Croatia and knowledge-based economy: Making a transition

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Abstract

The objective of this paper is to explore the essential nature of knowledge-based economy and to examine the current position of Croatian economy in the process of establishing sufficient conditions for transition to it. Particular attention is given to the production, transmission and transfer of knowledge and information and communication technology (ICT) in Croatia which determine the pace, direction and success of creating a knowledge-based economy. The paper concludes with the policy suggestions how to narrow the gap between Croatia and developed nations relying on the knowledge and ICT as two essential and interrelated core elements of any strategy aiming to build a knowledge-based economy.

Key words: knowledge-based economy, knowledge, information and communication technology, Croatia

1. Introduction

Central and Eastern European countries (CEEC) have been engaged since the late 1980s and early 1990s in the process of transition trying to open and liberalize its economy and society, create macroeconomic stability and develop market mechanisms and institutions in order to converge to the developed economies. At the same time, developed countries have also been engaged in a transition yet of different kind. The pressures of globalization, continuous and rapid advances in science and technology have shifted the weight of production factors' importance from labor and capital (favorized by the neoclassical theories of growth) to the knowledge, information and technology (new endogenous growth theories). Current economic literature is endowed by the arguments that the knowledge has become the main competitive tool for businesses and nations (e.g. Drucker, 1994, Senge, 1990, Lee, 2001). Thus, developed economies themselves are forced to seek new ways to reinvent and transform themselves in order to meet new demands imposed by the forces of technology, globalization and emerging knowledge-based economy. In the light of new revolution and changes that no country is spared from, CEEC are facing a double and parallel challenge - their economic and development policies need to be geared to macroeconomic stabilization and institutional convergence towards market economy while at the same time they need to develop policies oriented towards growth and structural changes based on knowledge, technology and information that the emergence of the global information and knowledge economy placing at the heart of sustainable growth and development.

Croatia as a transitional economy has been well aware of the concept of knowledge-based economy and necessity to shift from traditional resource oriented economy to knowledge-based economy. However, current weaknesses in education system, research and development (R&D) and innovation systems as well as insufficient technological reconstructuring of private and public sector coupled by feeble macroeconomic performance of the national economy indicate that knowledge and information and communication technology (ICT) have been recognized as new drivers of economic growth yet still not exercised as the key priorities of development policies. If the current policies remain only declarative in nature, they are becoming a serious impediment for bridging the gap with the developed countries.

The objective of this paper is to explore the essential nature of knowledge-based economy and to examine the current position of Croatian economy in the process of establishing sufficient conditions for a transition to it. Particular attention is given to the development of knowledge and ICT in Croatia which determine the pace, direction and success of creating a knowledge-based economy. The paper concludes with the policy suggestions how to narrow the gap between Croatia and developed nations relying on the knowledge and ICT as two essential and interrelated core elements of any strategy aiming to build a knowledge-based economy.

2. Knowledge-based economy in the knowledge society: *basic concepts*

Neo-classical models of growth that have been dominating in the economic theory for the last two hundred years recognized only two factors of production, labor and capital. The rapid advances in the science and technology induced new production function features of the 21st century - *knowledge* and its useful application and *ICT* best regarded as the facilitators of knowledge creation in innovative societies (OECD, 1999). These two mutually reinforcing production factors have transformed the majority of wealth-creating work from physically- based to knowledge-based. With increased mobility of information, the global work force, knowledge and expertise that can be transported instantaneously around the world, there is an agreement that we live in the knowledge society with the knowledge economy in which the country development strongly depends upon identifying, valuing, creating and evolving its knowledge and ICT assets.

The transition to the knowledge-based economy and subsequently to the knowledge society is not solely technological issue but development issue with strong economic, social and cultural dimensions. For this reason, there are numerous ways to define the terms knowledge society and the knowledge-based economy, one of the most successful concepts introduced by evolutionary economists (e.g. Foray and Lundvall, 1996, Abramowitz and David, 1996). Narrowly defined, a knowledge-based economy is one in which information and communication technology, other high-tech activities and e-commerce play a leading role (Evers, 2002). Broadly defined, a knowledge-based economy is the one which is directly based on the production, distribution and use of knowledge and information (OECD, 1996). Thus, the knowledge has assumed the leading position as a factor of production leading to the growth of high-tech investments, high-tech industries, more highly skilled labor and the rise of productivity. The largest share of value added in developed economies today does not come from material used or allocating capital in productive uses but from productivity and innovations which are two outcomes of putting the knowledge to work.

Knowledge as the primary factor of production, i.e. major source of productivity today significantly differs from traditional factors such as labor and capital. According to Evers (2002), knowledge is more difficult to measure than any other factor of production because once produced it can easily be reproduced and copied with fairly low transaction costs. Secondly, it is not subjected to the law of diminishing returns but rather to the rising marginal utility whereby for example each additional unit of knowledge produces and utilizes existing knowledge more effectively.

Not only it is specific in its nature, the knowledge itself has various forms recognized as the know-what, know-why, know-how, know-who (OECD, 1996: 12). *Know-what* refers to knowledge about facts and as such is the closest to what is usually called information. For example, how many people live in the city of Barcelona? When the European Union was established? This kind of knowledge is particularly important to the some experts who must handle a lot of facts in order to fulfill their jobs. *Know-why* refers to scientific knowledge of the laws and principles of the nature and as such underlies technological development and product and process advances in most industries. The access to this knowledge, often organized in specialized organizations (e.g. universities, laboratories), firms have to interact with these organization either through recruiting scientifically-trained labor or establishing joint activities with them.

Know-how refers to skills or ability to do something. For example, business people need to use the know-how of their personnel manager when they are selecting and training the staff, or workers need to develop know-how to operate complicated machines. Know-how is typically developed within the individual firm and can be shared and combined with other firms' know-how through organizing industrial networks. *Know-who* refers to information about who knows what, who knows who and the like. In another words, it involves the formation of special social relationships which make it possible to reach experts and use their knowledge. This kind of knowledge is increasingly important for modern managers in order to react quicker to the changes in their business environment.

Furthermore, know-what and know-why are commonly known as codified knowledge because they operate by codifying the meaning of information within a system. Know-how and know-who are classified as uncodified knowledge or tacit knowledge because they are hard to measure and it takes time to be absorbed. In the time when information are becoming easier accessed and less expensive, the tacit knowledge is becoming increasingly important in labor markets since it represent the tool how to manage the content of the codified knowledge.

Knowledge has deeply impact the emergence of the new societal reality. Throughout the history, when the new innovative production factor has been introduced, the society witnessed a change. The agricultural society has been replaced by the industrial society when in the 19th and 20th century labor and capital dominated as key sources of productivity. When the power from rich in capital shifted to the rich in information coupled with fast development and widespread diffusion of ICT in the late 1970s, the information society emerged. In the late 20th and early 21st century, when ICT have not been seen anymore like sole drivers of change but rather a tool for releasing the creative potential and knowledge embodied in people, i.e. human and social capital, the knowledge society ascended.

Often the concept of knowledge society is confused with the information society which Evers (2002) considers to be the result of thinking still colored by the epistemic culture of industrial society. He argues that in a knowledge society, systems are not technology driven but determine by the contents, meaning and the knowledge. In his words *"…it is not the hardware but the software that is the key stone of a knowledge society"* (Evers, 2002: 6). Some commentators[1] have drawn attention to the argument that information society should be regarded as the component of knowledge society since information is one of the components of knowledge. Namely, knowledge society relies on information society for its infrastructure and as such it represents a necessary but not sufficient condition for a knowledge society which requires more than just the active implementation of new technologies.

The characteristics of the knowledge society have been recognized by numerous authors (see Evers, 2002, Drucker, 1994) and there is a general consensus that they include following:

[1] Comments found in European Foundation for the Improvement of Living and Working Conditions (2006): Handbook of Knowledge Society Foresights, http://www.eurofound.europa.eu/publications/htmlfiles/ef0350.htm (Accessed 1.05.2008.)

- higher average standard of education attained by people in the country;
- upward mobility available to everyone through easier acquired formal education;
- increasing number of labor force employed as knowledge workers[2];
- higher competitiveness of not only businesses but other institutions (e.g. government, schools, hospitals) as well;
- older measures of competitiveness (e.g. labor costs, resource endowments, infrastructure) superceded by patents, R&D, Internet use, mobile phone users;
- organizations transformed into intelligent organizations;
- increased organized knowledge accrued in data banks, expert systems, other media;
- triple helix model of government-industry-university indicates a poly-centric production of knowledge
- more effortless travel of knowledge due to modern ICT infrastructure, etc.

Building a knowledge-based society is greatly conditioned by the capacity to produce, transmit and utilize knowledge as well as to use ICT. Therefore, knowing them is prerequisite in this process.

3. Towards knowledge-based economy in Croatia: *education and ICT assessment*

The efforts of a qualitative transition to knowledge-based economy have become common among policy-makers worldwide. For example, the Lisbon European Council (Summit in March 2000) agreed that the strategic challenge of the European Union (EU) is to become the most competitive knowledge-based economy in the world, stating that *"the shift to a digital, knowledge-based economy, prompted by new goods and services, will be a powerful engine for growth, competitiveness and jobs. In addition, it will be capable of improving citizens' quality of life and the environment."*[3]

Since Croatia is investing all its efforts to become a fully-fledged member state of the EU in the near future[4], it becomes increasingly important to establish an unyielding basis for transforming to the knowledge-based economy. Failing to do so could have the adverse impact on the future co-existence with other EU member states which advanced well on the road to the knowledge-based economy. In order to minimize the possible divide in generating and creating knowledge, as well as in its application, digital literacy and Internet access, a special attention should be given to the education and ICT. More precisely, the knowledge needs to be systematically organized and institutionalized as well as applied and ICT further developed and used since their synergy represents a podium on which the knowledge-based economy and society are build on. Following this statement we assess the current state of education and science, as well as ICT in

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[2] Knowledge workers are described as people with considerable technical knowledge and learning. Even if they perform manual work (e.g. computer technicians, manufacturing technologists) it is based on a substantial amount of theoretical knowledge which they gained through formal education (Drucker, 2001).

[3] See the Conclusions of the Lisbon European Council (2000), Presidency at http://www.europarl.eu.int/summits/lis1_en.htm#b (Accessed 1.05.2008.)

[4] Croatia applied for the EU Membership on 21st February 2003, got the positive opinion about the fulfillment of Copenhagen's criteria (avis) on 20th April 2004 and currently holds a status of the candidate country.

Croatia, which provides us with an insight into perspective of achieving the knowledge-based economy. This, however, should be observed in the context of macroeconomic performance of the country since its main features define both the reason and conditions to move towards the knowledge-based economy.

3.1. Macroeconomic profile of Croatia

Croatia is a small open economy with the population of 4.5 million people (Census, 2001), has relatively high educated labor force, gross domestic product (GDP) per capita of 8,452 EUR and the national economy structured similar to other developed market economies. After declaring its independence from ex-Yugoslavia in June 1991, it entered the process of transition aiming to achieve market economy and political democracy. The comprehensive political and economic reforms of the country were additionally lumbered by the Homeland war from 1991 to 1995 which caused serious damages of infrastructure and a decline in the country's economic vitality. Croatia has managed to restore its macroeconomic stability and made significant advances in the structural reforms that make it closer to its goal of developing fully-fledged market economy and becoming a member of the EU.

The analysis of the key macroeconomic indicators (table 1) shows that there has been a considerable progress along the path of achieving the stated goals.

The growth of the economy has been steady for several years with the rate of 4-5% primarily fueled by strong government infrastructural investment and personal consumption. Inflation rate has remained stable and under control of the Croatian National Bank (CNB) since 1993 when Croatia implemented one of the most successful stabilization program in the region. The most challenging problem for Croatian authorities has been a high unemployment rate that had been oscillating at the level of 20% for more than a decade, but in last couple of years it was continuously decreasing reaching the level of 9.6% in 2007. Current account deficit remains Achilles heal of the Croatian economy reflecting poor competitiveness of Croatian products as well the inward orientation of the economy. Even tough the deficit decreased in 2000 to -2.8% of GDP compared to -6.8% in 1998, it has risen to -8.6% in 2000 and remained as high in 2007, calling for actions in rising national competitiveness and promoting export orientation. Public debt of Croatia has been continuously slightly less than 50% of GDP with the lowest percentage of GDP in 2007 accounting for 44.3%. However, the external borrowing is troublesome being accumulated to 87.7% of GDP in 2007. Such public debt, particularly external component of it, has been in the center of the public and scientific debates since experiences across the world have showed that poorly structured debt in terms of maturity, currency or interest rate composition and large and unfunded contigent liabilities have been important factors in inducing and propagating economic crises in many countries throughout history.

Table 1 Selected economic indicators for Croatia (2003-2007)

INDICATORS					
	2003	**2004**	**2005**	**2006**	**2007**
GDP per capita (in EUR)	5,905	6,461	7,038	7,707	8,452
GDP, constant prices, annual percent change	5.3	4.3	4.3	4.8	5.6
Inflation, annual percent change	1.8	2.1	3.3	3.2	2.9
Unemployment (according to ILO definition)	14.3	13.8	12.7	11.2	9.6
Current account balance in percent of GDP	-7.2	-5.0	-6.3	-7.9	-8.6
Public debt in percent of GDP	48.6	48.9	49.2	46.7	44.3
External debt in percent of GDP	75.8	80.0	82.4	85.5	87.8
FDI (in million USD)	1,998.2	949.6	1,467.9	2,737.9	3,625.9

Source: Croatian National Bank

The investment environment in Croatia has been becoming more and more attractive to foreign investors, especially since 1995 when the country achieved political peace and stability. Up till third quartal of 2004 Croatia accumulated the amount of 10,417.1 million USD in the term of foreign direct investment (FDI). More than 70% of FDI has come from the EU member states (which are also its main trading partners), led by traditional Croatian trade partners Austria (27.23%) and Germany (25.8%) followed by the USA (18.7%). The FDI inflows have been showing continuous tendency of growth even tough in a couple of last years there are significant oscillations which point out at great dependency between dynamics of FDI inflows and privatization dynamics, but also at the lack of consistent FDI policy.

Several points summarize the weaknesses of the Croatian economy:

- recorded GDP is not completely sustainable due to its generation through excessive public and personal consumption based on high public and external debt;
- exports are concentrated in highly-subsidized but low value added industries (e.g. shipbuilding, tourism);
- Croatian goods, i.e. exports goods are uncompetitive due to the high prices, wages and production costs;
- competitiveness of domestic companies is limited and the most competition comes from import;
- foreign and domestic investments are not sufficient and not directed towards inducing exports;
- low capacity of using and developing innovations is caused by the low investment rates in R&D by business and public sector;

- education system is sluggish in responding to the challenges of knowledge-based society;
- development of the business sector is hampered by ineffective public administration, overly regulated business and legal environment in which the judicial system suffers from the lack of efficiency and autonomy of the courts;
- number of start-ups with growth potential is rather small and the entrepreneurial level of economic activity has been rather low measured by total entrepreneurial index (TEA)[5] developed by GEM.

Increasing competitiveness of Croatian economy calls for increasing the productivity growth. This in turn requires high-quality investments in both physical and human capital whereby new technologies, new knowledge and innovation become critical elements of improved competitiveness. Therefore, the focus should be directed towards improving the education system in general, i.e. science system in particular to increase competencies of Croatian labor force and the innovation environment, all supported by the modernization and more sophisticated utilization of ICT infrastructure.

3.2. Education in Croatia

Economic development through increased productivity and thereby increased competitiveness in today's highly competitive global economy leans primarily on enriching and expanding the knowledge and information. In such a context, human capital is becoming an irreplaceable variable in the economic development equation and production function. Thus, education system and its institutions take on increased importance in knowledge production and dissemination of it. But, more importantly, they are the most responsible not only to transfer knowledge but to enhance the likelihood that the knowledge is used effectively (Stiglitz, 1998: 5). Thus, the greatest challenge for Croatia is to develop more qualitative educational system that will increase the number of educated workers in Croatia, improve the competencies of Croatian labor force and induce better innovation and improvements in the economy as whole. In order to do so, Croatia recognizes the need to reposition the role of education making it one of the core priorities in its overall development policy. According to the Croatian Academy of Science (HAZU, 2004), the education in Croatia must keep up with the global trends that include following: (i) education must pursue more qualitatively the relevant knowledge that is being constantly changed and adjusted to the achievement in the technology and communication that enables the new modes of knowledge expansions; (ii) education must cease to be a single and rather short part in the people's lives prior to the employment and become a life-long activity that enables people to sustain the knowledge expansion; and (iii) education is equally important for all and everybody should be entitled to be educated even tough the differences will

[5] The TEA index is uniquely created indicator by GEM. GEM is a large multinational project focusing on the collection and analysis of internationally comparable data on entrepreneurship and its impact on economic growth. The TEA index measures a total entrepreneurial activity within a country. It combines the number of persons active in start-up process or managing business not older than 42 months. The identification of those persons is obtained by survey on random sample of at least 2000 adults in country participating in GEM project. More on TEA indexes on the official GEM web site http://www.gemconsortium.org.

appear regarding individual abilities and characteristics of people to absorb knowledge. In that sense, education must not be the criteria for the social separation.

Even tough Croatia has always stressed the importance of education, it has not (yet) translated into viable knowledge-driven economic growth. Drawing on the statistics from the Human Development Report 2007 (table 2), the performance of education sector in Croatia best described in comparison with other CEEC since they all share common experiences of transition which in many cases damaged their education systems, notably by withdrawal of state funding for pre-primary and secondary schooling. Croatia adult literacy rate of 98.1% is slightly lower than in other CEEC but still above the regional average. This implies that improvements could be made. Overall enrolment rates in primary and secondary education are lower in Croatia than in other CEEC, which adversely impacts the educational structure of Croatian population.[6] Furthermore, according to Lowther (2004), one of greatest pitfalls in Croatian education systems can be seen in terms of instructional time per year whereby Croatian students have 50-100% less of mandatory instructional hours than their counterparts in OECD countries.[7] This adversely impacts the skills that Croatian students are obtaining at earlier stages of education and complicates their further educational advancement.[8]

Table 2 Selected education indicators in selected CEEC

COUNTRY	**ADULT LITERACY RATE** *(% AGED 15 AND OLDER) 1995-2005*	**NET PRIMARY EDUCATION RATE** *(%) 2005*	**NET SECONDARY EDUCATION RATE** *(%) 2005*	**TERTIARY STUDENTS IN SCIENCE, ENGINEERING, MANUFACTURING AND CONSTRUCTION** *(% OF TERTIARY STUDENTS) 1999-2005*	**PUBLIC EXPENDITURE ON EDUCATION** *(% OF GDP) 2002-2005*
Croatia	98.1	87	85	24	4.7
Czech Republic	--	92	--	29	4.4
Estonia	99.8	95	91	23	5.3
Hungary	--	89	90	18	5.5
Latvia	99.7	88	--	15	5.3
Poland	--	96	93	20	5.4
Slovakia	--	92	--	26	4.3
Slovenia	99.7	98	94	21	6.0

Source: UNDP, Human Development Report 2007

Note: Data refer to the most recent year available during the period specified

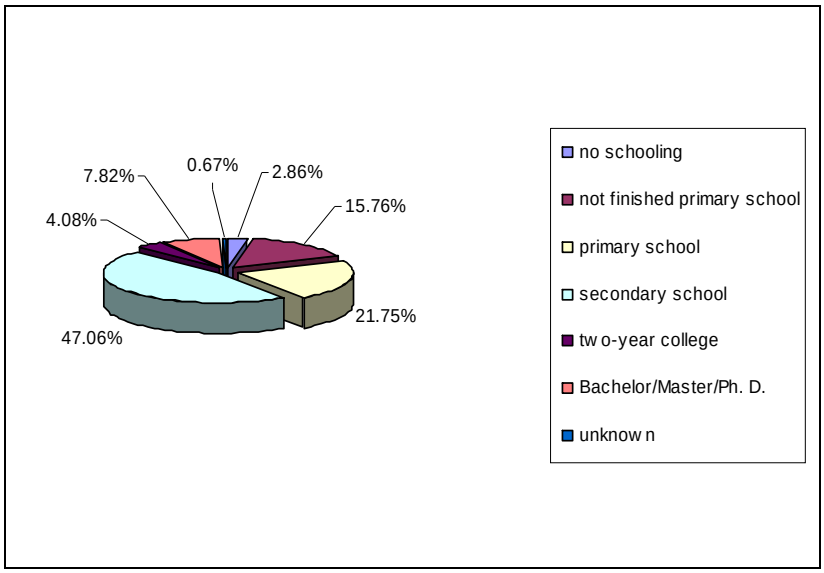
[6] Source: UNDP, Human Development Report 2007

[7] For example, at grade 8 the Croatia students have 814 mandatory instructional hours while the OECD average is 944 hours (Lowther, 2004).

[8] Croatian Academy of Science (2004) complains that primary and secondary education often does not provide students with enough of knowledge and poorly develops the abilities of students to learn and acquire knowledge and working habits. This is resulting in inadequate level of students' knowledge for tertiary education which then forces the higher education programs to be adjusted to the knowledge of students which reduces the level and quality of knowledge obtained at that stage of education thus adversely impacting the economy and society as a whole.

The educational level of Croatian population from age 15 and older, i.e. labor force (figure 1) is below the international average in many respects. Specifically, according to the 2001 census, 2.86 percent of the population has not completed any form of schooling, 15.76 percent has not completed primary schooling, 21.75 percent of the population has only primary schooling, and 47.06 percent of the total population holds some form of secondary school education. Meanwhile, 4.08 percent of the population has completed two-year college programs, 7.82 percent of the population holds Bachelor/Master/Ph.D. degrees, while the level of education for 0.67 percent of the population is unknown.

Figure 1 Percentage of the population over the age of 15 according to the level of education completed



Source: Central Bureau of Statistics, Population Census (2001)

Unfortunately, only 7% of population has higher education degree while that number is slightly higher when considering active labor force (from 25 to 64 years old) where they account for 15.9% which is still lower than in the EU with 21.6% (Jerolimov, 2004). According to Survey on Croatian managers (see Lowther, 2004), Croatian workers show good performance in terms of reading, writing and communication skills as well as in problem solving situations. However, they show weaknesses in teamwork, capacity for self-management and analytical skills, as well as computer literacy particularly when it comes to lower skilled workers. Since most of the skills[9] required

[9] Countries of EU recognize following competencies as necessary to develop knowledge-based economy: functional literacy, numerical literacy, ICT competencies, foreign languages, entrepreneurship, mathematics and natural sciences, interpersonal and social competencies, to learn how to learn, general knowledge and culture (recognition and use of their achievements). More in European Commission, Directorate-General for Education and Culture, Follow-up of the «Report on the concrete future objectives of the education and training systems»: Draft Interim Report: Working group B on Basic skills, foreign languages, entrepreneurship Objectives 1.2 (Developing the skills for the knowledge society), 3.2

by the knowledge based economy are generated in the tertiary education, this means that Croatia significantly lacks knowledge workers.

The total public expenditure on education recorded is 4.7% of GDP which is lower in comparison to other CEEC (table 2). Major complaints refer to continuous under-funding, lack of equity and transparency in budgetary allocation, unbalanced structure if the education budget in terms of categories of expenditure and source funds. This also reflects on physical equipment insufficiency (e.g. lack of enough computer labs, Internet access, multimedia potential for lectures and other educational necessities) necessary to suite the needs of modern education as well as it limits the human capital advancement (e.g. expanding teaching staff, financing professional advancement of teaching staff, etc.).

When it comes to the concept of lifelong learning, Croatia is showing feeble results. According to the joint research[10] on Croatian workers competitiveness conducted by the United States Agency for International Development (USAID) and Institute for Public Finance in Croatia, Croatian workers are inflexible, computer illiterate and with the poor knowledge of foreign languages which is attributed to the fact that Croatian workers are not life-long learners. The most penitent data is that 46.6% of total surveyed enterprises in 2002 did not additionally educated a single employee. The goal of the EU is to include 12.5% of labor force by 2010 in the life-long learning. Currently, 2.3% of labor force is involved in the life-long learning but the percentage is inadequate if Croatian enterprises want to increase the knowledge and skills of their employees in order to easier meet the demands of new technologies, increase their productivity and become more competitive.[11] The organization of the life-long learning system has started in Croatia by preparing the Strategy for adult education and the Law on adult education. However, it is still a long way to reach the European goal particularly when recent researches show (e.g. Poloski Vokić and Grizelj, 2007) that Croatian organizations have improved their training and development practices during the last five years, but that training and development activities are still not perceived as strategically relevant. Both theoretical conclusions and empirical findings suggest that Croatian organizations should invest more in training and development of their employees, not only in order to be successful on domestic market, but to achieve competitive advantages needed for success on increasingly integrated European and world market.

(Developing the spirit of enterprise), and 3.3 (Improving foreign language learning), Brussels (DG EAC/A-1/TS D(2002)), 2003

[10] Source of data: «Losiji, Losiji» (*eng.* Worse, worse), Banka, no. 7, Zagreb, July 2004, p. 8

[11] Source of data:http://www.entereurope.hr/cpage.aspx?page=clanci.aspx&pageID=171&clanakID=1007 (Accessed 13.05.2008.)

3.3. Higher education and R&D

Particularly important aspect of education for the future knowledge-based economy is strengthening the science system, i.e. institutions of higher education and R&D. The prime contributions of the science system (OECD, 1996: 21-26) are known as:

- *knowledge production* which refers to developing and providing new knowledge (generally termed as science) as opposing to the knowledge generated by more applied or commercial research which is closer to market and technology end of spectrum.
- *knowledge transmission* which refers to educating and developing human resources. This implies preparing young people to assume leadership roles in their societies by equipping them with relevant knowledge and skills, i.e. to expand the stock of individuals that embody the accumulated knowledge responsive to the new demands of the contemporary working place. Furthermore, it involves educating and training future researches for their professional advancement in the area if science and technology.
- *knowledge transfer* which refers to disseminating knowledge and increasing the innovations which particularly implies developing collaborations between university and industry in order to develop relevant scientific knowledge and put it in the concrete use.

Croatia recognizes the benefits of higher education in three different yet very interrelated contexts. First, the contribution of higher education to the creation of knowledge-based economy and economic development comes from the traditional role of university to create knowledge and transfer it to future generations thus expanding and improving the labor force in general. Second, education is recognized as the key determinant of the economic growth[12] and there is no doubt that without competencies and skills provided by the higher education the economic development comes into jeopardy. Third, the higher education is considered to have a significant power in creating a modern society since it creates experts in various fields, induces and promotes critical thinking and expands knowledge and understanding all of which is contributing to establishment and creation of values attached to democratic and civil society that Croatia is trying to achieve.

Higher education institutions in Croatia are defined by the Act as universities (sveučilište), whose constituent parts can be faculties (fakultet), art academies (umjetničke akademije) and departments (odjel or odsjek); polytechnics (veleučiliste) and schools of professional higher education (visoke skole). There are currently 7 public universities in Croatia (in Dubrovnik, Osijek, Pula, Rijeka, Split, Zadar, and Zagreb), 12 public and 1 private polytechnics, and 21 schools of professional higher education (of which 4 are public and 17 private).[13] The most important development in the last two

[12] An interesting study that Hall (2002) draws upon in his paper states that an additional year of education for a country's population is associated with an increase in output per capita by 4 to 7%.

[13] There are two types of study programmes in Croatia: university (ISCED 5A and 6, called "sveučilišni studiji") and professional (ISCED 5B, called "stručni studiji"). Universities can offer both university and professional study programmes, while polytechnics and schools of professional higher education can only

years is the adoption of a policy of polycentric development of higher education, especially the development of professional studies in smaller urban areas. The aim is to increase the availability of higher education that is adapted to regional needs and particularities and to increase the number of persons with higher education in the general population. Since 2005, five public polytechnics (in Vukovar, Knin, Gospic, Sibenik, and Slavonski Brod), one university (in Pula), and four private schools of professional higher education have been founded.

Taking into consideration that Croatia has approximately 4.5 million people (Census, 2001) it means that it is in line with the European average of one university to 800,000 to 1 million inhabitants. Compared to countries in the region (table 5), particularly the Central and Eastern European Countries as EU member states such as Czech Republic, Slovenia, Slovakia, Poland and Hungary, Croatia does not differ in terms of number of students and teaching staff, number of universities and other higher education institutions. The number of students studying at higher education institutions in Croatia at the beginning of 2006 was around 160,000, of which there were around 110,000 studying at university studies, and 50,000 studying at professional studies (70:30 ratio). There were 13,000 students (8% of the total number of students) enrolled in private higher education institutions, and around 16,000 (10%) enrolled in polytechnics. The rest (131,000 or 82%) were enrolled at universities. Of all university students, 21,000 were studying at professional studies (12% of all students in Croatia), and 110,000 were studying at university studies.[14]

Table 3 Statistical information on higher education in selected countries of Central and Eastern Europe (2004-2005)

COUNTRY	**NUMBER OF STUDENTS (%)**		**NUMBER OF HIGHER EDUCATION INSTITUTIONS (%)**		**NUMBER OF STUDENTS PER 100,000 INHABITANTS**	**RATIO STUDENT/ TEACHING STAFF**
	Public	Private	Public	Private		
Czech Rep	93.8	6.2	40.3	59.7	2,923	20.4
Croatia	96.9	3.1	83.7	16.3	3,632	24.0
Hungary	86.3	13.7	45.0	55.0	4,166	17.7
Poland	69.7	30.3	29.5	70.5	5,023	21.6
Slovakia	97.9	2.1	85.2	14.8	3,058	13.1
Slovenia	85.2	14.8	67.0	31	5,618	19.6

Source: European Centre For Higher Education (2008)

As already mentioned, Croatia is at the lower end of the European qualifications scale with only 7% of higher educated working population, i.e. 15.9% if the active labor force (from 25 to 64 years old) is considered. Higher education in Croatia has been also

offer professional programs. Croatia aims to establish a binary system, in which universities will offer only university programs and polytechnics only professional programs.

[14] Source of data: Background information on the Croatian Higher Education System http://www.ond.vlaanderen.be/hogeronderwijs/bologna/links/National-reports-2007/National_Report_Croatia2007.pdf (Accessed 20.05.2008.)

showing internal inefficacy in terms of too long period of completing the tertiary education, often double than foreseen study time. According to Jerolimov (2004) only 20-25% of enrolled students graduate on time and 60% never complete their undergraduate study. Part of the reason are unfavorable living and working conditions in Croatia and low motivation of students due to the uncertainty of getting employment after finishing their studies. The enrollment policy has not been adjusted to the capacities of the economy in the sense that the rate of unemployment for particular profession has not been considered. Even tough the highest rate of unemployment are professions related to the social-humanistic sciences, still there is a significant increase in social-humanistic sciences within last decade, from 45.6% to 62.5% (Jerolimov, 2004).

The qualitative aspect of higher education in Croatia also represents the source of the problem. Even tough Croatia has been committed to the Bologne process[15] of adjusting its educational system to the EU standards, the changes have not yet come into practical life. Curriculum is still theory-based, lectures are dominant teaching style while the learning style of students is more oriented toward memorization of facts rather than to development of skills for solving problems and critical thinking (Lowther, 2004). They are less exposed to innovative and modern ways of learning that ICT enables today, for example distance learning, video conferences, etc. Croatian students tend to be quite educated because they possess the extensive knowledge, yet they lack skills how to put that knowledge in practical use. Surely, one of the problems that may be the most worrisome in this new global era is the fact that vast number of students does not tend to consider learning as a process and lifelong activity but rather an activity confined to their formal education period. Introducing the Bologne process and entering the European education area means that Croatia is committed to the idea of improving its higher education system that will make its students more quickly and better prepared for the practical business and social activities as well as make them more capable of successful adjustment to new technologies.

Croatia invests approximately 1.22% of GDP into the higher education and science (R&D) compared to 3.86% in Finland, the EU country that Croatia often uses as a benchmark.[16] Due to the importance of higher education for the competitiveness improvement of Croatia, there should be increase and redistribution of public expenditure on this sector. For example, the public expenditure for enterprises is 5% of GDP in 2003 was five times greater than the EU norm (NCC, 2003). Thus, the means from the budget could be redirected towards education to increase the number and the quality of labor force that in turn becomes better and more productive human capital input. Also, more sufficient financing of higher education could enable the overall equality in obtaining education in general and tertiary education in particular since the knowledge-based economy and knowledge society calls for greater number of highly qualified population.

[15] The Bologne declaration is a joint declaration of the European ministers of education signed in Bologne on 19th June 1999 with the purpose to harmonize the European higher education system.

[16] Source of data: Strateski okvir za razvoj znanosti do 2010 (*eng.* Strategic framework for science development by 2010), available at http://public.mzos.hr/fgs.axd?id=12628 (Accessed 1.06.2008)

R&D in Croatia requires particular attention since innovations are among the most significant drivers of the economic growth and development. Croatia is a small country with rather limited resources to make major breakthroughs in technology. However, it faces a challenge to develop and commercialize fundamental research, i.e. technological advances devised elsewhere as well as to invest time, effort and money into dissemination of worldwide best practices into the whole economy.

According to the Eurostat (2006) Croatia invested 0.87% of GDP in 2006 into R&D compared to the 1.84% in EU 27 and 2.61 in the USA. The majority of investments are oriented towards the natural sciences (40%), technical sciences (22%) and social sciences (14.8%). R&D is mostly financed by the government (55.8%) followed by the industry (34.6%) and from abroad (2.6%). This is a reverse situation than in the case of EU where more than 55% of investments come from the industry sector. In 2004, R&D in Croatia employed 13,139 researchers (mainly or partly employed) out of which 9.3% are working in the business enterprise sector, 35.93% in government sector and 54.72% in the higher education. There is only 0.06% of the total number of students in tertiary programs which leads to an advanced research qualification (ISCED level 6), in the educational fields Science, Mathematics and Computing and Engineering, Manufacturing and Construction which forms the base for the R%D sector development. In this case, Croatia is far behind the EU countries (e.g. Finland 1.33%, Sweden 0.87%, Czech Republic 0.79%, Switzerland 0.73%, Estonia 0.39%).[17]

Patents, representing the practical application of specific ideas, have been generally assumed as a good indicator of knowledge creation and commercialization within R&D framework. In the period from 1992 to 2004, Croatia accumulated 11,222 patent applications out of which 4,270 are resident patents and 6,952 are non-residents (HGK, 2005) while granted patents amount to 1,754 out of which 392 are resident and 1.362 are non-resident ones. Discrepancies in numbers of resident and non-resident patents reveal that Croatia should increase the efforts to improve the quality of science, and education in general, so that it makes up for the domestic inefficiency in the process of knowledge formation/or commercialization.

Lastly, even tough not the least significant issue is a state of the knowledge transmission. The role of research cooperation between industry and academic institutions has received increased attention in recent years as the existence of numerous empirical studies is showing (e.g. Adams et al, 2001, Hall et al, 2001, Lee, 2000, Svarc et al., 1996). Croatia has been trying to improve industry-science relationship but the relationship still remains fairly symbolic. A study conducted by Radas (2003) of Croatian firm's perspective on collaboration with science has showed that firms who consider access to new technologies and processes have a need to collaborate with academics, as well as firms who need to resolve concrete problems. However, more firms collaborate with foreign research institutions and consultants. This is greatly due to the inability of Croatian academics to provide solutions to problems that would have real commercial impact either due to the lack of equipment for academics, the lack of relevant knowledge and information about the most research in that area and the like.

[17] Only Malta and Iceland are behind Croatia in terms of doctorate students in science fields, with 0,02% and 0,1% respectively.

Croatian industry sector often complains that the qualifications of students for the practical work are often not adequate for employment. However, the impact of industry on building the curriculum that would produce labor force able to meet the standards required by the industry is often impossible due to the universities' skepticism. Namely, the university considers that theory-based, i.e. scientific education is more important than pragmatic needs which if enforced reduce the quality of higher education. The practical needs should be at the center of vocational education. Teaching staff is often opposed to the idea of curriculum adjusted to the practice being afraid that they alone would not meet the quality criteria of such curriculum. The importance of scientific knowledge obtained through higher education should not be diminished, yet the know-how should be incorporated in the existing curriculum. This requires a significant increase in the teaching capacity and adjusting teaching and learning methods to the contemporary business and global needs.

3.4. ICT in Croatia

The emergence of globalization has led to increasing the importance of ICT in economies and societies worldwide. Even tough the digital divide between the countries has been evident, it is unquestionable that all countries are recognizing that ICT, particularly Internet, are becoming the major industry and basic infrastructure for sustainable growth and development. The presence of ICT has been introducing great shifts in the economy and society as a whole such as:

- strengthening civil societies by providing a medium that bypasses communicative barriers of time and space enabling easier access to information which in turns results in increased level of democracy;
- increasing trade agreements among countries by increasing profit margins of enterprises, speeding up transactions and providing new transaction vehicle;
- reducing transaction and operating costs in market relationships on a micro level, leading to increase in overall profits for enterprises;
- increasing importance of services and lowering the value of manufacturing goods with the respect to information and knowledge-based goods;
- altering international demand for labor by shifting the weight of importance from factory workers to knowledge workers (e.g. software developers, system integrators, etc.) (USAID, 2000).

Croatia does recognize that creating knowledge-based economy and increasing its competitiveness in the global context requires well-developed and broadly utilized ICT infrastructure. This is proved by the Croatian Parliament adoption of a strategy in January 2002 entitled *"Information and Communication Technology - Croatia in 21st Century"* and endorsement of the *"General Measures for the Development of the Information Society"*. Also, the program of Croatian government for 2002-2007 has included the *E-Croatia 2007 Program* on the top of its development priorities.[18]

[18] Details about mentioned programs are available on the official site of the Government of the Republic of Croatia at www.vlada.hr

The statistics[19] on ICT industry[20] in Croatia reveal the increasing importance of ICT sector in Croatia but also to the fact that the potential that Croatia has in terms of people and infrastructure to support ICT development has not been fully utilized yet. The development of the ICT sector that has started in early 1960s has been developing progressively by the Homeland war of 1991-1995 when it experienced the slowdown and has been assumed in 1995 as the war has ended. In 2004, Croatian ICT industry recorded 1,415 enterprises and 23,763 employees and achieved the turnover of approximately 4,8 billion USD, value-added of 1,8 billion USD while the export reached 660 million USD. Out of the total number of enterprises, 1,274 enterprises belong to the sector of IT industry and employ 9,303 employees, while the rest of 141 are involved in the telecommunication sector with 14.460 employees. A share of IT sector in the total revenue of the ICT industry was 32% while telecommunication contributed with 68%. When it comes to value-added, a difference between these two sectors has been even more emphasized, i.e. 83.2% by ICT industry and 16.8% by IT. Total revenue of the Croatian ICT industry has been increasing in the period from 1999 to 2004 by the compounded annual growth rate of 18.4% (compared to the 11.9% of the national economy) while the number of employees was growing by 3.4% (compared to 2.5% of increase in the total number of employed in the country).

The most of the ICT companies are small enterprises with 9 and less employees (80.2%) with the 14.3% share of employment and 7.2% of ICT segment revenue. The largest companies (i.e. those employing 100-200 employees) accounted to 1.2% of all enterprises with the employment share of 56% and 69.3% of the total revenue.

When looking into qualitative data on these companies, it can be noticed that the majority of the companies are oriented towards the equipment distribution and personal computer (PC) assembling (36.7% of all ICT enterprises) and less towards software manufacturing (3.8% of all ICT enterprises). This implies passivity of the ICT sector in the sense of being behind the high potential gains that ICT sector is offering but which come more from software development than equipment and hardware distribution and PC assembly. According to the USAID (2000), foreign companies in Croatia employ significant number of people for software development which demonstrates that the potential among Croatian force exists, i.e. supply but that the demand is quite limited primarily due to the small and purchasing power weak domestic market.

The role of the ICT industry in the national economy (table 4) is relatively weak compared to the developed Western countries (for comparison see Eurostat, 2008). In 2004, ICT companies accounted for 2.1% of all enterprises in Croatia, generated 57% of total national revenue and contributed with 9.0% in the total value-added of the Croatian enterprises. The ICT export participated with 2.4% in the total national export. Employed by the ICT sector accounted for 2.9% in the total number of employed in the country.

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[19] Source of data: Hrvatska udruga poslodavaca – Udruga informatičke i komunikacijske djelatnosti: Analiza hrvatske industrije 1999-2004 (*eng.* Analysis of Croatian ICT industry), IDC Adriatics, Travanj 2006

[20] The Croatian ICT industry is divided into eight separated categories (segments) according to the activities they deal with: IT channels, IT hardware, Software, IT services, Carrier services, Manufacturers of telecommunication equipment, Telecommunication channels and Telecommunication support services.

Table 4 Shares of the ICT industry (%) in the national economy (2004)

	IT SECTOR	TELECOM SECTOR	TOTAL ICT
Number of enterprises	1,9	0,2	2,1
Number of employed	1,1	1,8	2,9
Revenue	1,8	3,9	5,7
Value-added	1,5	7,5	9,0
Export	0,7	1,7	2,4
Import	2,8	1,9	4,7

Source: IDC Adriatics, 2006

Compared to the EU countries, Croatian ICT industry is lagging behind in terms of the number of enterprises and the number of employees in this sector. However, the average revenue per ICT company is in line with the European average (table 5).

Table 5 Indicators of ICT industry development in Croatia and EU (2003)

	CROATIA	EU 15	EU 6
Number of ICT enterprises (per 1,000 people)	0,3	1,5	1,5
Number of employed in ICT industry (per 1,000 people)	5,3	13,0	10,6
Average revenue per ICT enterprise (mil EUR)	2,3	2,9	0,9

Source: Eurostat

In the information era, the number of PCs and Internet use are of significant importance particularly when considering efforts of creating knowledge based economy that relies on those amenities. Compared to other CEEC (table 5), Croatia does not significantly differ in terms of number of PC users and Internet users and the ICT expenditure as a percentage of GDP. The number of PCs per 1,000 people has significantly increased in the period from 1999 to 2004, from 67.0 to 190 respectively (World Bank, 2006). It has been estimated that only 15% of households have PC primarily due to the low purchasing power of the people whose household incomes are spent more on obtaining basic necessities than to procure ICT equipment (USAID, 2000).

Table 6 Selected indicators of the Information age (2004)

COUNTRY	PC PER 1,000 PEOPLE	INTERNET USERS PER 1,000 PEOPLE	ICT EXPENDITURES AS % OF GDP
Croatia	190	293	--
Czech Republic	240	470	6.0
Estonia	921	497	--
Hungary	146	267	5.9
Latvia	217	350	--
Poland	193	236	4.3
Slovakia	296	423	5.0
Slovenia	353	476	--

Source: World Development Indicators 2006

Internet use in Croatia has also showed a significant increase from 200,000 users in 1999 to 1,318,000 in 2004 (World Bank, 2006). According to the market research conducted by the GFK center in 2007, 50% of all Croatian citizens have the ensured access to Internet, the actual use is approximately 38%. Compared internationally, the Internet penetration rate in Croatia is currently 35.3% which is in line with those found in the Eastern Countries of the EU.[21] The Internet is mostly used for communication (67%), searching (65%) and daily informing (53%). Even tough the Internet is increasingly used in Croatia, a vast forms of Internet usage have not been yet fully utilized (e.g. payments, administration, shopping, etc.) since they do not depend solely upon the individual but they depend to a large degree upon state and other businesses (primarily in the sphere of services) which are still not organized in adequate way or not organized simple enough. Lately, Croatian government has been more aggressively promoting the on-line business and operation through the program called *e-Croatia* which is modeled upon the project e-Europe. The basic goals which are to be achieved are: (i) offering public services via Internet (e.g. e-administration, e-health, e-justice, e-culture); (ii) creating dynamic environment of e-business; (iii) increasing the accessibility to broadband internet and (iv) enabling safe and stabile information infrastructure.[22] The implementation of the e-Croatia Program is planned on an annual level within the operative implementation plans, and the implementation of activities within the e-Croatia Program are also located in other strategic documents of the Government of the Republic of Croatia such as: *Reform strategy of the State Administration for the period of 2008 – 2011, Strategy of developing electronic business activities in the Republic of Croatia for the period of 2007 – 2010, Strategy of developing Broadband Internet access in the Republic of Croatia by the year 2008, National program against corruption 2006 – 2008,* etc.

[21] The penetration rate for all Europe countries has been 41.7%, EU-27 54.2% and world 21%. For more details see Internet World Stat at http://www.internetworldstats.com

[22] Detailed information and data regarding the e-Croatia Programme can be obtained from the Central State of Administrative Office for e-Croatia at the web site http://e-hrvatska.hr

There are number of existing conditions that make the future of the ICT sector development in Croatia a promising one - good physical infrastructure that is supporting high-speed networking, well-educated labor force with the potential for excellent ICT skills and increasing trend of PC and Internet users. However, latent problems to wider spread of ICT or significant application of it are primarily caused with feeble macroeconomic performance of the country primarily affecting the purchasing power of the people and the legal, regulatory and institutional framework that is not conducive to modern technology development. Croatia has been increasing the use of ICT, but more in terms of technical convenience (e.g. communication via e-mail) than in terms of being a tool to release a creative potential and knowledge embedded in people.

5. Concluding remarks: *policy implications*

The global transition to a new age defined by global competition, rampant changes of information and communication, increasing business complexity and pervasive globalization is a contemporary global process that leaves no country immune to its impact. Building an information and knowledge-based society is greatly conditioned by the capacity to produce and utilize knowledge as well as to use ICT as the infrastructure of the modern and sustainable growth and development.

Croatia recognizes the importance of knowledge and ICT as the key strategic factors in creating knowledge-based economy. The real basis of the Croatian competitiveness in the 21st century based upon these two amenities is development of the human capital which is able to use the knowledge and information in successfully managing tangible, intangible and virtual parts of the new modern era. In order to do so, promotion of education, particularly higher education is at heart of development policy of the country. Increasing the number and quality of higher educated people ensures development of knowledge workers that are able to understand the world around them and to act upon it in the efficient and productive manners. Furthermore, knowledge workers and educated people in general will be able to utilize more of ICT in terms of producing knowledge-products that have higher level of value-added than traditional production outputs.

The policy actions to facilitate the transition from resource-based to knowledge-based economy and thus to enrich the inherited comparative advantages of Croatia with competitive advantages in terms of educated, creative and skillful human capital should focus on following:

- ***improvement of the knowledge transmission:***

Education should be recognized as a lifelong activity and extended to as much people as possible in order to create a critical mass of well educated people who are able to understand and capitalize on the opportunities continuously emerging from the global and dynamic business environment. The basic education should be improved since skills, knowledge, ability to learn and working habits determine the quality of students as inputs into later phases of education. Particular attention should be given to reforming system of higher education. Curriculum should continue to support acquiring the scientific, theory-based knowledge while integrating at the same time practical knowledge (know-how) so that students can assume better and faster their positions in

the business environment. New methods of teaching and learning should be introduced in order to create people able to implement knowledge in a more productive way. This further implies developing entrepreneurial skills in individuals to be able to make jobs as well as to take jobs. Increasing the computer literacy should be on the top of priorities since it represents the basic skill in the information and knowledge-based society. The qualitative reform of higher education should be followed by re-defining the model of financing education since current public expenditure on the sector are neither sufficient for the support of the existing system nor for its expansion. Redistribution of the state budget in favor of education should improve the physical and human capacity through improving the working and studying conditions that should positively affect both internal and external efficacy of the students and academics.

- **improvement in knowledge production:**

Improving the innovation environment of Croatia requires a development and strengthening of the institutional technological infrastructure accompanied by the adequate financial support which enables capitalization of the knowledge. They are the key elements of the inducing and supporting domestic innovative creativity thus accelerating economic growth and development. Institutions of higher education should be financially encourage to conduct basic and applied research, i.e. enable them to have a continuum of technological activities that range from long-term basic research to immediate applications. From the macroeconomic point of view, the government should support the acquiring of knowledge from abroad by open trade regime, encouragement of foreign investments and technological licensing.

- **improvement of knowledge transfer:**

The cooperation between institutions of higher education and industry should be significantly increased from the current symbolic status. Upgrading the working conditions of academics in terms of enabling them all necessary equipment as well as resources for their professional advancement is the way of increasing the quality and credibility of their research and promoting them as relevant and useful technical assistance providers to the business and industry to solve concrete business problems. Higher education institutions do not involve solely the role of technology transfer, but they can play a key factor in economic analysis and policy development for their communities and regions. Their economic research and analysis can help government, economic development agencies and other institutions when formulating economic development plans and policies. Furthermore, they can help various organizations to engage in strategic planning, assist organizations to develop analytical skills to participate more effectively in the economic and social development of the country.

- **improvement of the existing information infrastructure:**

ICT applications, to a big degree, are still in their nascent phase. The connectivity should be increased so that the critical mass can be developed for more common uses of ICT. Legal, regulatory and institutional barriers to faster ICT sector development should be removed and the improvement of the general business environment is the major factor that will positively impact the development of the telecommunication services. More affordable and widespread availability of telecommunications sector would

increase the utilization of ICT which would in turn push the growth of the Croatian economy. The shift of using ICT for primarily word processing and e-mail communications to more productive way such as using distance learning, telemedicine, electronic marketplaces and other activities related to the ICT sector, such as software production.

Knowledge-based economy and society is certainly achievable strategic goal for Croatia because the country has both human and infrastructure potential to support it. However, in order to do so, a joint effort of government, business, education and the society as a whole is required to produce, disseminate and transfer knowledge as well as to use ICT to mitigate the disadvantages of being a small country with limited resources. If Croatian declared recognition of knowledge and ICT as two key important cornerstones of the economic development starts to live in the practice and 'being educated' becomes a high scaled social value, Croatia could narrow the existing knowledge gap and enter the new global era with competencies and confidence.

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