field of technology transfer and innovation systems, the Sector for Technological Development, Technology Transfer and Innovation System has a mission to support network between research organisation and industry in order to facilitate the transfer of knowledge and technology.

According to the new Constitution of Serbia adopted in 2006, one of the autonomous rights which are allocated to the Province of Vojvodina, is finance and management of R&D activities in the province. Thus, the Secretariat for Science and Technological Development of Executive Council of Province of Vojvodina also supports R&D, international cooperation, infrastructure and cooperation with industry.

Finally, in 2006 the Government of Serbia adopted the **National Investment Plan** (NIP) for the period from 2006 until 2011. According to that plan the Republic of Serbia would invest 30 million euros in science, of which 17 million euros will be invested in equipment for research, 2.5 million will be invested in the financing the facilitation of creating innovation (up to 50 innovative project per year), 2.6 million euros for the building the scientific-technological park, and 7.9 million will be invested in the creating of scientific data-bases. Also, according to the NIP from the 2006-2008 42.8 million euros will be invested in the development of e-government.

2 OVERVIEW OF ICT RESEARCH ACTIVITIES

2.1 ICT Research Projects

ICT research in Serbia was present for decades, but it was just recently that it got integrated to some extent into European research community. On 13th June 2007 the Republic of Serbia signed Memorandum of Understanding (MoU) with the European Commission which enabled research organisations from Serbia to participate fully in the EU's Seventh Research Framework Programme (FP7). During past years, Serbia was building its research capacities, which is supported by the fact that there are a great number of research projects that were carried out in Serbia during past 5 years. Obtained from Ministry of Science, below is given the summary (pie chart) of research projects carried out in public research institutions and for which realization was supported by the Ministry.

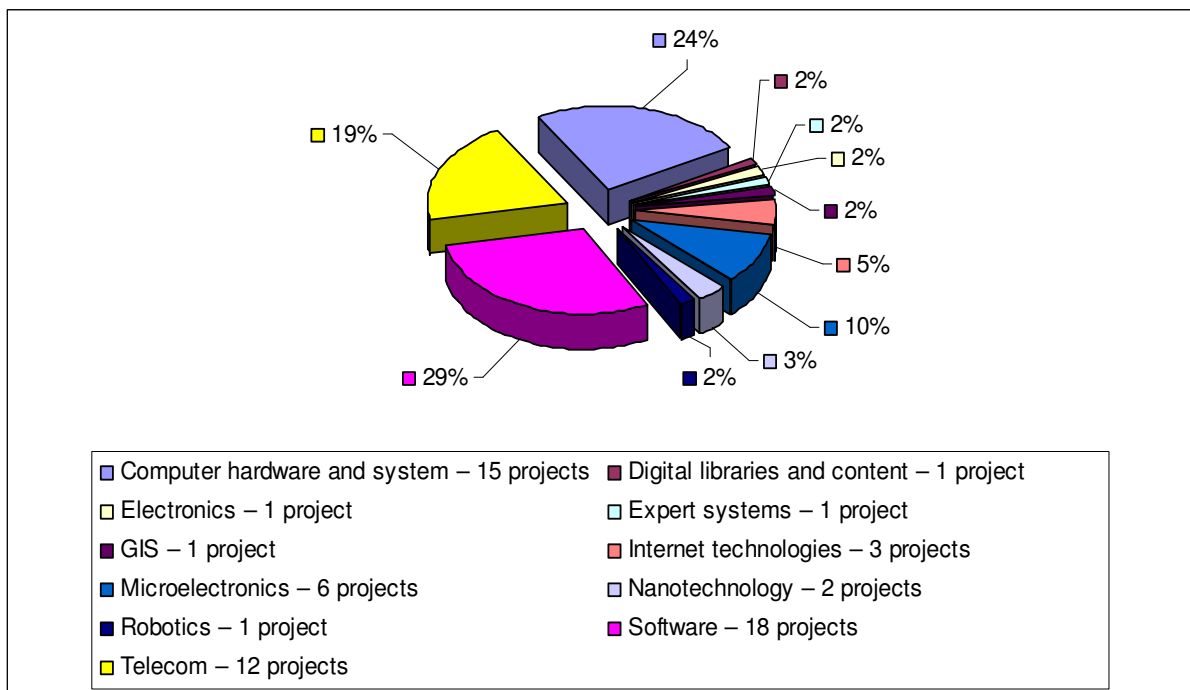


Figure 1 – Key research fields of national ICT research projects

It can be concluded that the areas of great interest in Serbian research community include: software, computer hardware and systems and telecommunication. However, official data on private financed and implemented research are not available. SME research capacities data provided by the FP6 funded project SEE Innovation¹ can be used as an indication, and it shows that embedded systems, computing and control and well as intelligent infrastructure are fields in which SME IT companies (with research activities) are most active in.

Currently there are several EU projects running in Serbia and more than 100 nationally funded ICT projects².

¹ www.see-innovation.org

² Please find list of national ICT research projects funded by the Ministry of Science

Regarding international cooperation during the past 5 years, numerous projects have been realized within the 6th Framework Programme³. Below is the list of research projects funded under FP5 and FP6 by the IST Programme and names of participating organisations from Serbia.

FP6 IST Priority Project Acronym	Partner from Serbia
ELLECTRA-WEB	EVOLUTION ONLINE DOO PUBLIC PROCUREMENT OFFICE
FIT	CIM COLLEGE D.O.O.
SCORE	INFORMATION SOCIETY SCG BELGRADE OPEN SCHOOL
SEE Innovation	INFORMATION SOCIETY SCG
CALIMERA	LIBRARY "MILUTIN BOJIC"
IDEALIST-EXTEND	MINISTRY OF SCIENCE OF THE REPUBLIC OF SERBIA
IS2Web	BELGRADE OPEN SCHOOL
SEE-GRID	UNIVERSITY IN BELGRADE
WE-GO	UNIVERSITY IN BELGRADE PEXIM LTD
SEEFIRE	UNIVERSITY IN BELGRADE NEWS AGENCY TANJUG
WEB.DEP	EUROPEAN CENTER FOR PEACE AND DEVELOPMENT OF THE UN UNIVERSITY OF PEACE
GREAT-IST	MINISTRY OF JUSTICE OF THE REPUBLIC OF MONTENEGRO
SWEB	MUNICIPALITY STARI GRAD AUTONOMOUS PROVINCE OF VOJVODINA MATHEMATICAL INSTITUTE OF SERBIAN ACADEMY OF SCIENCES AND ARTS PROZONE LTD
TEAM	CIM COLLEGE LTD
RACWEB	MINISTRY OF FINANCE, CUSTOMS ADMINISTRATION

Table 2 – List of ICT projects funded by the FP5 and FP6

³ The 6th Framework Programme for Research and Technological Development, is the European Commission's high-level programme determining the direction of research and technological development activities for the period 2002 to 2006.

2.2 Key Competences in ICT Research Fields

According to the data showed at Figure 1 ICT research fields of great interest in Serbian research community are: software, computer hardware and systems and telecommunication. The Table 3 presents the most competent research fields in Serbia. The data on this table are based on the results of two EC funded FP6 projects IS2WeB and SEE- Innovation.

IS2WeB⁴ developed a directory (also available on-line) of key Higher Education and NGO research organisations in the field of ICT through a mapping exercise. The number of Serbian research organisations in the IS2WEB directory is 32. As a part of the project a survey on research potential of research organizations was conducted. The results from questionnaire (based on the FP6 workprogramme) concerning their interest in particular ICT research fields showed that research organizations are the most interested in the following fields:

- ICT for content, creativity and personal development: technology enhanced learning – 13 organisations
- Intelligent infrastructure – 12 organisations
- New perspectives in ICT drawing on other science and technology disciplines – 11 organisations
- ICT for content, creativity and personal development: cultural resources - 10 organisations

SEE-Innovation⁵ (a sister project of IS2WEB) developed a similar directory, targeting SME ICT companies that have research activity. The number of Serbian SME companies with research activity included in the SEE INNOVATION directory is 18. As a part of the project a survey on research potential of research organizations was conducted. The results from questionnaire (based on the FP6 workprogramme) concerning their interest in particular ICT research fields showed that they are the most interested in the following fields:

- ICT supporting businesses and industry: business processes, work organisation etc. – 14 SMEs
- Intelligent infrastructure – 10 SMEs
- Embedded systems, computing and control – 8 SMEs
- ICT meeting societal challenges for governments – 7 SMEs

Classification of ICT research fields	No of Academic & NGO research organisations (Based on total sample of 32 in IS2Web directory)	No of SME research organisations (Based on total sample of 18 in See-Innovation directory)
ICT Technology Pillars		
• New perspectives in ICT drawing on other science and technology disciplines	11	2
• Simulation, visualisation, interaction and mixed realities	7	2
• Embedded systems, computing and control	5	8
• Nano-electronics, photonics and integrated	4	0

⁴ www.is2web.org

⁵ www.see-innovation.org

Classification of ICT research fields	No of Academic & NGO research organisations (Based on total sample of 32 in IS2Web directory)	No of SME research organisations (Based on total sample of 18 in See-Innovation directory)
micro/nano-systems		
● Ubiquitous and unlimited capacity communication networks	4	3
● Software, grids, security and dependability	1	1
● Knowledge, cognitive and learning systems	1	3
Integration of Technologies		
● Intelligent infrastructure	12	10
● Personal environments	9	7
● Home environments	4	3
● Robotic systems	2	1
Applications research		
● ICTs for learning & eLearning	13	2
● ICTs for Cultural Heritage	10	2
● ICTs for Business (business processes, work organisation etc.)	1	14
● ICTs for Government	7	7
● ICTs for Inclusion	6	3
● ICTs for new media & digital content	6	3
● ICT for trust and confidence	6	3
● ICTs for environment	5	2
● ICT for Health	4	2
● ICTs for Mobility	4	4
● ICT for Manufacturing	1	6
Future and Emerging Technologies	4	1

Table 3 - Competent research fields of key research organisations in Serbia

3 KEY DRIVERS OF ICT RESEARCH

3.1 Main ICT Sector Trends in Serbia

The (ICT) sector in Serbia is constantly growing. Government is setting out to implement an E Government programme at national and regional levels, and industry and utilities seek to modernize basic administrative and process functions. According to the Serbian Investment and Export Promotion Agency, there are 1,408 IT⁶ companies.

Main segments of ICT sector are: Telecommunication companies, software and hardware development companies and media companies.

Telecom segment:

In Serbia, there are currently 3 major mobile providers one fixed service provider. The greatest investment had been made, over last 5 years in telecommunication sector and sum up to over 1 billion euro. Telekom Srbija (fixed service provider) itself, invested over 800 million euros in its infrastructure. Optical infrastructure has been built and it covers all major cities in Serbia.

Republic agency for telecommunication has been formed and is expected to contribute to the regulation and development of this sector.

Software technology segment:

This industry had significant improvement during last 3 years. Microsoft Regional development centre had been opened (one of 6 of such kind in the world), CISCO's regional development centre had also been opened in Belgrade. In software sector, most dominant are corporative applicative solutions (applications), especially software for banking services, which are implementer in over 40 banks. There are also numerous domestic software solutions in the field of e-Government and Municipality IS which are implemented in more than 100 Municipalities and several Ministries.

835 Serbian IT companies are engaged in software development. They have highly-skilled engineers which are competent in a broad range of methodologies, technologies and tools supporting efficient development of high quality software and systems integration. They have expertise in developing front-end, back-end and middle-ware components but also are very proficient at understanding client requirements due to their extensive business knowledge and creating tailored software and systems⁷.

Hardware technology segment:

In this segment numerous development activities have been realized in the field of high speed data transfer as well as great number of systems with specific needs in various industries. Development activities as well as basic technology research in this sector are being carried out mainly in institutes and at Universities. During past 2-3 years, infrastructure in education and research institution had been developed – academic network. This network has currently 1500 km of optical fiber which connects all important R&D institutions.

⁶ <http://www.siepa.sr.gov.yu/attach/ITS.pdf>

⁷ Data of Serbian Investment and Export Promotion Agency, <http://www.siepa.sr.gov.yu/attach/ITS.pdf>

Also, In Serbia, there are 573 hardware manufacturers. The industry focus to date has been on development of customized products for specific industry applications for the local market with the larger companies offering a wider systems integration and full technical service approach. Nowadays, modern hardware (LCD monitors, memory modules, toners cartridges for printers, etc) are made in Serbia.⁸

Media segment:

Media companies developed great number of web portals and TV signal distribution. Web portals of some media are among the most visited ones in the country.

Republic agency for radio diffusion has been formed and is expected to contribute to the regulation and development of this sector.

Key ICT sector developments have been achieved especially in Telecommunication infrastructure and national academic network. Over last 5 years investments in telecommunication sector adds up to over 1 billion euro. Two more mobile service providers entered Serbian market and their investments are yet to be determined.

Key technological needs of the ICT sector are:

- Investment in ICT sector, significant investments in software development
- Greater level of cooperation between international environment and domestic companies
- Joint projects of research sector and industry

With excess budget money from privatization, Serbia created NIP (National Investment Plan) to be spent on industry development projects and support to local economy. Over 40 million euros had been intended for e-Government. Finally, the trends of ICT usage have been improving in the past years. The following table reveals some recent statistics⁹.

Number of PCs	Number of Internet users	Number of mobile users (per 1000 inhabitants)	Number of fixed lines (per 1000 inhabitants)
34% of households have PC	29,9% of population in Serbia were using internet in the last three months	472,96 (2004)	268,54 (2004)

3.2 Main Socio-Economic Challenges in Serbia

During the last decade of twentieth century Serbia has undergone a period of economic and political isolation and escalated conflict. The wars in the former Yugoslavia, severe sanctions of international community (including sanctions on scientific cooperation) and bombing of Serbia in 1999, destroyed the country's infrastructure and devastated the environment and the economy. Since 2001, after a delayed transition, the country has progressed steadily towards a democratic society and modern market economy. More than ten years of economic, social and

⁸ Data of Serbian Investment and Export Promotion Agency, <http://www.siepa.sr.gov.yu/attach/ITS.pdf>

⁹ Sources: The Republic Statistical Office of the Republic of Serbia "USAGE OF INFORMATION COMMUNICATION TECHNOLOGIES IN THE REPUBLIC OF SERBIA, 2007" survey (http://webzs.statserb.sr.gov.yu/axd/en/dokumenti/ICT/2007/ICT_2007_saopstenje.pdf) and CIA factbook for Serbia for 2006

institutional deterioration seem to have left a more difficult legacy than the stabilization and reform challenges facing other countries in Central and Eastern Europe in the early 1990s.

Today Serbia is still an underdeveloped country with some serious economic and political problems. The state is going through painful transition processes, rebuilding the democratic society and democratic institutions. Although it records a big improvement since 2001 a lot more should be done. Also there is the unsolved issue of the Kosovo status.

Serbia is a country with a population of almost 7.5 million in 2002 (not including data for Kosovo and Metohija which is under UN administration, Statistical Office of the Republic of Serbia). Average age of Serbian population is 40.3 years which brigades Serbia among the oldest populations in Europe. Out of 25 districts in Serbia, only 5 have a growth of population.

Serbia is a lower middle-income country with a GDP per person of \$3,243 in 2005. In 2004, services accounted for about 57 percent of GDP, industry for 31 percent, and agriculture for 12 percent¹⁰. Serbia had a total number of 2,068,964 employed persons compared to 895,697 unemployed in 2005 (Statistical Office of the Republic of Serbia, 2006).

Serbia has great potential for fast economic development, as the country is rich in natural and mineral resources and agricultural land is fertile and arable. Serbia is also well positioned for development as a transportation hub given its location at the crossroads of land and air routes linking Europe from north to south and west to east.

Macroeconomic stability, achieved swiftly in 2001 and 2002, was broadly maintained, though the high current account deficit and persistent inflation remain a problem. During the first five years of transition the economy grew on average 5.5 percent per annum, peaking in 2004 with 9.3 percent GDP growth, one of the highest growth rates among transition economies. In 2005, growth remained strong at 6.3 percent. At the same time Serbia managed to significantly reduce indebtedness, thanks to favourable agreements with main creditors that resulted in debt write-offs and because of relatively small new borrowing¹¹.

One of the key social challenges faced by Serbia is also subsequent brain drain which followed the dissolution of former Yugoslavia. Socio-economic crises and brain drain influenced negatively on the Serbian science and technology system. Also, years of isolation of the country resulted in our researches being practically excluded form the international scientific community. However the quality of the science system in Serbia is generally considered to be much higher than the level of economy would suggest, possibly as a result of the sufficient supply of human capital. The education system, although not generally modernised and consequently facing difficulties in providing highly qualified graduates on a large scale, is capable of supplying competent scientists to keep up the status of the science sector. However, the continuous brain-drain poses a severe threat to science in Serbia¹².

Research and development of information and communication technology could be a strong driver for economic and overall development of Serbian society. ICT and R&D are widely promoted and supported by the European Commission in order to increase economic growth

¹⁰ World Bank , Country Brief 2006,
<http://www.worldbank.org.yu/WBSITE/EXTERNAL/COUNTRIES/ECAEXT/SERBIAEXTN/0,,menuPK:300913~pagePK:141132~piPK:141107~theSitePK:300904,00.html>

¹¹ ibid

¹² Science and Technology Country Report, Draft 1.1, Reviewed by: Andrea Mayr and Djuro Kutlaca, September 2006.

and employability. Some recently conducted studies¹³ showed that, between 1995 and 2003, information and communication technologies significantly contributed to the productivity and overall economic growth in the 10 new member states and through that also facilitated their process of European integration.

The public sector could also have a special role in driving ICT-led growth. Public “push strategy” is particularly important in the context of transition economies, where the market mechanisms do not yet work as efficiently as in developed countries and thus leave more scope for effective public intervention. That could be done primarily through full development of public e-services (e-government). This would not only bring considerable savings in the public sector, decrease bureaucracy, reduce corruption, facilitate the dialogue between government and citizens and enhance the quality of the business climate, but also stimulate the interest of enterprises in using more advanced ICT applications. A number of countries in the CEE region have demonstrated the benefits of active public ICT policies. This in particular concerns Estonia and Slovenia, the two regional leaders in ICT diffusion and the development of information society.

Information Society in Serbia is underdeveloped. The penetration of Internet users in Serbia is at a low level and the main cause is a lack of e-services and e-content on Serbian language on the Web but also a lack of skills for ICT usage. Information-communication technologies are a very effective tool for societal and economic development. Therefore various problems could be transformed to an opportunity and challenge to improve living conditions and to achieve sustainable development.

Having in mind the fact that Serbian population is amongst the oldest in Europe, ICT can also strongly improve the quality of life of older people. Also the health sector is deteriorated in Serbia during the years of regional wars and international sanctions. Behavioural and environmental risk factors, along with aging of the population, unemployment and social deprivation and the spread of risky life styles contribute to declining health of the population. The existing health care system cannot meet these challenges. Thus, there is a good potential for ICT applications supporting health services.

Following all data stated above it is very important to map and identify the research priorities in ICT field which will meet the social and economic challenges of Serbian society. Also that will contribute to the effectiveness of research and improvement of Serbian science and technology system.

¹³ Piatkowski, M. (2006), Can Information and Communication Technologies Make a Difference in the Development of Transition Economies?, <http://www.mitpressjournals.org/doi/abs/10.1162/itid.2006.3.1.39>

ANNEX I – LIST OF NATIONAL ICT PROJECTS

ICT Research Field	National-funded Projects
Software	<ul style="list-style-type: none"> • Modularni softverski paket za dimenzionisanje i pracenje rada procesnih aparata (<i>Modular software package for dimensioning and tracking operation of processing machines</i>) • Multimedijalna platforma za upravljanje vanrednim situacijama u tehnološkim sistemima (<i>Multimedia platform for managing extraordinary situations in technological systems</i>) • E-rentgenologije Specijalne bolnice za plućne bolesti "Dr Vasa Savić" Zrenjanin (<i>e-rendgenology of special hospital for lung diseases "Dr Vasa Savic" Zrenjanin</i>) • Implementacija RFID tehnologije (<i>Implementation of RFID technology</i>) • Primena termovizije, razvoj novih metoda ispitivanja i softvera za obradu termovizijskih slika (<i>Application of thermo vision, development of new examination methods for and software for processing thermo visual pictures</i>) • Razvoj virtuelnog okruženja za trodimenzionalnu vizuelizaciju oblaka i dejstvo na gradonosne ćelije (<i>Development of virtual environment for 3D shapes visualization and its influence on some type of cells</i>) • Razvoj govornih tehnologija za srpski jezik i primena u Telekomu (<i>Development of speech technologies for Serbian language and its application in Telekom</i>) • Razvoj kompjuterskih metoda i softvera za modeliranje i simulacije u oblasti opšteg i biomedicinskog inženjeringa (<i>Development of computerized methods and software for modeling and simulation in general biomedical engineering</i>) • Razvoj metodologija i softvera za projektovanje, simulaciju i optimizaciju krilnih pumpi (<i>Development of methodologies and software for design, simulation and optimization of certain type of pumps</i>) • Razvoj softvera za analizu čvrstoće i procenu radnog veka konstrukcija (<i>Development of software for analysis of hardness and evaluation of life cycle of constructions</i>) • RAZVOJ SOFTVERA ZA INTEGRISANE SISTEME MENADŽMENTA (<i>Development of software for integrated management systems</i>) • Razvoj softvera za podršku izradi prototipova pomoću 3-D štampača u Internet okruženju (<i>Development of software for support in production of prototypes with 3-D printer in Internet environment</i>) • Razvoj softverskih rešenja u Internet/Intranet okruženju za integrisani razvoj proizvoda i procesa (<i>Development of software solutions in Internet/Intranet environment for integral development of products and processes</i>) • Savremeno daljinsko upravljanje sistemima za vodosnadbevanje i tretman otpadnih voda (<i>Modern remote control of systems for watering and sewage water treatment</i>) • Simulator potrošnje električne energije za elektroenergetski sistem sa dinamičkom dodelom tarifa – SIMEPS (<i>SIMEPS – Simulator of electrical</i>)

ICT Research Field	National-funded Projects
	<p><i>energy spending for electromagnetic system with dynamic price assignment)</i></p> <ul style="list-style-type: none"> • Softverski sistemi u službi održivog tehnološkog razvoja (<i>Software systems like diving force of sustainable development</i>) • Govorni portal za slepe i slabovide osobe na srpskom govornom području – Kontakt (<i>Kontakt - Speech portal for blind and sight impaired people in Serbian speaking region</i>) • Merači softverskih metrika u proceduralnom, objektno-orijentisanom i Internet programiranju (<i>Measurers of software metrics in procedural object-oriented and Internet programming</i>)
Computer hardware and system	<ul style="list-style-type: none"> • Novi procesni računar za upravljanje u elektroenergetici baziran na real-time Linux OS (<i>New processing computer in electromagnetic based on real-time Linux OS</i>) • Razvoj i proizvodnja elektronski senzorski upravljanih bistabilnih elektromagnetnih hidrauličkih ventila (<i>Development and implementation of electro-sensor managed bi-stable electromagnetic hydraulic ventil</i>) • Razvoj metoda i opreme za prikupljanje i prenos mernih podataka pri ispitivanju vučnih vozila (<i>Development of methods and equipments for gathering and transfer of measurable data in examination of freight vehicle</i>) • Implementacija kontrolera Internet rutera (<i>Implementation of Internet router controller</i>) • Win logon sistem na bazi smart kartica za zaštićenu kontrolu pristupa radnim stanicama (<i>Smart card based Win logon system for protected access to workstations</i>) • Automatizovani sistem protivgradne zaštite (<i>Authorized system for frosted rain protection</i>) • Laka bespilotna letilica sa pratećom elektronikom (<i>Light pilotless airplane with accompanying electronics</i>) • Mobilna automatizovana platforma za otkrivanje i prostorno mapiranje dejstva jonizujućih izvora zračenja (<i>Mobile automated platform for detection and special mapping of influence of ionized radiation sources</i>) • Razvoj digitalno upravljanih elektronskih automatizovanih sistema za biohemijsku analizu uzoraka krvi (<i>Development of digitally managed electro-automated system for biochemical analysis of blood samples</i>) • Razvoj tehnologije proizvodnje termičkih prekidača (<i>Development of technologies for production of thermo switches</i>) • Razvoj uređaja i metoda za neurorehabilitaciju osoba sa poremećajima senzorno-motornih funkcija (<i>Development of appliances and methods for neurological rehabilitation of people with sensor-motoric functions disorders</i>) • Sistem za kontrolu i upravljanje javnom rasvetom (<i>System for control and management of public lights</i>) • Razvoj kompjuterizovanog mernog sistema za termotehnička ispitivanja parnih turbopostrojenja (<i>Development of computerized measuring system for thermo technical observations of steam turbo systems</i>) • Razvoj, izrada i ispitivanje hardvera i softvera inteligentnih izvora napajanja za primenu u galvanotehnici (<i>Development, production and assessment of hardware and software of intelligent energy sources to be</i>

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	<p><i>applied in galvano-technics</i>)</p> <ul style="list-style-type: none"> • Projektovanje i izrada uređaja za ranu dijagnostiku pigmentnih kožnih tumora i melanoma (<i>Design and development of appliance for early diagnostics of pigmented skin cancers and melanoma</i>)
Telecom	<ul style="list-style-type: none"> • PoC (Push to talk over Cellular) aplikacija za mobilne telefone sledeće generacije (<i>PoC application for next generation of cell phones</i>) • RF i mikrotalasne komponente i antene za bežične računarske mreže i WiFi Internet infrastrukturu (<i>RF and microwave components and antennas for wireless comuter networks and WiFi Internet infrastructures</i>) • Antikolizioni radarski sistem na 24 gigaherca (<i>Anti-collision radar system at 24 GHz</i>) • Bežične senzorske mreže (<i>Wireless sensor networks</i>) • Nova generacija linkova kapaciteta (155Mbit/s) na frekvencijskim opsezima (<i>New generation of links (capacities 155 Mbit/s) in frequencies 4,6,13,15,18,23,26 i 38GHz</i>) 4,6,13,15,18,23,26 i 38GHz • Prognoziranje, planiranje i tarifiranje u telekomunikacionim mrežama (<i>Forcasting, planning and charging in telecom networks</i>) • Razvoj elemenata telekomunikacione mreže nove generacije (<i>Development of new generation telecom networks' elements</i>) • Razvoj i realizacija softvera, hardvera i usluga na bazi softverskog radija za bežične komunikacije (<i>Development and realization of software, hardware and services based on software radio for wireless communications</i>) • Razvoj nove generacije komunikacionih sistema u funkcionalnim mrežama (<i>Development of new generation of communication systems in functional networks</i>) • Razvoj softverske i hardverske podrške za potrebe telekomunikacionih pristupnih mreža (<i>Development of software and hardware support according to the needs of telecommunication access networks</i>) • Razvoj dodatnih servisa u radio komunikacionim mrežama na bazi digitalne obrade signala (<i>Development of additional services in radio communicational networks based on digital signal processing</i>) • Razvoj FM pojačavača i FM predajnika snaga od 1 kW do 10 kW (<i>Development of FM amplifier and FM transmitter of 1kW to 10kW</i>)
Micro electronics	<ul style="list-style-type: none"> • Visokokvalitetni transmiteri pritiska nove generacije (<i>New generation pressure transmitters of high quality</i>) • Projektovanje i izrada debeloslojnih pasivnih mikroelektronskih kola i mreža za rad na visokim učestanostima (<i>Design and production of thick layered passive microelectronic circuits and networks for operation on high frequencies</i>) • Razvoj i industrijska primena novih tehnologija projektovanja integrisanih elektronskih kola i sisteme (<i>Development and industrial application of new technologies of ingeral circuits and systems design</i>) • RAZVOJ NOVIH POLUPROVODNIČKIH MATERIJALA I IZRADA DEBELOSLOJNIH SENZORA (<i>Development of new semiconducting materials and realization of think layered sensors</i>) • Linija za automatizovanu pripremu elektro-kontaktata (<i>Automated line for preparation of electrical contacts</i>)

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Digital libraries and content	<ul style="list-style-type: none"> • Digitalizacija naučne i kulturne baštine (<i>Digitalization of scientific and cultural inheritance</i>)
Expert systems	<ul style="list-style-type: none"> • Web inteligencija i elektronsko učenje (<i>Web intelligence and e-learning</i>) • Sistem za objektivnu procenu kvaliteta artikulacije i njegova primena u korekciji patološkog izgovora (<i>System for objective evaluation of articulation quality and its application correlated to pathological pronunciation</i>)
Internet technologies	<ul style="list-style-type: none"> • Korporativni Web portal za permanentno obrazovanje zaposlenih • ETHERNET 10/100baseTx/1GbE – prenos Ethernet saobraćaja preko SDH optičkih sistema prenosa i fleksibilnih multipleksera IRITEL • Istraživački Web portali
Nano technologies	<ul style="list-style-type: none"> • Mikro i nanosistemske tehnologije, strukture i senzori (<i>Micro and nano system technologies, structures and sensors</i>) • Nova generacija milimetarskih linkova na bazi kompozitnih nanostrukturisanih materijala (<i>New generation of millimeter links based on composite nanostructure material</i>)
Electronics	<ul style="list-style-type: none"> • Razvoj višenamenskog multisenzorskog sistema za kontrolu i nadzor u javnom i privrednom sektoru (<i>Development of multipurpose multisensored system for control and</i>)
GIS	<ul style="list-style-type: none"> • Geografski informacioni sistem za evidenciju, održavanje i analizu elektrodistributivne mreže
Robotics	<ul style="list-style-type: none"> • Sistem za daljinsko upravljanje robotizovanim sistemima putem glasa (<i>System for remote control of robotized systems via voice</i>)