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# Innovation and Skills in the Western Balkans:
## A Comparative Analysis of Croatian and Serbian Policies

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## 1. INTRODUCTION

After a decade of isolation and declining economic fortunes, the Western Balkan countries have in recent years experienced renewed economic growth. Transitional reforms have been introduced and the institutional framework has reached levels similar to advanced transition countries. Reforms to the investment climate have opened up a level playing field for small and medium sized enterprises which have come to play an important role as drivers of growth in the region. Foreign direct investment inflows have begun to increase significantly. Additionally, the integration of the banking systems into global capital markets through takeovers and acquisitions has released capital constraints and led to sharply lower interest rates on business credit. All of this has led to significant economic restructuring, as old industries have declined and new sectors and industries have begun to emerge.

Yet this positive outlook is clouded by the continuing difficulties in raising the competitive level of the economies and weak export performance. Behind all this, one of the main constraints to growth is now the supply of skilled labour to meet the demands of new foreign investment and the new technology which it brings, and the lack of innovative capacity within domestic companies which hinders their effective engagement with foreign-owned companies and with new export market opportunities in the EU. Weak and unreformed education systems and sclerotic national innovation systems have emerged as major constraints on growth. In response, governments in

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the region are introducing new policies to build domestic competitiveness, raise the skills of the workforce, and provide incentives to boost innovation and knowledge transfer.

In advanced OECD economies innovation and knowledge transfer has brought about a general 'upskilling' of the workforce (Machin and Van Reenen, 1998; Berman et al., 1994). The introduction of new technologies has led to an upward shift in the demand for skilled labour, a widening skill wage differential, and an increased share of skilled employees. This effect has become known as 'skill-biased technical change'. A major cause has been the advent of globalisation. Countries with comparative advantage in skilled labour have specialised in goods with high skill content, raising the demand for labour and the wages of skilled workers. The transition countries might join the group of upskilling countries, or the group of less developed countries specialising in low-skill sectors. Transition countries may therefore follow two feasible paths: a high technology path and a low technology path. Along the first path, favourable initial conditions followed by speedy restructuring, combined with preservation and growth of human capital, can lead to a rapid recovery and growth catch-up with the EU average. The second path is characterised by unfavourable initial conditions and political instability, leading to a slow pace of transition and restructuring. Along this path, transitional recession characterised by deindustrialisation and mass unemployment is prolonged, leading to deskilling and the loss of human capital.

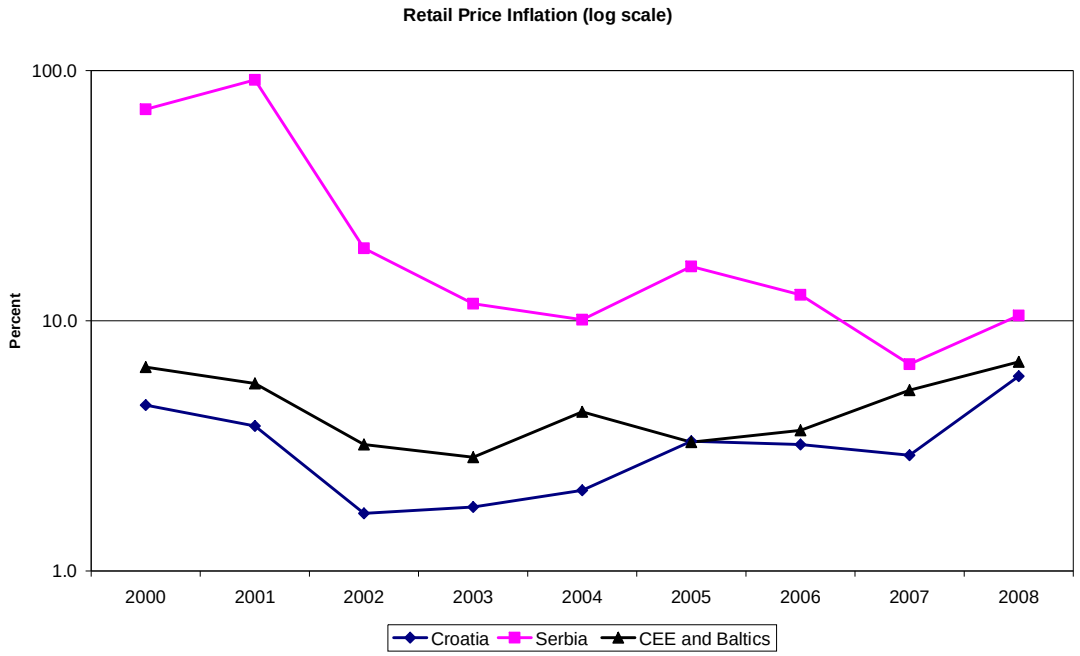
In this paper we compare the patterns of transition, and the consequences for innovation and skills, in the two largest countries in the region: Croatia and Serbia. The paper begins with an overview of the reform process and recent economic growth experience in the two countries, and identifies the weaknesses in innovation and skills as one of the major constraints on competitiveness and growth (section 2). Recent reforms of the national innovation system in Croatia and Serbia, aimed at improving incentives for developing a knowledge-based economy (section 3), and to reform the education systems to develop high skill labour forces, are also discussed (section 4). The paper concludes with an evaluation of the policy regimes in the two countries and suggests what can be learned for the future, including the potential for policy transfer and mutual policy learning.

## 2. PATTERNS OF TRANSITION IN CROATIA AND SERBIA

Croatia and Serbia started the transition to market economy while still part of SFR Yugoslavia, during the last Yugoslav government's programme of economic reforms implemented in 1988-91. Whereas at that time there were major differences between the two republics regarding the level of development, industrial structure, unemployment rates and degrees of openness, the institutional setting was very similar. In 1989, both republics had a dominant non-private sector, as the social sector of the economy still contributed 91.5% and 87% respectively of Croatia's and Serbia's Gross Social Product (Savezni zavod za statistiku, 1990). The 1988 Constitutional amendments, the 1989-90 privatization law and a series of other laws introduced the first more radical market-oriented economic reforms throughout SFR Yugoslavia, including Croatia and Serbia. For a short time, until the break-up of SFR Yugoslavia in June 1991, the patterns of economic reforms in Croatia and Serbia were similar, including enterprises commercialisation and privatisation, trade liberalization and removal of price controls.

Immediately after, during the first years of transition, the two countries faced a number of similar political and economic problems. Following the disintegration of the Yugoslav federation, political independence of Croatia and of FR Yugoslavia (of which Serbia was part after 1992) also brought the time-consuming task of creating a new legislative framework, as new laws had to be adopted to replace the previous ones used in the former federation. Military conflict on Croatian territory and international sanctions against FR Yugoslavia made the environment for effective economic reforms especially challenging. Thus both countries faced hyperinflation in 1992-93, though its magnitude was incomparably higher in FR Yugoslavia where, in 1993, one of the highest annual hyperinflations ever recorded in economic history was registered, of 116.5 trillion percent. A stabilisation programme was introduced in Croatia in 1993, which succeeded in bringing inflation down to single digit levels by 1995. This was not the case with Serbia where inflationary pressures continued and where more permanent monetary stabilization was reached only after 2002 (see Figure 1).

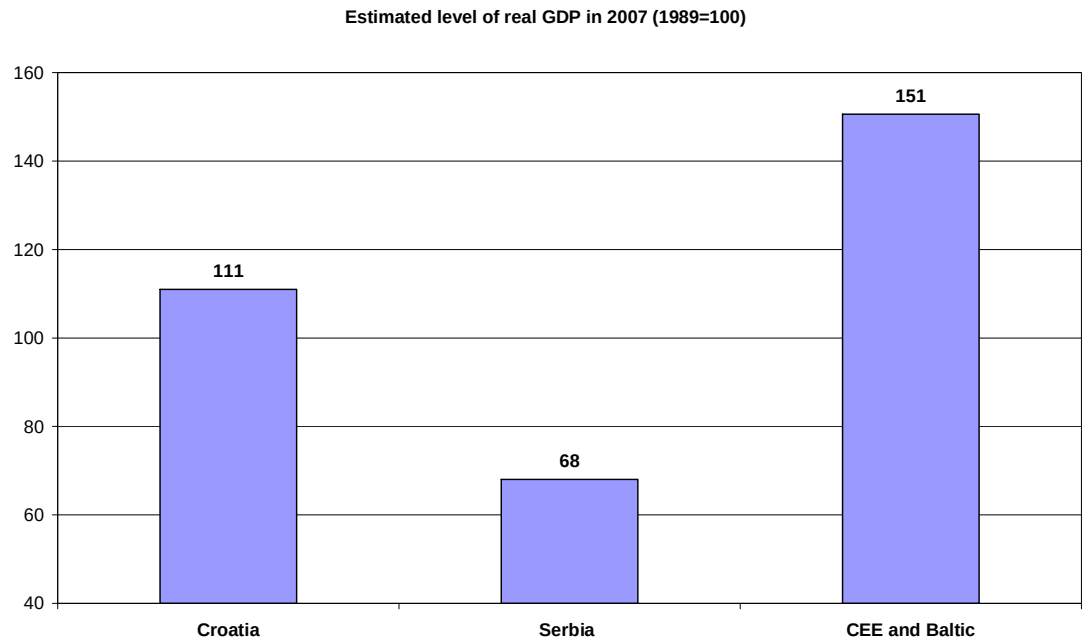
**Figure 1**




*Source: EBRD Transition Report online data, 2008*

Regarding growth performance, both Croatia and FR Yugoslavia registered a very substantial fall in output in the early 1990s, but the recession was much more severe in FR Yugoslavia, due to economic mismanagement as well as the UN sanctions imposed during 1992-95. Both countries also experienced a further period of recession in 1999, although this was more pronounced in FR Yugoslavia as a consequence of the NATO bombardments due to the Kosovo crisis, than in Croatia where a banking crisis brought a temporary end to growth. These features are clearly reflected in the long-term growth patterns of the two countries: whereas Croatia managed to reach its 1989 level of GDP in 2005, Serbia at that time was still at only 60%, and today is still at only around 68%, of its 1989 GDP (see Figure 2).

**Figure 2**

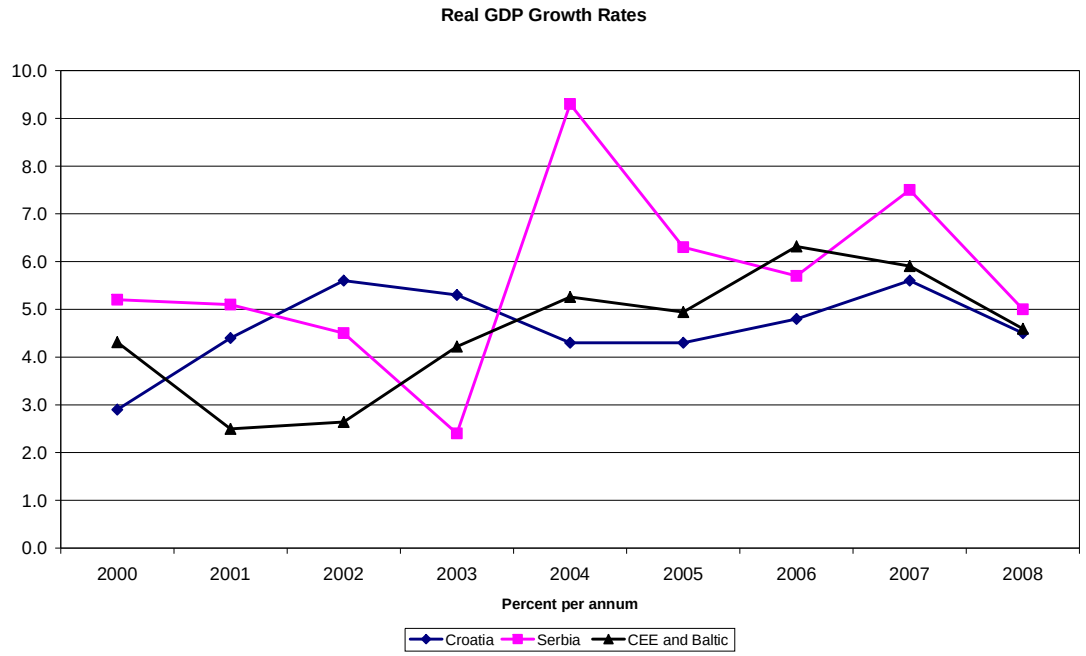



*Source: EBRD Transition Report online data, 2008*

Relatively high growth rates of real GDP have been registered during the last seven years, especially in Serbia (see Figure 3), although it should be noted that this growth performance is similar to that of the Central East European and Baltic country average to which both countries growth rates have converged. 2008 is the ninth consecutive year of positive growth of real GDP in both countries, and prospects for the next few years are fairly optimistic. Recent strong domestic demand in Croatia and Serbia has been fuelled by fast credit growth and revival of exports markets, thanks to a general process of trade liberalization both through a privileged access to EU markets and the region-wide network of trade liberalization agreements (see Bartlett, 2007a). Given that already in 1989 there were substantially differences in the level of development of the two Yugoslav republics, Croatia being the more developed, and that Serbia had a much more pronounced GDP fall in the 1990s, over the last twenty years these differences have become even wider. By 2006, GDP per capita in PPS of Croatia was already 52%, whereas that of Serbia only 33%, of the EU-27 average[3].

[3] Eurostat News Release, 179, 17 December 2007.

**Figure 3**

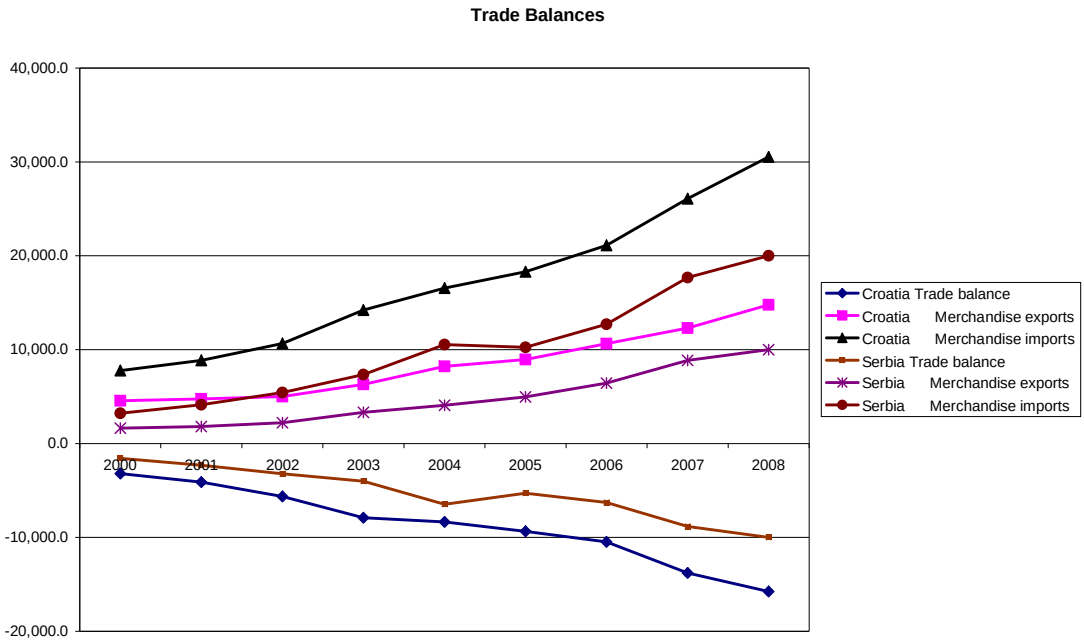



*Source: Source: EBRD Transition Report online data, 2008*

The EU granted autonomous trade preferences granted to all Western Balkan countries in 2000,[4] which ensured privileged access of their products to EU markets. As a consequence, foreign trade with the EU has grown substantially in recent years. Still, imports have grown even faster, determining growing foreign trade deficits (see Figure 4).

[4] These EU trade concessions provide for the elimination of duties and quantitative restrictions for around 95% of goods from the Western Balkans entering the EU market, including agricultural and sensitive industrial products, with only a few exceptions, including some fishery products, baby-beef, and wine, while trade in textile products is covered by bilateral agreements. The trade preferences were extended to FR Yugoslavia somewhat later, on 1 November 2000

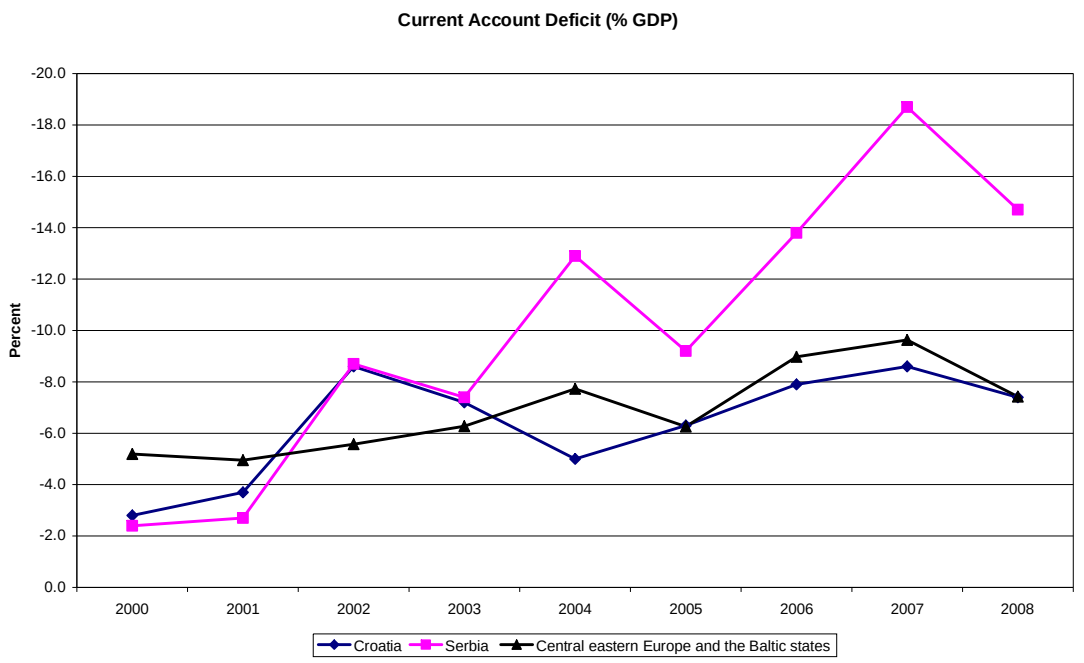
**Figure 4**




*Source: EBRD Transition Report online data, 2008*

Serbia also continues to have a high and increasing current account deficit; which is now almost double the average in Central Eastern Europe and the Baltics, while the Croatian deficit is similar to this benchmark (see Figure 5).

**Figure 5**

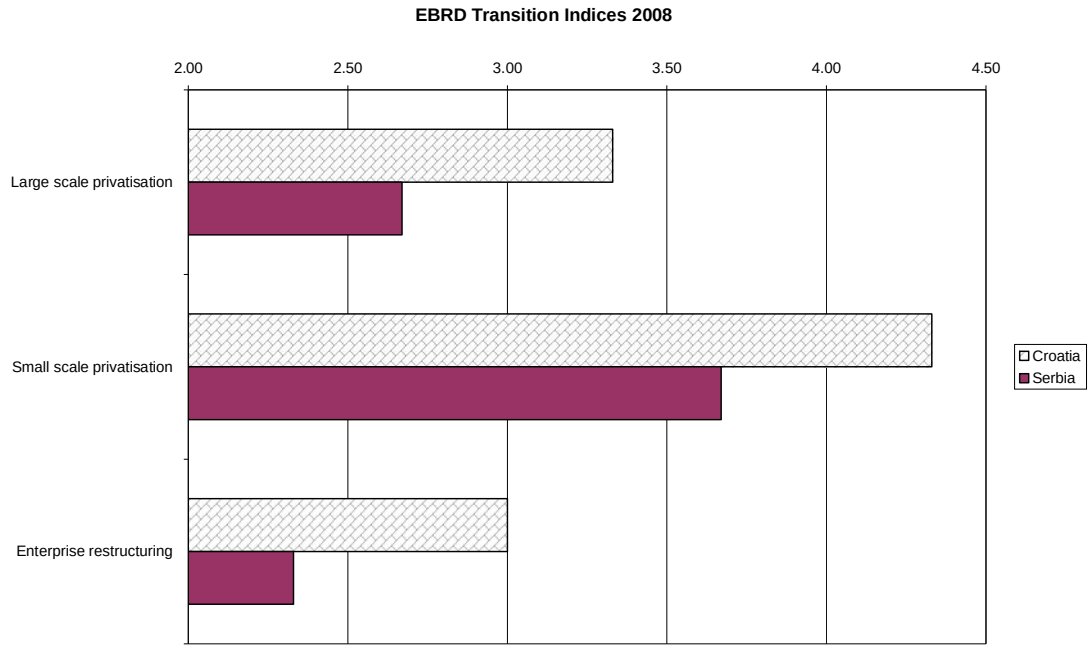



*Source: EBRD Transition Report online data, 2008*

Despite the opening of EU markets after 2000, many products from the Western Balkan region are not sufficiently competitive or face non-tariff barriers on foreign markets. The main reason behind the limited competitiveness of Croatian and Serbian products on world markets has been the slow pace of domestic productivity growth due to insufficient restructuring and modernisation of key industries, weak innovation performance, and low levels of human capital due to unreformed education systems.

Although a slow pace of reform has afflicted both countries' productivity performance, important differences in the pace and timing of reforms should be noted (see Bartlett 2008). Generally, Croatia was an 'early reformer', introducing pro-,market reforms immediately after independence in 1991, and began to catch up with the more advanced Central East European countries in the second half of the 1990s. In contrast, Serbia was a 'late reformer' and only began to implement institutional reforms after the radical changes of the political regime in October 2000. A major difference between the two countries lies in the extent of privatisation, with Serbia lagging far behind in terms of both large-scale privatisation and enterprise restructuring (see Figure 6). By 2007, the contribution of the private sector to GDP was 70% in Croatia, but only 55% in Serbia. After the October 2000 political changes in Serbia, the 'politically correct' model of privatisation was chosen based mainly on commercial sales, but the results have been disappointing: many socially-owned enterprises have not found potential buyers and have survived well beyond the set deadlines, while the privatisation of large state-owned firms only began in 2007 (Uvalic, 2007). Other major differences include the banking system, the development of the stock exchange and non-financial institutions, since Croatia started financial sector reforms much earlier than Serbia, though Serbia has also made much progress in this area during the last three years. On the other hand, in the field of business environment reforms, Serbia has advanced further than Croatia is several respects. According to the OECD SME Policy Index, Serbia scores above average in the dimension of 'cheaper and faster start-up' while Croatia scores below average in this respect. However, Croatia is the better performer in SME policy implementation overall in comparison to Serbia (OECD 2007).

**Figure 6**




*Source: EBRD Transition Report online data, 2008*

Croatia and Serbia have also had very different recent histories regarding their paths towards the European Union. Both countries were initially excluded, for political reasons, from EU assistance programmes. With the launch of the Stabilization and Association Process (SAp) in 2000, all the Western Balkan countries were offered the prospect of EU membership, major trade concessions, a special programme of financial assistance (CARDS), and the early possibility of establishing contractual relations with the EU through signing Stabilization and Association Agreements (SAA). Croatia took rapid advantage of these possibilities and concluded a SAA with the EU in October 2001, and became an EU candidate in 2004. Serbia however has adopted a much more ambivalent attitude towards the EU with powerful anti-EU forces still active in the political arena. With the latest elections in 2008 the pro-EU forces appear to be on the ascendant. An SAA was signed in April 2008 conditional on outstanding issues including full collaboration with the ICTY in The Hague. Thus, there are large and substantial differences in Croatia's and Serbia's status of relations with the EU. However, it should be stressed that economic integration is taking place even in Serbia through increasing trade, growing inflows of FDI, and capital market integration due to the sale of the predominant part of the banking sector to foreign banks from EU countries (Germany, Italy, Austria).

Despite progress with EU integration, albeit at markedly different speeds, the crucial problems facing both countries remain the issue of long-term competitiveness and growth to support catch-up with the EU average, rather than merely holding existing relative positions. The major barriers to sustained long-term growth in both countries are the limited reforms of the national innovation systems and education systems. The incentives for innovation, transfer of knowledge and introduction of new technologies are still inadequate, while the education sector has not been sufficiently reformed, leading to increasing problems of skill mismatches and inadequate supply of high-skilled labour (see sections 3 and 4 below).

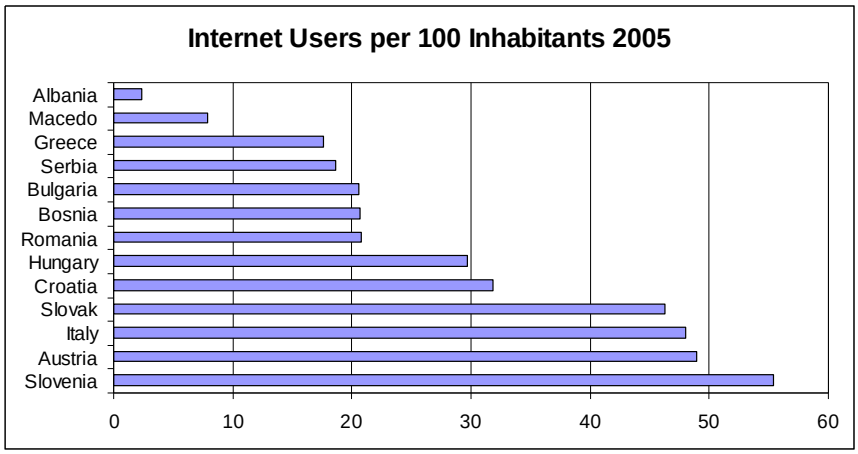
Although investments in human capital, through improved and modernized innovation and education systems can crucially contribute to longer-term growth, these issues are too often regarded as sectoral priorities, rather than key developmental challenges. The experience of the Central East European countries has shown the importance of innovation and reforms of education systems, especially for attracting more investment in higher value-added production. For example, one of the key requirements today for maintaining competitiveness of the Czech economy is to invest more in human capital, education and innovation (Svejnar and Uvalic, 2008).

A recent National Innovation Audit in Serbia undertaken in 2005-6, based on a survey of over 600 enterprises and 40 innovation support organizations suggests a number of weaknesses (see MSEP, 2007). Though some emerging fast growing sectors include electronics with computers and office equipment developing particularly fast, employment in medium/high technology manufacturing and in high-tech services are still significantly below the EU-25 levels, even below those in neighbouring Bulgaria and Romania (except for some high-tech services in Romania, where Serbian firms are quite active). Serbian firms consider themselves to be highly active in terms of innovation, but investment in innovation is very low and most of the innovation activities (more than 50%) are concentrated in the acquisition of machinery, equipment and software and related training (MSEP, 2007, p. 19).

Available evidence suggests that there are substantial differences in the technological level between Croatia and Serbia. One frequently used index of technological change

is the number of internet users per 1000 people. In 2005, Croatia had 32 users per thousand; while Serbia had just 19 users per thousand (see Figure 7). Although these data do not distinguish between work-based usage and usage for private consumption, there is likely to be a close link between the two variables, and the measure is one of the few pieces of comparative information that are available to gauge the relative technological level of the two countries.

**Figure 7**




*Source: International Telecommunications Union; Internet host data: Network Wizards, RIPE.*

The most recent World Competitiveness Report indicates notable differences between the competitiveness of the two countries, as measured by the Global Competitiveness Index. The 2007-8 rankings indicate that Croatia ranks 57$^{th}$, whereas Serbia ranks only 91$^{st}$. Over the last year, however, it is worth noting that both Croatia and Serbia have worsened their relative position, moving downwards in the global ranking (see Table 1), indicating a loss of competitiveness.

Table 1. Global Competitiveness Index, 2006 and 2007

| | **2005 GCI Rank** | **2006 GCI Rank** | **2007 GCI Rank** |
|---|---|---|---|
| **Croatia** | 64 | 51 | 57 |
| **S&M** | 85 | 87 | - |
| **Serbia** | - | - | 91 |

*Source: World Economic Forum (2006), Global Competitiveness Report 2006-7, and (2008) Global Competitiveness Report 2007-8.*

The analysis presented above has shown how Croatia and Serbia started the transition from a similar institutional framework, but that each soon experienced a divergence in their transition paths, which led to radically different outcomes regarding progress with economic reforms, economic performance, and integration with the EU. Over the last seven years, however, Serbia has made progress in implementing many transition reforms and has greatly improved its economic performance, especially in improving the business environment for entrepreneurial start-ups. Though major differences regarding the features of a market economy between the two countries exist, they are not as pronounced as they were some years ago. Nevertheless, as Serbia turns towards EU integration and accession policies it may benefit from the policy lessons and policy transfer from its Croatian neighbour, which has now several years more experience in adopting EU-compliant policies and institutions in both innovation and education spheres, as well as other areas.

## 3. INNOVATION AND KNOWLEDGE TRANSFER POLICES

Research into national innovation systems has shown that differences in innovative capacities between countries are linked to the development of institutional networks that facilitate the reciprocal exchange of knowledge and information between research institutes, university science departments, and industrial enterprises. Such knowledge transfer networks are especially important in transition economies such as Croatia and Serbia where the legal system fails to protect intellectual property rights, former research teams have been dispersed, foreign direct investment is weak, and large enterprises are insulated from the full force of market competition. In these circumstances it is likely that there will be low levels of knowledge transfer between public research institutions and the business sector, and consequently the government has an important role in stimulating innovation activity. Governments have therefore sought to promote a variety of measures to enhance the transfer of knowledge and technology from institutions of higher education and research to the business sector, including measures such as support for the development of spin-off companies and the development of technology parks, technology centres, technology networks and innovation clusters.

In recent years, institutions of higher education in many industrialised countries have created programmes to encourage academics and students to establish spin-off companies to commercialise the results of their scientific inventions. The commercialisation of scientific research through spin-offs is a direct way to transfer knowledge from higher education institutions to the private business sector. However, spin-offs may find it hard to raise equity capital or loans to finance their activities. They also typically lack the managerial expertise needed to exploit the commercial potential of their technologies. If research institutions are constrained by restrictive regulations and bureaucracy there is little chance that their spin-off activities will be successful. Studies carried out in EU countries have shown that a high level of support is needed, especially in those cases where the entrepreneurial culture is weak. In the absence of adequate support, spin-offs may remain stuck at a small scale of operation.

A technology park is a form of incubator, aimed at high technology enterprises, which facilitates the commercialisation of academic research. The location of small businesses in a technology park can accelerate the diffusion of new technologies. Proximity between SMEs and researchers in technology parks can promote the exchange of ideas through formal methods such as licensing of technologies, and through informal methods such as meetings between academic researchers and business personnel, and through the career mobility of scientists and researchers. Interactions between companies based on technology parks may also stimulate innovation. One study carried out in Sweden found higher levels of technological innovation and higher rates of growth in small businesses located on technology parks, compared to off-park businesses. Yet small businesses located in technology parks may also suffer from lack of financial support for early stage development, lack of protection of intellectual property, bureaucracy, and isolation of high technology companies.

Another potential approach is the development of technology centres and technology networks. Technology centres focus on a specific industrial branch or region. Such centres provide participating companies with assistance in marketing, and provide legal and technical information, and facilitate links with research and development

facilities in companies and research institutes. They aim to promote long-term linkages between participating enterprises and the research and development sphere. Technology networks support investments in new technologies in sectors where a critical mass of knowledge already exists, with the aim of widening access to new technologies by SMEs and spreading their use to other sectors. A related model is that of knowledge clusters. These have been highly effective as sites for the promotion of innovation in some notable cases such as Silicon Valley in the USA. Similarly, Italian industrial districts have been effective vehicles of improved competitiveness based upon dense clustering of small firms in specific geographic locations. The influential work of Michael Porter has stimulated a growth of policy interest in the beneficial effects of industrial clusters. Porter has argued that clusters develop links between universities and businesses which facilitate knowledge transfer. Such experiences and ideas have created a strong interest among policy makers in transition countries to support the creation of clusters involving high technology companies and institutions of higher education. However, clusters can rarely be created as sustainable organisations through the top-down initiative by government. Effective clusters are usually created by entrepreneurs' as a bottom-up process in response to economic incentives. They evolve, rather than being the product of conscious design.

Croatia and Serbia have undergone substantial institutional reforms in recent years which have also directly affected the knowledge sector. There are a range of policies that can be used to create and sustain innovation and the transfer of knowledge, many of which have recently been applied in Croatia and Serbia. Among the most important tools are incentives for establishing business and technology incubators; stimulating the creation and expansion of SMEs and supporting their innovation efforts; setting up science and technology parks and inter-firm clusters; building export processing zones; forging innovation networks; and restructuring financial institutions to enable banks to promote technological innovation and development. Both the Croatian and Serbian governments have indicated their desire to facilitate the transfer of technology from their domestic science base to the enterprise sector, rather than relying exclusively on technology transfer from abroad. Technology parks have been established to encourage the transfer of knowledge from universities to private business. However, these policies are still in an embryonic stage and lag far behind the comprehensive set of measures that have been used to promote technological

development in Slovenia which also emerged from the former Yugoslavia in the early 1990s (Bartlett and Čučković, 2006).

In the rest of this section, we look into the most important features of national policies of Croatia and Serbia in this area, including recent legislation and institutional changes, government strategies and priorities, expenditure on innovation, and existing infrastructure.

### *3.1. Legislation and institutional developments*

Croatia and Serbia have recently adopted a number of new laws which directly concern the national innovation system. There have also been a number of institutional reforms in both Croatia and Serbia, including changes in the name and functions of the responsible Ministries and the setting up of new institutions aimed at facilitating progress in the area of innovation.

Until a few years ago, research activity in Croatia was regulated by the 1997 *Law on Scientific Research Activities.* The law has been criticized because it removed all research institutes from the university and transformed them into public institutes, thus cutting the functional links between universities and professional research organizations and contributing to the fragmentation of the scientific potential (see Svob-Djokic, 2002). In the meantime, there have also been measures towards greater centralization. The two ministries – Ministry for Science and Technology, and the Ministry for Education – have been merged to become the Ministry of Science, Education and Sports. In line with these changes, the two laws regulating the two areas - *Law on Scientific Research Activity* and the *Law on Higher Education* - have been replaced by one fundamental law adopted in 2003 covering both areas - *Law on Scientific Activity and Higher Education.* The law draws heavily on a number of legal acts adopted earlier in the 1990s, and in July 2004 has been further amended in order to facilitate its implementation.

A key role has recently been assigned to the Croatian Institute of Technology (HIT), founded by the Croatian government in 2006 with the vision of becoming the leading institution in charge of developing and implementing technology policy. HIT is

focused towards strengthening the knowledge triangle (education, research and innovation) and should also support closer cooperation between the scientific community and business. It administers one of the main national programmes supporting technology development.

There are a number of other government and non-government organisations in Croatia which are directly involved in sustaining innovation. The Business Innovation Centre of Croatia (BICRO), established by the Croatian government in 1998 with the aim of developing a financial system to support innovation and technology-based businesses, has evolved into a leading innovation agency. BICRO manages five national development programmes supporting technology development. During 2002-6, BICRO operated the RAZUM programme in support of knowledge-based companies, providing financial and technical support to some 40 innovative start-ups and early stage companies (Machačová and Dall, 2008).

In November 2007, the Affiliation of Clusters was established within the Croatian Chamber of Economy,, as a bottom-up initiative of existing clusters in Croatia which operate in many different branches (including civil engineering and construction, wood processing, shipbuilding, yacht engineering, graphic design, ecological food production, metallurgy, ICT, railroad infrastructure). Their activities include education of cluster managers, promotion of best practices, dissemination of information, and encouragement of internationalisation (Machačová and Dall, 2008). The Chamber of the Economy also hosts the Affiliation for Innovations, established in November 2007, which has 270 members – regional or local associations of innovators, individual innovators, and companies. The Affiliation of Innovations is a member of the European Association for the Transfer of Technology, Innovations and Industrial Information in Luxembourg and its objectives are to build information systems, coordinate social actors engaged in innovation, build teams in specific fields, introduce innovations into the market, and assist innovators (see Machačová and Dall, 2008).

Within the Croatian Employers' Association, the National Centre for Clusters was created in 2007, which aims to strengthen the competitiveness of the Croatian economy through clusterization. The Croatian Agency for SMEs (HAMAG), created

in 2003 as an institution for small business development and promotion offering credit guarantee schemes, but since 2007 it has begun to take over a number of programmes previously under the competences of the Ministry of Economy, Labour and Entrepreneurship and has begun to provide support infrastructure to businesses and to promote entrepreneurship (Machačová and Dall, 2008).

In Serbia, the national innovation system has for almost a decade functioned on the basis of the *Law on Scientific and Research Activities* adopted in 1993. Following the 2000/01 political changes, there have been many important initiatives in order to increase R&D expenditure and stimulate innovation in the business sector. In 2004, the Serbian Ministry for Science, Technology and Development was transformed into the Ministry for Science and Environmental Protection.

During the last few years, two important new laws have been drafted and publicly debated, and finally approved in December 2005: the *Law on Science and Research Activity* and the *Law on Innovative Activity*. In 2003/04, new regulations have also been adopted regarding innovation centres and technology parks. There is a separate *Law on Universities*, the latest version adopted in 2005, which also contains provisions on innovation; within educational institutions, the law allows the setting up of technology transfer and innovation centres, business and technology parks and other organisations for the purpose of commercialisation of research results (see Ministry of Science and Environmental Protection (MSEP), 2007).

Despite many positive developments in Croatia and Serbia regarding legislative changes and new institutions in support of innovation, there have also been delays in implementing many of the new laws and regulations, either because of the lack of resources to carry forward the set objectives, or because of other more urgent government priorities. Political changes in the respective governments have usually led to proposals for further amendments to existing regulations, postponing their implementation further, while the proposed changes do not always take into account the previously applied measures, thus providing discontinuities in implemented policies. For a variety of reasons, the important changes in innovation legislation and institutions have not always contributed to effective change. There are many fundamental problems, mainly deriving from the generally unfavourable position of

the national innovation system which has prevailed during most of the last 20-year period. There is also lack of functional links between research institutes, education, and the industrial and commercial sector.

*3.2. Strategies and priority tasks*

In Croatia, one of the urgent tasks in the innovation area was the elaboration of the *Strategy for S&T policy* which was to be prepared by the National Council for Sciences nominated in 2004. Previously, the national science policy used to be based on the *National Scientific Research Programme* adopted in 1996, while after July 2003, it was based on the *Strategy of Development of Croatia in the 21st Century – Science.* The national technology policy was based on the *Programme for Innovative Technological Development (HITRA)* adopted in 2001. There are three strategic long-term goals of the HITRA program: creation of incentive measures for technology policy, creation of the technological institutional structure, and establishment of control mechanisms for innovation and technology policy. In April 2004, a Cooperation Agreement was signed between the Ministry of Science, Education and Sports and the Ministry of Economy, Labour and Entrepreneurship, on the harmonisation of education policies with the country's economic needs, and on developing the national innovation system.

The most recent document which lays down the current research policy goals, adopted by the Croatian government in May 2006, is the *Science and Technology Policy of Croatia for 2006-2010.* It reflects the main strategic goals of integrating the EU Lisbon and Barcelona targets into national development plans and creating a knowledge-based society in Croatia. As specified in the document, the overall goals of science and technology policies are to: increase funding for excellent science and technology champions and to increase investment, in order to reach 3% of GDP; restructure publicly funded research institutes and innovation centres, in order to reorient them towards the needs of industry; encourage research partnerships and strengthen support schemes for qualified young researchers; invest in infrastructure and knowledge-transfer institutions; promote the commercialisation of academic research; promote technological development and innovation; and encourage innovation through business-friendly legislation, including appropriate intellectual property laws and tax incentives for investment in priority innovation areas. These

research policy objectives are expressed in the Action Plan for the 2007-2010 period (UNESCO, 2008).

Croatia also has a national strategy for business support, including incubation, and strategies to support clusters via special programmes. In 2006, the development of 18 clusters in six sectors was supported (wood and metal processing, food, textiles, printing and publishing, and tourism). In 2007, in addition to the Affiliation of Clusters mentioned earlier, the CRO.ICT was established as an alliance of Croatian ICT associations, bringing together 6 smaller ICT associations. The Croatian Technology Infrastructure Development Programme, initiated by the government with support from the World Bank, has generally supported technology innovation centres. Technology centres are located in the urban areas of Zagreb, Split, Rijeka and Osijek, but it is reported that their performance has not been ideal (Machačová and Dall, 2008). There are also three technology and science parks operating in Zagreb, Varazdin and Kutina, but they have still not generated any significant economic activity (Machačová and Dall, 2008).

Serbia has established a solid policy framework in innovation, with a number of important initiatives in course, particularly during the last few years. The general aim of innovation activities is to provide world class research and encourage the research community to contribute to economic growth of the country. One of the main priorities is to increase government expenditure on R&D, which ought to gradually increase further, towards the Lisbon objective of 3% of GDP by 2010. Other priority tasks include the further improvement of project proposals evaluation systems; improvement of the position of top researchers; building an innovation infrastructure (research labs, academic internet networks and libraries, computer equipments, journals, books and digitised research journals); and international cooperation in R&D (Uvalic, 2006).

At the end of 2006, two important documents have been approved - the National Strategy for the Economic Development of Serbia 2006-2012 and the National Programme for Business Incubators and Clusters Development in the Republic of Serbia 2007-2010 - demonstrating the interest of the government to improve the entrepreneurial and information infrastructure. Financial resources have also been

provided from the state budget to support entrepreneurship and small and medium-sized enterprises. Active programmes to foster technological cooperation have been launched. The framework for establishing clusters has been set up, as envisaged by the mentioned National Programme, supported further by a project of the Ministry of Economy and Regional Development on Cluster Development Support Project in 2007 that has supported numerous cluster initiatives; at the beginning of 2008, there were 16 cluster initiatives operating already. There are also several technology and science innovation centres (e.g. Technology Transfer Centre at the University of Novi Sad, Innovation Centre at the Mechanical Faculty in Belgrade, the Novi Sad Innovation Centre). Science and technology parks of the Institute "Mihajlo Pupin", Novi Sad and Nis were recently founded, as well as the Business Technology Incubator of technical faculties in Belgrade. A research was undertaken on the innovative capacities in the Serbian ICT sector. The National Business Incubator Programme started in 2005, with the plan to establish some 15 incubators in operation until 2010. In December 2006, the Serbian Association of Business Incubators was established, supported by the Serbian government (Machačová and Dall, 2008).

An overall innovation strategy has recently also been prepared in Serbia, laid out in a document (still in draft form) of the Ministry of Science and Environmental Protection – *Innovative Serbia: A Strategy for Action* (see MSEP, 2007). The strategy sets out the framework for the development of the country as an innovative and knowledge-based society, suggesting how to create conditions for the rapid commercialisation of scientific research and progress in innovation. Some of the necessary requirements include further restructuring of industry, increased investment, fundamental reforms of the education system, radical reform of research institutions in order to provide greater focus on the commercial application of research, setting up a network of innovation support organizations, development of ICT. Recent research provides ground for Serbia to emerge as a potential leader of innovation activity in the region, but in order to accomplish this aim and maintain economic growth, Serbian enterprises will need to increase investment in new technologies to promote productivity gains and develop new products and services. A National Innovation Fund is envisaged and public support of innovation and technology centres, business technology incubators, technology parks, innovative enterprises. As stressed and elaborated further in the strategy, the key challenges

ahead are to place innovation at the heart of all government policies; to improve access to finance for innovative ideas of Serbian enterprises; to develop innovation support infrastructure to sustain the competitiveness of key sectors; to boost the linkages between science and industry; and to develop an innovative culture and education (MSEP, 2007).

*3.3. Investment in innovation*

The current economic situation in Croatia, and even more in Serbia, poses major constraints on national policies on the development of the national innovation systems. The political events of the 1990s have had very negative effects on the two economies and the process of economic recovery has been slow. Restrictive fiscal and monetary policies, while necessary for attaining macroeconomic stabilization, have severely limited public expenditure and have contributed to very low investment in general, and investment in the national innovation system has been among the most affected. The inflows of foreign direct investment have, until fairly recently, been limited, and among all the Western Balkan countries has mainly gone to Croatia (around 60%). Donors financial assistance has greatly helped to modernise the national innovation system in recent years, but funding has not been sufficient and specific programmes for these purposes are usually not provided on a continuous basis. There has also been limited interest of donors to offer assistance for certain key areas where the needs are greatest, such as the modernization of laboratories (Uvalic, 2005).

Over the last few years, general expenditure on R&D (GERD) in Croatia has slightly increased, from 1.07% of GDP in 2001 to 1.14% of GDP in 2003, and is therefore already higher than in a number of EU countries, not only the new member states but also some of the founding members.[5] Thereafter GERD has increased further, to 1.22% in 2004.

Croatia is also one of the few Western Balkan countries to have statistics on R&D expenditure by sector of finance, therefore separately for the three sectors – the

[5] Croatia had a higher GERD in 2000/02 than Greece, Portugal, Spain, most of the incoming new EU Member States, and Italy (in 2000); see European Commission (2003b, p. 22).

government, the business sector, and the higher education sector. GERD has been increasing in recent years thanks primarily to increased spending in higher education, since R&D expenditure of both the government and the business sector has been stagnating. Nevertheless, there has been an upward trend in available financial resources after 1997, as the Ministry's budget for science has gradually increased from around ˆ200 million in 1996 to almost ˆ350 million in 2003. Since 2000/01, the budget has also been financing some new areas, such as Technological Development and Informatics. Increased budgetary funds have also permitted an increase in the number of projects financed in all six groups of scientific disciplines, especially in medical sciences, technical sciences, and humanistic sciences: in each case (Uvalic, 2006).

Croatia has a number of instruments for financing innovation. These include permanent on-budget and off-budget support to scientific research, co-financing by the private sector and industry, providing special funding for training and development of human resources in science, programmes for training young researchers, and various legal instruments (for defining decision–making for setting priorities, assessment of project proposals, organization of project implementation and operation of scientific institutions). Regarding the national policy for technology development, the instruments used are budget grants for technology projects; co-financing development of new technologies/innovations with private partners; R&D subsidies to companies (30% of total project value); favourable commercial loans (interest amounting to the discount rate of the Croatian National Bank); conditional loans in case of high-risk projects and particularly in case of academic entrepreneurship (i.e. spin-offs from the university); grants for feasibility studies for developing research and technology nuclei; and subsidizing research equipment, the employment of young experts on technology, and technology infra-structural institutions.

In Serbia, government expenditure on R&D was a low 0.32% of GDP in 2003 (Uvalic, 2006). Since then it has slight increased, by 2004 to about 0.5% of GDP. About half of total expenditure on R&D in 2004 was by the government (0.25% of GDP), the higher education sector is the second most important contributor (0.18% of GDP), whereas the lowest proportion is financed by the business sector (0.07% of

GDP) (UNESCO, 2008). It should be noted that the level of expenditure on R&D of 0.5% is a remarkable, fivefold, increase, with respect to 2000 when it was only around 0.1% of GDP. If considered in Euros, after 2000 there has been a six-fold increase in total government expenditure on R&D in absolute terms, and a similar increase in per capita terms from ˆ1.5 in 2000, to ˆ8.3 in 2003. The objective set a few years ago was to increase government expenditure to around 1.4% of GDP by 2010 (Uvalic, 2005).

The Serbian Ministry for Science and Environmental Protection dedicates the largest part of the budget to innovation programmes, in 2004 more than 86% of the total. More than 50% of the Serbian R&D budget in 2004 was allocated to the Basic Research Program, 30% to the Technology Development Program, and another 8% to the R&D Facility and Infrastructure Upgrade Program (Uvalic, 2006). In June 2004, the Serbian government decided to invest some ˆ9 million in R&D infrastruct ure and the development of technological parks (UNESCO, 2008).

In Serbia also, there are various financial instruments used to finance innovation within the Ministry for Science and Environmental Protection (MSEP). There are twelve main programmes which are supported directly through grants of the MSEP, some targeted towards specific objectives/areas, others towards a certain category of beneficiaries; some of them are also co-financed by the enterprise sector. Thus the *Basic Research Programme* provides grants to research organizations; within this programme, a special Fund for awarding successful researchers in basic research areas has been created. The *Technology Development Programme* offers grants and loans to local companies to develop or implement new technologies or to engage experts from universities and institutes in their development projects. The *Knowledge and Technology Transfer Programme* supports the development of S&T parks, incubators and innovation centres for knowledge-based and technology-oriented companies. The *International Research Collaboration Programme* provides grants to local research organizations that are part of international bilateral or multilateral collaboration projects. The *R&D Facility and Infrastructure Upgrade Programme* provides grants to universities and research institutes to upgrade their laboratory equipment. The *Development of Researchers Programme* provides support for participation at international conferences, study trips, and scholarships for post-doc fellows, Ph.D. and M.Sc. students. There are also programmes for the purchasing of research

journals and books for libraries, and for supporting local scientific conferences and journals.

Private sector financing of innovation in Croatia and Serbia has remained limited. In Serbia, one of the key factors that has contributed to low private financing of R&D are delays in privatisation, which has still not involved some of the most important large state-owned firms. The private sector in both Croatia and Serbia has grown thanks to primarily small-scale privatisation, but small firms usually lack the resources to invest in innovation, as many examples from the EU countries seem to suggest. Recent surveys have indeed confirmed that in the EU there is strong correlation between firm size and innovation (see European Commission, 2008, p. 87). In Croatia and Serbia, the closure or restructuring of many large public enterprises has all but eliminated corporate financing of innovation. Private sector financing of innovation also remains limited because external sources of finance have remained scarce and are still today offered at unfavourable terms (high interest rates, short repayment period). There have been cases of FDI-based privatisations which have also implied substantial innovation and investment in innovation, but overall there have not been too many success stories.

### *3.4. Infrastructure*

Croatia has recently been investing heavily in scientific infrastructure and technical equipment. During the past five years, the Ministry of Science, Education and Sports has provided special equipment grants in the total amount of over ˆ30 million that have significantly improved technical equipment at universities and research institutes. The private sector has also made significant investments in research infrastructure, particularly in the pharmaceutical and telecommunications sector. However, significant investments are still needed, especially in higher education institutions outside Zagreb. Croatia still lacks equipment of major scale, and compensates this through international cooperation schemes (see Uvalic, 2006).

Regarding computer networks in Croatia, the Ministry of Science, Education and Sports has already in 1991 established CARNet (Croatian Academic and Research Network), and a year later Croatia became part of the Internet and obtained its Internet domain. Today, 176 institutions at 263 locations, in 31 towns throughout the

country, are connected to the CARNet, including all institutions in science and higher education (with links of 2Mbit/s and more). The capacity of the CARNet links with the rest of the world is 622 Mbit/s. The Ministry of Science, Education and Sports financially supports the establishment and operation of referral centres for programme licences in different branches of science (for instance Mathematica, Mathlab, Statistica, SAS, etc.). In 2002, there were 12 active referral centres which received funding from the Ministry. Only in 2002, 660 PCs, 30 servers, and 57 overhead projectors were purchased for research and higher education institutions. The design and building of 12 local networks received additional funding (Uvalic, 2006).

As to Croatian libraries, the National Information System in the libraries (NISKA) is a joint project of the Ministry of Science, Education and Sports, and the Ministry of Culture launched in 1996, which organized the design of the national library information system connecting all libraries in Croatia, with the aim of establishing a system that would enable the collections of all libraries in Croatia to be accessible in electronic, multimedia, format to the public in the country and abroad (Uvalic, 2006).

The Croatian National Foundation for Science (NZZ) runs several programmes that facilitate the participation of Croatian scientists in EU Framework Programmes, while the Ministry of Science, Education and Sports continues to develop the needed assistance infrastructure in collaboration with the Croatian Institute for Technology (HIT). HIT was established in 2006 to strengthen the implementation of the Lisbon research triangle in Croatia. The Regional Competitiveness Operational Programme, one of the instruments of the IPA programme, aims to strengthen the “third function” of the University, intellectual property rights in knowledge transfer processes and bio-science incubators (UNESCO, 2008).

In Serbia, research infrastructure have severely deteriorated during the 1990s, as very little investments have been made in modernizing existing technical equipment in research institutions. The only exception was information technologies through individual computer use, but the degree of information networking is still insufficient. Although the recovery of the R&D sector started in 2001, the severe consequences of neglecting the sector during the 1990s are still evident. Within the Ministry for Science and Environmental Protection, the Department for Information Society

coordinates and encourages activities concerning e-management and Internet. In order to involve Serbia into e-Society and e-Europe initiatives and programmes, various initiatives have been launched, including the preparation of a Policy and Strategy for the creation and development of Information Society, and of various regulations in the field of informatics and Internet; the adoption of the Electronic Business Law; and the implementation of contracts between the government and ICT companies. The ratification of the contract between the Ministry for Science and Environmental Protection and Microsoft is in course, while the Ministry has also signed a contract with Oracle. The Academic Network of Serbia is today a constituent part of the GEANT Network, providing connections between all educational and research institutions in the 18 cities in Serbia. So far, the Academic Network involves 1,947 academic institutions (including all Universities, research institutes, libraries, museums and health institutions), and an additional 622 republic institutions. The infrastructure at Faculties and research institutions comprises several local computer networks and special-purpose computer purchases for research institutions. Since the Optical Academic Network has been formed, which is about to connect 18 cities in Serbia, the Ministry for Science and Environmental Protection is planning to finance local computer networking, Optical Academic Network connecting, and special purpose computers purchase for research institutions.

Regarding the information system of Serbian libraries, the largest part of acquisitions is carried out through *KoBSON* (Consortium for Coordinated Acquisition),[6] which comprises representatives of all important scientific libraries in Serbia.[7] The main goals of KoBSON are acquisition of scientific information, use of electronic publishing, and promoting access to electronic information. The overall subscription system is financed by the Ministry for Science and Environmental Protection. Some 111 institutions in Belgrade, and another 64 in other Serbian towns, presently have access to the KoBSON website, involving 328,820 users (Uvalic, 2006). Researchers

[6] KoBSON - http://nainfo.nbs.bg.ac.yu/Kobson/page/.

[7] The National Library of Serbia; Matica Srpska Library, Novi Sad; University Library of Belgrade "Svetozar Markovic"; University Library of Nis "Nikola Tesla"; University Library of Kragujevac; Library of SASA –Belgrade; and representatives of the Community of University Libraries and Community of Libraries of Serbia.

in Serbia therefore enjoy good connectivity and wide access to international journals and databases.

Serbia has its own Intellectual Property Office, which since 2004 has ratified and applied a Cooperation and Extension Agreement with the European Patent Office. The Agreement envisages technical, legal and administrative cooperation for the purpose of infrastructure development in Serbia. In June 2007, Serbia joined the Framework Programme 7 for research and technological development, which will help the participation of Serbian scientists in EU scientific and research initiatives (UNESCO, 2008). A number of technical incubators have already been established in Serbia, despite the initial delay in the development of Serbian innovation centres. (UNESCO, 2008).

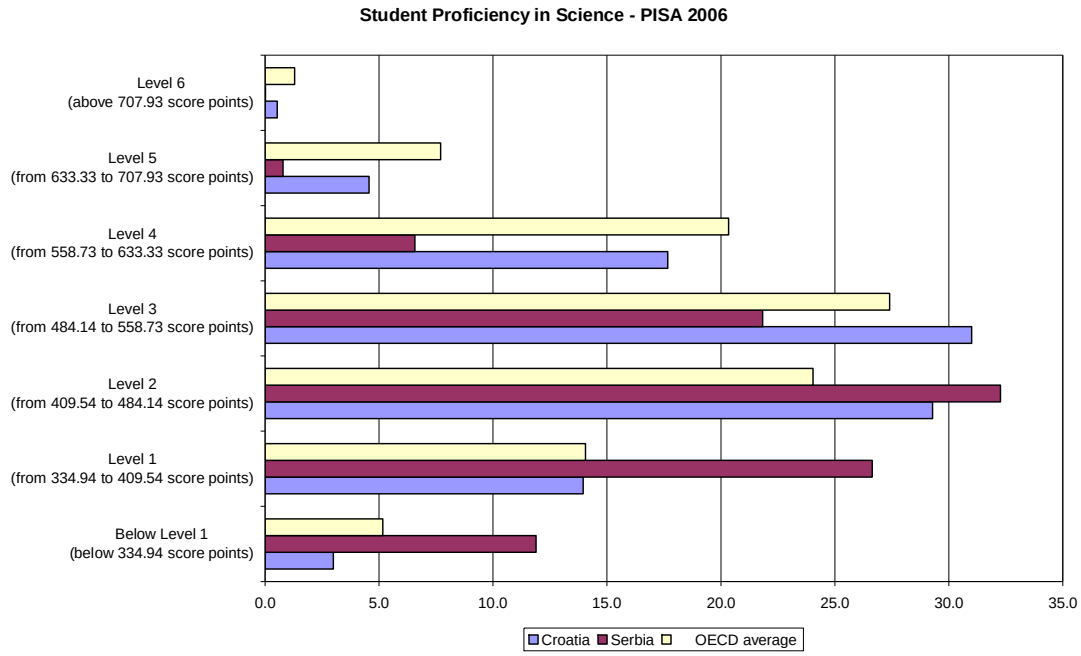
Therefore, there are large differences in Croatia and Serbia regarding the state of research facilities, scientific equipment, laboratories, and libraries, level of computerisation and penetration of Internet. Croatia as the more developed country has been able to invest more in the modernisation of research facilities than Serbia, though substantial efforts are presently being undertaken also in Serbia through a number of important initiatives.

## 4. EDUCATION POLICES FOR SKILL DEVELOPMENT

Transition has involved a bias against unskilled workers who have suffered a disproportionate loss of employment, while new job creation has been biased against workers with low educational attainment and skills (Commander and Kollo 2004). Although most transition countries had a high share of the labour force with secondary education or above, many had been taught in lower vocational schools which offered only one or two year's compulsory schooling (Boeri 2000). Such training was usually carried out in cooperation with local enterprises, and mainly firm-specific skills were taught. Upper vocational schools offered five year courses, but these rarely opened up pathways to tertiary education, nor did they enable workers to easily move from one occupation to another. In the mid-1990s, workers in East European transition countries with vocational training accounted for more than one-third of the unemployed. In the Western Balkans, workers with vocational education

suffer disproportionately from unemployment, indicating that secondary vocational education has provided skills that were specific to now-outdated technologies and working practices (Bartlett 2007b). These adverse aspects of the vocational education system can be observed in both Croatia and Serbia. In Croatia, vocational education often leads to premature subject-specific specialization, and the curriculum is narrowly focused on subject specific skills, competencies, and attitudes that rapidly become obsolete (Bejaković 2004: 120).

**Figure 8**




*Source: PISA 2006: Science Competencies for Tomorrow's World, OECD online data*

While the education and training systems in Croatia suffer from numerous defects, and require significant reform if they are to meet the needs of developing a knowledge based society, the results from the OECD PISA survey of educational performance show that Serbia is even further behind in promoting student proficiency in science subjects. The percentage of students in Croatia able to answer questions at levels 5 or 6 on the PISA science test is 5%, compared to the OECD average of 9%. However, only 0.8% of Serbian students are able to achieve this level[8]. The data show that the

[8] At level 6. students can consistently identify, explain and apply scientific knowledge and knowledge about science ina variety of complex life situations. At level 5, students can identify the scientific components of many complex life situations, apply both scientific concepts and knowledge about

distribution of achievement in science in Serbian schools is very much below that of the OECD average, while the distribution in Croatian schools is much closer to it (see Figure 9).

In Serbia, compulsory education lasts for 8 years. About 93% of those completing primary education continue on into secondary education, either into four year gymnasium which provides the possibility of entry into university, a four-year vocational education which also permits entry to university, or a three-year vocational education without entry into university. Vocational schools offer a choice of 312 profiles in 15 sectors. According to a recent study by the European Training Foundation "the main problem with the secondary education system is that it is structured around educational profiles and course contents that now correspond to an obsolete economy" (ETF 2006a: 4). Moreover, the quality of education is frequently criticised by employers who cite lack of problem-solving skills, lack of entrepreneurial spirit, excessive theoretical knowledge and lack of specific technical skills among school leavers. At tertiary level, with 5 public universities and 3 private ones, Serbia has a low level of participation. Only 15% of the population has a university education compared to 22% in the EU-15. The system of adult education ahs also deteriorated since the collapse of former Yugoslavia in which adult education was promoted through workers' universities. This training infrastructure has now collapsed, and of 200 workers' universities only 205 at most are still active.

Educational attainment levels are also relatively low in Croatia where 40% of the population had only basic primary education according to the results of the 2001 census. According to the central Bureau of Statistics, by 2005, about 60% of employees had secondary education, and less than 20% had a university education. A survey carried out by the Croatian Chamber of Economy in 2005 showed that employers were dissatisfied with the quality of the education system, citing in particular the poor results of the vocational education system. Employers considered that many young people were trained in outdated profiles, using obsolete equipment. The survey reported that technical skills of young people were insufficient and that

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science to these situations and can compare, select and evaluate appropriate scientific evidence for responding to life situations.

key competences such as using ICT, communication skills in their own and a foreign language, numerical skills, motivation to work, problem solving and independence and self-initiative were underdeveloped (ETF 2006b: 8).In Croatia, the workers' universities inherited from the former Yugoslavia have been transferred to the competence of the local authorities, as part of the policy of decentralisation of adult learning. Consequently their financial resources depend on the limited capacity of local governments. The system has therefore declined just as in Serbia. By 2005, a survey by the Croatian Chamber of Crafts and Trade covering 274 SMEs revealed that 85% of the costs of formal adult education were paid for by companies, rather than the state whether central or local (ETF 2006b: 19)..

## 5. COMPARATIVE EVALUATION OF POLICY REGIMES

In the EU, innovation and skills are seen as key dimensions of improved competitiveness to underpin faster long-term economic growth. As part of the transition to a knowledge-based economy, the Lisbon European Council of March 2000 emphasised the importance of stimulating the creation, absorption, diffusion and exploitation of knowledge, education and training for the knowledge society, and encouraging the start-up and development of innovative businesses. At the Barcelona Council meeting in March 2002, one of the strategic objectives agreed upon was to increase R&D expenditure to 3% of GDP by 2010, of which two-thirds should be made by the private sector. [9]

The objectives posed by the EU to create a knowledge-based economy and society are highly relevant for the candidate and potential candidate countries. Although so far only Croatia has obtained candidate status and started accession negotiations, Serbia has been offered the prospect of EU membership, and is likely to follow. In preparing for future accession both countries will need to consider the priorities identified in the pre-accession strategies set out by the European Commission, including those related to the area of innovation, education, and skills.

[9] In the EU-15 in 2000, average general expenditure for R&D was 1.93% of GDP (against 2.69% in the US and 2.98% in Japan), while in 2001 it was 1.98% (or 1.93% in the EU-25, according to the estimates of the Commission); see European Commission (2003a, p. 48 and 2003b, p. 22). Industry-financed R&D in 2000 was 56.3% of total R&D spending (against 68.2% in the US and 72.4% in Japan); see European Commission (2003), p. 31.

Dedicating more resources to innovation, education, and skill development does not preclude combining different strategies of development, based on the utilization of modern technologies available in the more advanced countries, and the development of domestic technological capabilities. Enterprises can adopt new technologies through licensing foreign patents, rather than through own activities. Considering that Serbia specializes less in high-technology industries than Croatia, a crucial aspect of its future economic growth will be the transfer of technology from abroad through increased inflows of FDI.

There have been many complaints about the inappropriate treatment of research institutions both countries. Though the research systems have substantial potential, they are characterised by an unfavourable structure, weak interaction with the business sector, and insufficient international linkages. Given the extensive new legislation in both countries, efforts should be directed towards an acceleration of the implementation of laws and related measures.

Education systems are a further critical weak point in both countries, at all levels including especially secondary vocational education and university level education systems. Reforms and improved practices are needed in both countries. Croatian education institutions have performed better in terms of outcomes related to scientific instruction at secondary level, and Croatia is also more advanced in its reforms of higher education in regard to the Bologna process. Both countries, have however allowed the systems of adult education and life-long learning that were rather advanced in former Yugoslavia, to deteriorate. These institutions will need to be re-built as EU accession processes are carried forward.

Overall, Croatia is making substantial progress in the policy fields of innovation and education, and is successfully pursuing a strategy of skill-biased technical change and beginning to adopt a high-skill and high-technology path of development. In order to succeed in its ambitions towards EU accession, and catch up with EU living standards, Serbia needs to follow this example, and to avoid the alternative low-skill and low-technology path of transition and development.

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