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CROATIAN ICT SKILLS GAP ANALYSIS

Executive Summary

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1. INTRODUCTION

The objective of this study is to develop recommendations based upon the findings and conclusions of a skills gap analysis that can be implemented by key stakeholders to increase the number of graduates in engineering and math and science fields. The increased supply of qualified graduates is essential to support the development and increased productivity of the information and communications technology (ICT) industry and overall economic growth in Croatia.

The study was launched with USAID technical assistance based on indications of a gap existing between the demand for ICT specialists and their availability in the labor market. In recent years, the labor market has experienced several problems with ICT skilled labor, including: finding and employing appropriate ICT skilled workers, their outflow and mobility, and high labor costs and expected benefits for private and public sector employers. These problems present employers with the following challenges:

- Optimal hiring, training, retention, and management of human resources and meeting employees' expectations;
- Effective intellectual property protection;
- Protection of investments in education and training of human resources; and,
- Reduced competitiveness in the domestic and foreign markets (compared to the SEE countries) with the rising costs of skilled ICT workers and their limited availability.

The skills gap is a symptom of the current competitive position of the ICT industry, which has implications for the dynamics of economic growth. Several critical economic issues arise:

- The shortage of qualified ICT professionals limits Croatia's ability to attract new foreign and domestic investment in higher value-added technology industries in which Croatia must compete because of its relatively higher labor cost in the region.
- The relatively weak position of the ICT industry with a small domestic market and limited capability to compete in business process outsourcing (BPO) and information technology outsourcing (ITO) and other export services in international markets, in spite of the presence of the top technology companies, undermines innovation and adoption of higher technologies among all sizes of enterprises and industries.
- The virtuous cycle of economic growth must be stimulated through higher quality and quantity of skilled workers that will attract additional investment and support a knowledge-based economy with higher growth rates.

The following pages highlight the findings, conclusions and recommendations of the study.

2. FINDINGS

Through research, interviews and surveys, the study identified important findings that highlight the skills gap and its implications for ICT and economic performance.

2.1. Availability of Skilled ICT Workers

- Croatia produced 607 engineering graduates among all faculties of engineering in 2005. This output of engineers is low compared to other countries on a per capita and pro-rated GDP comparison. For example, Bulgaria produces 2,637 engineering graduates, more than three times as many graduates per GDP and population compared to Croatia.
- There is no systematic harmonization of educational curricula with the needs of industry and public administration, with a few exceptions of some of the largest companies that do interact with the Faculties of Engineering and Computing. The rigid procedures for changing the curricula are almost entirely left to the initiative of faculty and administrators of higher education institutions.
- There is no systematic dialogue or planning of enrollment (and graduation output) of ICT specialists to match the needs of industry and public administration.
- Over 50% of ICT specialists in the work force only have a high school diploma.
- The data show that 89% of ICT employees are ready to migrate, and one-third of all ICT workers are continuously searching for a better job. There are more than 7,300 CVs of ICT job seekers published on the web portals. These data indicate the ICT workforce is highly transient.
- ICT engineers are the best paid profession in the ICT industry. However, salaries in Zagreb are more than 22% higher than those in other Croatian regions and salaries in telecoms are more than 37% higher than those in government and public administration.

2.2. Calculating the Skills Gap

One estimate of the skills gap is based on EU experience and an accepted EU methodology.¹ Parameters (variables) have been adapted to Croatian conditions, and are estimated based on the Croatian ICT market in Table 1 below.

This method estimates that Croatia is missing about 250 ICT engineering specialists with a university diploma each year. This represents about 42% of the formal educational system's current annual "production of ICT engineers"

This skills gap estimate does not include other ICT industry needs for human resources, including qualified sales specialists for equipment and services, marketing, logistics, customer service, customer care, etc. The skills gap is evident in this estimate and other Eurostat data that indicate a relatively low investment rate in research and development and a low graduation rate of science and math students compared to the EU 25 and EU 15 groups of countries.

¹ Source: *Determining the Future Demand for ICT Skills in Europe*, International Co-operation Europe Ltd, 2001

Table 1: Estimated Skills GAP using EU Guidelines

	2006	Comments
Total Employed (Industries +Government + NGO/PVO)*	1,455,000*	Source: National Statistics Office
Total ICT Jobs	~ 44,000	EU : 3.9 % ICT Jobs/Total Jobs * HR: 3% ICT Jobs/Total Jobs (because of low tech absorption)
Distribution of ICT jobs	22,000 ICT 22.000 Ind&Gov	EU: 44% ICT, 56% Ind&Gov* HR: 50% ICT, 50% Ind&Gov (because of SME majority) 20 k * 0.9 ICT + 9 k * 0.45 Telco)
Estimated Growth p.a.	5 % 2.200 jobs p.a.	EU: 20% (Forcast: for 2001-04)* HR: 5% estimated growth/IT spending Fastest growing demand: -SW Engineers, Analyst, Programmers
Estimated Demand Structure	1.100 (L4) ~ 750 (L5)	HR: Existing structure -cca 50 % High Schools Graduated - cca 34 % Uni Graduated
Estimated Supply from ICT faculties p.a.	500	Faculties in Zagreb, Varaždin, Split and Rijeka
Estimated Balance (% of Supply)	~ 50%	

3. CONCLUSIONS

- The labor market of ICT specialists is functioning and appears to be self-regulating between supply and demand at current levels. The function of employment mediators is filled by job-portals (ICT specialists are among the first to recognize the advantages of the virtual labor market).
- Increases in the demand for ICT specialists result from various factors, including:
 - Increased expenditures of the government in the recent years (e-Croatia projects, pre-accession funds, grants, etc.).
 - New jobs in the next generation telecommunications firms and other foreign investment in the industry.
 - The increased number of foreign companies starting operations in Croatia with high standards of business operations that often require higher skilled professionals.
 - Greater awareness of the possibilities and reasons for applying ICT in business and management processes in Croatian companies, primarily medium and larger firms, and of the decrease of prices of hardware, and better financing terms for equipment.
- There is a disproportional demand for certain skill profiles. In the period between 2001 and 2006, the most sought after skills were ICT infrastructure engineers certified by vendors (estimated by the authors based on the structure of IT expenditures).
- The continuing trend of increased industry and government investments into ICT-knowledge intensive services (application development and implementation),

combined with export jobs (outsourcing), will raise the need for human resources that cover the entire application lifecycle. Increases in both people gap and the skills gap are to be expected because the labor market lacks consultants, designers, analysts, etc.

- Employers try to compensate for the shortage of human resources by investing in human resources (e.g. scholarships, training, further education), by hiring people without university degrees (51% are high school graduates), employing students (e.g. Polaris, SWING and other firms), and recruiting human resources from other companies.
- To date, there have been no documented cases or data of importing labor. The Ministry of Interior does not even have quotas for work permits for foreign ICT specialists. In addition, there is no data on larger outsourced jobs from the SEE or other countries.
- Due to the absence of dialogue and consultation between the ICT industry and government and the educational system, the employers are forced to compensate for the lack of (easily applicable) knowledge and skills of (new) employees by significant investments in education and on-the-job training. Therefore, the actual total amount of investments in education probably exceeds the official 3.7% of GDP. New modalities for financing the educational system (e.g. through public-private partnership models) have to be given serious consideration.
- The cases of cooperation between the educational system and the industry on planning human resources and harmonization and development of new curricula are an exception and not a rule. Regional universities and colleges in Rijeka, Split and Varazdin, and Rijeka show more flexibility and openness to new approaches.
- Tougher ICT market conditions and lack of trust are the primary reasons for the high degree of fragmentation in the industry. Companies do not cooperate formally and informally, and do not cluster into consortia, networks and other forms to achieve economies of scale and innovative solutions by sharing resources and achieving synergy effects. This results in a large number of small ICT companies with an average of 7.6 employees without vertical integration, specialization and diversification. Thus, everybody does everything. Many firms are mostly dependent on one key account, the vendor or revenues generated from equipment sales. These are symptoms of a low innovation, low productivity ICT industry.
- Due to the absence of effective trade and/or professional associations in the Croatian ICT industry, there is no catalyst for a continuous, systematic dialogue and actions to improve the ICT industry.
- An effective industry association could work with:
 - The Government of Croatia to develop a vision and strategy of the ICT industry in Croatia, as a prerequisite for restructuring and supporting ICT growth in the industry and ICT applications across the economy. In the absence of joint efforts to increase value added services to benefit the industry overall, vendors are taking advantage of existing government procurement, which spends approximately 75% of the total IT budget on hardware and licensing rather than on stimulating research and development.
 - The public administration bodies to develop more effective and transparent procurement procedures to encourage the participation of

- small businesses and consortia of enterprises and stimulate innovation and growth of local content.
 - Higher education institutions to increase the output of qualified engineers, math and science graduates and to cooperate on joint commercial and applied R&D projects for development of innovative products and services.
 - Potential investors to attract new investment and create new market opportunities for higher value added services. To date, there has been no significant FDI in the ICT industry, and therefore no new jobs and no technology transfer.
- Clustering of knowledge intensive parts of the ICT industry would create greater value and a quality culture through the implementation of industry standards, such as ISO, CMMI, etc. Such changes would protect the ICT industry from the negative effects of the gray economy and abuses of intellectual property, improve professional and business practices, and create the prerequisites for cooperation with domestic and foreign companies.

4. RECOMMENDATIONS: HOW TO CLOSE THE SKILLS GAP

4.1. Short- and Medium-term Measures

The following short-term and medium-term measures can be implemented to improve the output of ICT qualified graduates and build the necessary partnerships between higher education institutions, the ICT industry and government to improve ICT performance.

4.1.1. Higher Education and Training Institutions

- Increase the output of engineering and math and science graduates by reallocating the budget resources and improving the curriculum to meet industry needs.
- Continually harmonize the curricula and enrollment with the actual needs, achieved through interaction with the industry and the government and cooperation with technology partners.
- Develop e-learning university courses and modernize the resources and capabilities of the universities (primarily invest into curricula and education; infrastructure can be set up through cooperation with all vendors, following the experiences of other countries such as Egypt)
- Create hybrid, flexible educational institutions (3 year programs) through public-private partnerships.
- Improve education using external resources to address financial challenges, improve key skills, such as English language, etc. Study abroad programs in Germany, Italy, and other countries and E-study have been positive experiences in Bulgaria and other SEE countries.
- Develop partnerships with European and American universities that have state-of-the-art programs in engineering, math, and science to train faculty, develop curricula, establish R&D innovation centers, etc.

4.1.2. ICT Industry

- Organize the industry by creating a voluntary, private association of knowledge intensive companies that promotes the interests of the industry and a knowledge-based economy and society. The action agenda would include:
 - Policy advocacy to fully implement intellectual property rights, ready-access of broad band and telecommunications services nationwide, R&D innovation centers, higher internet penetration, and high quality education for qualified math, science and engineering graduates.
 - Education programs in partnership with local and foreign universities, high schools, and training institutes to produce highly qualified ICT human resources by upgrading existing and new programs.
 - Services to members to improve their understanding of international standards and requirements for BPO, ITO and other export services
- Create complementary commercial, politically and technologically independent associations to support clusters, networks, partnerships and consortia with the aim of sharing resources and knowledge and improving ICT industry growth
- Develop linkage programs with the educational system to develop future qualified human resources, including:
 - High school programs that include practical work opportunities, involvement in classes, scholarships along the lines of the Bulgarian experiences
 - College and university programs to develop curricula, form R&D initiatives, utilize private sector expertise in human resource development, etc.

4.1.3. Government

- Create the business environment and the physical, human and enabling infrastructure to encourage investment, research and development initiatives, and higher value-added ICT growth.
- Enforce intellectual property rights and policies that encourage higher productivity, innovation, and research and development.
- Participate in branding and raising the image of Croatia as an ICT/high tech destination, creating a competitive investment climate and promoting investments in the ICT industry.
- Establish transparent procurement procedures that encourage the participation of small businesses through consortia and partnerships to provide ICT services.

4.2 Long-term Vision and Strategy

The long-term prospects for improving industry growth require a vision and strategy managed by a leadership team of representatives from government, industry and higher education. This team should ensure that appropriate resources and actions are implemented through a strategy that integrates the efforts of government, industry, and higher education institutions. Among the actions specifically aimed to close the skills gap to support ICT growth include:

4.2.1 Develop an ICT Strategy for Higher Value-Added Productivity

- Appoint a Working Group to Design an ICT Strategy

- Mobilize resources from industry, government and higher education to implement the strategy

4.2.2 Develop an ICT Human Resources Monitoring Framework (within ICT Strategy)

- Develop Generic Skills Profile and Job Classification System
 - This tool will create greater industry awareness of global ICT requirements for key job and skill areas for which the ICT industry is experiencing skills shortages to guide education budget allocations, curriculum changes, and support for training.
 - Describe jobs, technology areas and tasks, required level of behavioral and technical skills
- Develop Curriculum Development Guidelines
 - Universities and ICT Industry should work together to design and develop programs and courses to match the skills profile and industry needs
- Develop a methodology for better quantification of the human resources required by the industry/industries and economy to guide policies for adapting public and private investments and programs to evolving market changes

In sum, only through a sustained, coordinated effort involving leaders from government, educational institutions, and the ICT industry will Croatia develop the human resources required to improve the ICT industry and support the transformation of Croatia into a knowledge economy.