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Executive Summary

Innovation policy framework in Croatia in recent years has not been adequately improved or revised. The Science and Technology Policy of the Republic of Croatia 2006 – 2010 expired, with most of its objectives remaining unfulfilled. The new Government elected in December 2011 has initiated the development of new strategic documents and legal acts. The first such document is the [Guidelines for strategy of teaching, education, science and technology](#) carried out by the Ministry of Science, Education and Sports (MSES) in collaboration with the Croatian Academy of Science and Arts. The high expectations regarding strategy of innovation are related with the future project "National Strategy for the Croatian innovation development 2013-2020", which will be carried out by the Organisation for Economic Co-operation and Development (OECD) experts in collaboration with local institutions. The Memorandum of understanding and cooperation was formally signed on 9th May 2012.

As far as reforms of the science and higher education system are concerned, the new Government has withdrawn from the parliamentary procedure the proposals of three laws from October 2010: the Law on Science, the Law on Universities and the Law on Higher Education. The proposed laws were expected to substitute the current Science and Higher Education Act from 2003 and have encountered strong criticism in the academic community. The Government has proposed a new draft of the law amending the Law on Science and Higher Education from 2003 which is currently in the process of a public debate. In addition, a draft of the law amending the Law on the Croatian Foundation for Science is presently in the final stage of a public debate. The changes envisaged by the new laws are quite significant since the funding of scientific projects should be transferred from the central public administration (MSES) to the Foundation as a professional institution.

In 2010 the investments in research and development (R&D) have significantly decreased due to the stagnation of national economy during the last four years, which was additionally affected by the global financial and economic crisis. The total gross expenditures on R&D (GERD) in 2010 have reached its lowest level since 2000 and amounted to 0.73% of GDP (€330m). This is not only 36% of the EU-27 average in 2009 (2.01% of GDP), but also 0.69% of the national investments in 2004 of 1.05% of GDP. GERD also significantly decreased compared with two previous years, from 0.89% of GDP in 2008 (€421m) and 0.83% of GDP (€383m) in 2009. The public – private ratio remained at 60:40 in favour of the public sector. The public as well business resources for R&D are not only low but also decreasing. The public resources amounted to 0.4% of GDP in 2010 (€184m) – which is far from the national target of 1% of GDP of public resources for R&D defined in the Science and Technology Policy 2006-2010.

Business R&D expenditures are low and continue to decrease. In 2010 the business sector investments in R&D have decreased in comparison to the previous year in absolute terms (from €155m in 2009 to €128m). In relative terms, R&D performed by business enterprise sector as a share of GERD increased from 40.44% of GERD in 2009 to 44.12% of GERD in 2010) mostly due to the significant decrease of total GERD. Total investments of business enterprises in R&D amounted to 0.32% of GDP (0.34% in 2009 and 0.39 % in 2008). Government budget appropriations or outlays on R&D — GBAORD amounted to €312m or 0.69% of GDP in 2010. The majority of GBAORD is spent on institutional funding of universities and Research

and Technology Organisations (RTOs). Approximately 10% is spent on grants for research and technology projects and approx. 3.6% is spent on international research cooperation.

Concerning the EU funding Croatia will become eligible for the structural funds like the European Regional Development Fund (ERDF) and European Social Fund (ESF) upon accession expected in July 2013. The innovations and research are financed mostly through Seventh Framework Programme (FP7), European Cooperation in Science and Technology (COST) and EUREKA programmes. The orientation towards Instrument for Pre-Accession assistance (IPA) IIIc programmes related to the regional development also has an important role in financing of research and innovation of large scale programmes and science – industry cooperation. The IPA programme currently includes the Science and Innovation Investment Fund (SIIF) and the Biosciences Technology Commercialisation and Incubation Centre – BIOCentre. The financial resources for SIIF amount to €5m while the BIOCentre is a greenfield investment of approximately €18m.

The key structural challenges of the system include:

- **The lack of strategic, coherent and integrated policy framework**

The development and adoption of the new policy remains to be done in the future. The key gaps that need to be addressed are related to creation of strategic development vision tightly based on national resources and related to policy implementation mechanisms. A structural deficiency is also a lack of coordination between different bodies responsible for innovation policy, as well as an inadequate planning and evaluation processes which are either underdeveloped or missing.

- **Business environment is not conducive to innovation**

Overall business environment creates disincentives to innovation. Its key features include inefficient state administration (sometimes prone to political voluntarism) at central and local levels, financial system dominated by banks (with relatively shallow and illiquid capital market), high costs of utilities and local services, widespread illiquidity, limited state support to innovation, and weak linkages between education sector and the labour market. Consequently, enterprises with more ambitious business strategies based on innovation and higher governance and competitiveness standards are likely to be burdened by high risks and costs.

- **Low technology capability and R&D expenditures of companies**

Innovation and R&D occupies a marginal role in the development strategies of the most of Croatian companies. Although the level of business R&D expenditures is higher than in some new EU member states, this performance is clearly insufficient. Innovations are mainly incremental and forced by survival on the domestic market than a result of meaningful and long lasting strategy for competition on international markets

- **Inadequate research performance and technology transfer mechanisms**

Knowledge production and circulation need to be significantly improved, in order to create preconditions to more effective innovation processes. The overall productivity of Croatian scientists was beyond the average productivity in the world (Podobnik and Biljaković, 2008). It decreases not only the technology transfer mechanisms but also threaten the research excellence

and the international recognition of the Croatian universities and science. Although the number of Seventh Framework Programme projects with Croatian participants is increasing, much more can be done. Both inward and outward mobility of researchers in Croatia is unsatisfactory.

- **Weak regional innovation systems**

Various national institutions collect and process data on innovation performance (primarily CBS). However, statistics are usually published as grouped indicators on a national level, which results in lack of data on sectoral or regional aspects of innovation performance. Still, on the basis of available evidence it can be concluded that regional innovation systems are weak. This is related to the overall centralisation of the country, as well as to limited role of regional actors (e.g. regional development agencies and academic institutions) in innovation policy. The role of universities as vehicles of regional development has so far been only partially recognized – partly due to the lack of university integration which would lead to a unified strategy and the development of common interfaces that would link university and its environment.

The strategic main goals of the strategic documents have not been achieved. With some exceptions (e.g. regional innovation systems), these priorities broadly correspond to the structural challenges outlined above. The main goals include:

- Increasing investment in research and development towards the "3% target" to overcome low investments in R&D; it assumed an increase in funding for R&D in both the private and public sectors at a rate of at least 25% annually and increase investments in private business to reach a 1:1 ratio of public vs. private sector investment in R&D by 2010;
- Reforming the Croatian science system in order to integrate research potentials and increase the efficiency since the management of scientific research at the RTOs is obsolete while universities suffer the functional and financial disintegration;
- Strengthening cooperation among science, government and industry when creating new knowledge and goods in order to increase the level of capitalisation of scientific research, to overcome weaknesses in the sectors of high technology and foster innovative SMEs;
- Increasing participation of Croatian scientists in the EU framework programmes since ERA is of growing significance for the national science policy and research projects financing.

Since 2001 Croatian government has introduced a plethora of new policy instruments that complement standard science policy and presents a policy mix to stimulate research and innovation. In the last three years the policy mix has mostly been stable. However, the effects of these measures on innovation and socio-economic development remain fairly modest, probably due to the overall framework conditions which do not favour research and innovation for development and growth. Besides, the aforementioned five structural challenges which hinder innovation are not appropriately addressed within the policy mix.

National policy mix is becoming increasingly aligned with the ERA pillars and objectives. However, more efforts need to be invested to address the strategic challenges outlined above and achieve further alignment with the ERA. Some of the

key challenges include increasing inward and outward mobility of researchers, increasing the proportion of researchers in the private sector, developing research infrastructures and securing their efficient utilisation, reforming research and higher education (through improved funding mechanisms, quality assurance, and accountability), developing science - industry collaboration and internationalisation.

Future developments could include the following suggestions:

- Developing the new science and technology policy and an action plan and monitoring their implementation on an annual basis;
- Performing regular evaluation of innovation policy (including the work of institutions which are responsible for policy implementation);
- Upgrade regional development strategies with regional innovation strategies;
- Analyse and redefine mechanisms of coordination between different government bodies (ministries, agencies, regional authorities etc.) responsible for socio-economic development in general and innovation policy in particular;
- Developing a platform for dialogue among researchers, policy-makers, business people, media, the general public and others concerned by innovation development.

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Introduction

Croatia is a small country on the Adriatic coast with population of 4.4 million inhabitants that accounts for less than 0.9% of the EU-27 population. The Croatian economy is the most developed in Southeast Europe, reaching €10,400 of GDP per capita in 2010 or 42% of GDP of the EU-27 average. After a sharp decline of GDP of 6% in 2009 due to global financial crisis and structural deficiencies of national economy, there is a trend of slight recovery in 2010, still marked by the decline of GDP (-1.2%). The recent parliamentary elections brought centre-left coalition into power instead the previous conservative one, as well as on the prospects of the full EU membership status. Croatia has signed the Accession treaty for the membership in the EU on 9th December, 2011 and it should become 28th member of the EU on 1st July 2013.

In 2010 the investments in research and development (R&D) have significantly decreased due to the stagnation of national economy during the last four years, which was additionally affected by the global financial and economic crisis. The total gross expenditures on R&D (GERD) in 2010 have reached its lowest level since 2000 and amounted to 0.73% of GDP (€330m). This is not only 36% of the EU-27 average in 2009 (2.01% of GDP), but also 0.69% of the national investments in 2004 of 1.05% of GDP.

Both public and business resources for R&D are low and decreasing. The public resources amounted to 0.4% of GDP in 2010 (€184m), which is a decrease compared to 2009 (€196m) and 2008 (€208m). This is also far from the national target of 1% of GDP of public resources for R&D defined in the Science and Technology Policy 2006-2010.

Business R&D expenditures are low and continue to decrease. In 2010 the business sector investments in R&D have decreased in comparison to the previous year in absolute terms (from €155m in 2009 to €128m). In relative terms, R&D performed by business enterprise sector as a share of GERD increased from 40.44% of GERD in 2009 to 44.12% of GERD in 2010) mostly due to the significant decrease of total GERD. Total investments of business enterprises in R&D amounted to 0.32% of GDP (0.34% in 2009 and 0.39 % in 2008). Government budget appropriations or outlays on R&D — GBAORD amounted to €312m or 0.69% of GDP in 2010. The majority of GBAORD is spent on institutional funding of universities and Research and Technology Organisations (RTOs). Approximately 10% is spent on grants for research and technology projects and approx. 3.6% is spent on international research cooperation. The share of resources from abroad has increased from 6.99% of GERD in 2009 to 9.99% of GERD in 2010. They are mostly coming from private business (82%) while EU funds contribute with 5.5%

Croatian scientific community consists of around 2,700 researchers per million inhabitants, which is 58% average in the EU-27 (4,600 researchers per million inhabitants). Researchers are mainly concentrated in the public research sector – universities and public research and technology organisations – RTOs (over 80%; 52% in HE and 29% in RTOs) while research sector in private businesses is underdeveloped and it employs only 19% of all researchers (CBS, 2010). A share of highly educated population has significantly increased and amounted to 17.2% in 2010, while the share of highly educated employees (aged 15-59 years) is 20%, which is close to the plan of 20% of persons with the tertiary degree by the year 2010

envisaged by the Education Sector Development Plan 2005-2010. In 2009 the number of tertiary graduates (ISCED 5-6) in science and technology per 1000 persons aged 20-29 years was 12.8 (almost double from 2003 when it was 5.6) but still lower than EU-27 (14.3).

Universities and their faculties have a large degree of autonomy lacking functional and financial integration that resulted in fragmented research infrastructure, which is primarily national in character and dominated by small research units and equipment.

The public research sector consists of seven universities, 14 public and 18 private polytechnic and professional higher education institutions, three academies and 26 public institutes. It also includes about fifty "other" public research institutions such as the Croatian Academy of Arts and Sciences or research units within health care institutions. The business research sector includes 13 private scientific institutions, six of which are in-house institutes affiliated with large industrial corporations, while remaining are research institutes that operate independently in the market. The majority of human resources are concentrated at the University of Zagreb (around half of all researchers and university teachers). The University of Zagreb is the first university from Croatia listed at Shanghai ranking in August 2011.

Some studies (Podobnik and Biljaković, 2008) have revealed that the overall productivity of Croatian scientists was beyond the average productivity in the world. According to the [SCImago](#) Journal and Country Ranking of 234 countries, Croatia was ranked at 48th place by the H-index¹ and at 195th place by citations per document.

The exploitation of scientific results in the economy is rather low as well as the cooperation of science and industry. The main reasons are the low absorption capacities of the business sector and the dominance of the low-tech sectors in the economy structure.

The patent applications are noticeably low compared to the EU-27 average. In 2005 Croatia has registered a small number of patent applications to the European Patent Office (EPO), only 6.65 per million inhabitants, while the EU-27 average is 105.95.

The three largest export industries are textiles, chemicals and electrical and optical equipment, while technology oriented industries are missing. Service sector is very important since it makes 60% of GVA (Gross Value Added) and employs more than 60% of workforce. It is dominated by tourism which also makes a half of total exports. FDI have not brought new technologies since the majority of FDI is realized in wholesale trade and commission trade followed by financial intermediation trade. R&D in business sector is concentrated in a few large companies like PLIVA and GlaxoSmithKline (pharmaceuticals), Ericsson-Tesla Institute, (telecommunication) Podravka (food industry) and Končar–Electrotechnical Institute. The highest potential in commercialisation of basic science can be identified in biomedicine and life sciences.

The pillar institutions of the Croatian science and innovation system are the Ministry of Science, Education and Sports (MSES), Ministry of Economy and Ministry of Entrepreneurship and Crafts. The latter two ministries, together with the Ministry of Labour and Pension System, are new ministries, established in December 2011. The former Ministry of Economy, Labour and Entrepreneurship ceased to exist by decision of the new Government, and its scope of work was divided between three

¹ H-index quantifies both the scientific productivity and the scientific impact of a journals

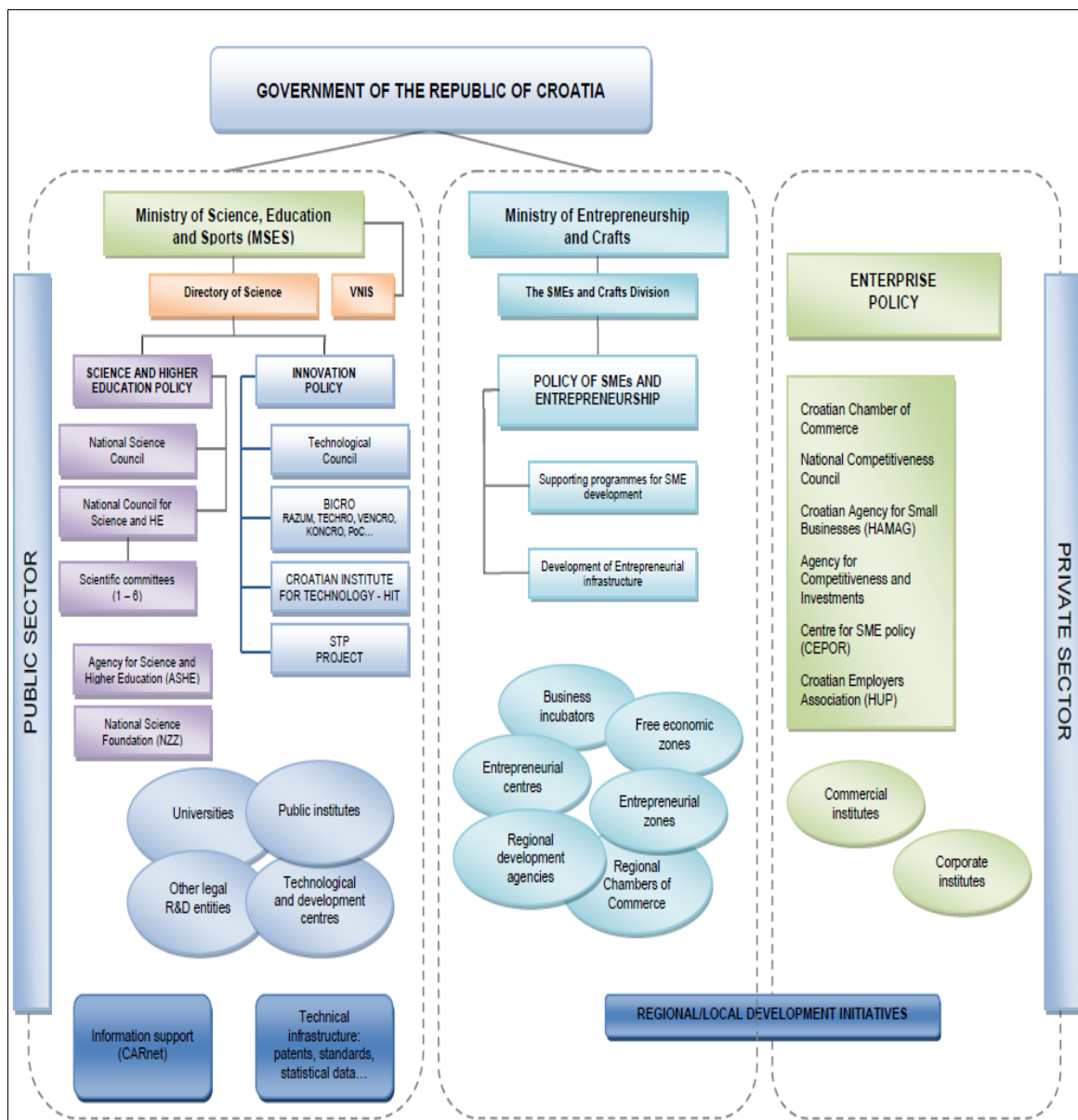
new ministries. The MSES is responsible for the entire research and higher education system, and innovation policy in terms of science-industry cooperation and commercial exploitation of research. Ministry of Economy is responsible for competitiveness of the Croatian economy, industrial policy, policy of application of innovation and new technologies, application and usage of intellectual and industrial property rights. Ministry of Entrepreneurship and Crafts has somewhat similar scope of work as MoE, with emphasis on small and medium-sized entrepreneurship and concrete support measures. The scope of work includes fostering SME competitiveness, fostering application of innovations and new technologies, development of business infrastructure for SMEs, etc.

Policy formulation and implementation include the National Council for Science (NCS) and the National Council for Higher Education (NCHE) which are the highest advisory bodies in their respective fields. The Agency for Science and Higher Education (ASHE) is responsible for setting up a national network for quality assurance in science and higher education. The Strategic Council for Science and Technology (SVEZNATE) and the National Innovation System Council of MSES (VNIS) have been established to coordinate research and innovation policy but they are not fully functional.

The main financial bodies are the Croatian Science Foundation (CSF), the Business Innovation Agency of Croatia (BICRO), the Croatian Institute for Technology (HIT), the Unity through Knowledge Fund (UKF) and the Science and Innovation Investment Fund (SIIF).

The role of science and research as vehicles of regional development has not been strongly and adequately articulated. However, in 2010 Croatia's Government adopted the Strategy of Regional Development 2011-2013 which also includes policy measures related to the research and innovation policy by NUTS 2 and NUTS 3 level. The greatest impetus to regional development is provided by the Instrument for Pre-Accession assistance programme (IPA), component IIIc focused on development of entrepreneurship and innovation.

Figure 1: Overview of the Croatian research and innovation system



Structural challenges faced by the national system

1. The lack of strategic, coherent and integrated policy framework

In recent years innovation policy framework in Croatia has not been adequately improved or revised. The Science and Technology Policy of the Republic of Croatia 2006 – 2010 expired, with most of its objectives remaining unfulfilled. Moreover, the development and adoption of the new policy remains to be done in the future. The key gaps that need to be addressed are related to creation of strategic development vision tightly based on national resources and related to policy implementation mechanisms. The latter should be further developed and/or simplified for final beneficiaries. A structural deficiency is also a lack of coordination between different bodies responsible for innovation policy, as well as an inadequate planning and evaluation processes which are either underdeveloped or missing. Consequently, future developments could include the following suggestions:

- Developing the new science and technology policy and an action plan and monitoring their implementation on an annual basis;
- Performing regular evaluation of innovation policy (including the work of institutions which are responsible for policy implementation);
- Upgrade regional development strategies with regional innovation strategies;
- Analyse and redefine mechanisms of coordination between different government bodies (ministries, agencies, regional authorities etc.) responsible for socio-economic development in general and innovation policy in particular;
- Developing a platform for dialogue among researchers, policy-makers, business people, media, the general public and others concerned by innovation development.

2. Business environment is not conducive to innovation

Overall business environment creates disincentives to innovation. Its key features include inefficient state administration (sometimes prone to political voluntarism) at central and local levels, financial system dominated by banks (with relatively shallow and illiquid capital market), high costs of utilities and local services, widespread illiquidity, limited state support to innovation and weak linkages between education sector and the labour market. Consequently, enterprises with more ambitious business strategies based on innovation and higher governance and competitiveness standards are likely to be burdened by high risks and costs. Weak response of the former government to the economic and financial crisis also entailed postponement of structural reforms – which are likely to be undertaken by the new government. This has further decreased the quality of the business environment. The current trends are likely to have negative effects on innovation activities in the medium term, as companies struggle with low demand and liquidity problems and are forced to cut costs and lay some workers off. Therefore, the main structural challenge is to ensure the fundamental economic conditions conducive to innovation-based competitive and economic growth. The policies for fostering innovation and science – industry cooperation cannot work without fundamental business prerogatives like openness to FDI, transparency and stable fiscal environment. Therefore the efforts for well-functioning business environment of economic and social institutions should be reaffirmed.

3. Low technology capability and R&D expenditures of companies

One of the key issues in the Croatian innovation system is a low level of business R&D expenditures, which is reflected in insufficient innovation performance. Although innovation may be performed even with low R&D budgets (especially in the case of incremental and process innovations), this is often difficult to achieve, as the data on innovation outputs (e.g. CIS survey) demonstrate. Innovation and R&D occupy a marginal role in the development strategies of the most of Croatian companies. Although the level of business R&D expenditures is higher than in some new EU member states, this performance is clearly insufficient. Innovations are mainly incremental and forced by survival on the domestic market rather than a result of meaningful and long lasting strategy for competition on international markets.

The challenge is, therefore, to re-vitalise research and innovation activities in both industrial (manufacturing) and service sector with a view of upgrading technological capabilities of companies towards higher technological capacities. A new national innovative and ecological (“green”) industrial policy should be envisaged taking into account production and skills abilities of the workforce. Government support should focus not only on low and medium innovations which is now the case but also should support areas with high social and economic benefits that push out the technological frontiers.

4. Inadequate research performance and technology transfer mechanisms

Knowledge production and circulation need to be significantly improved, in order to create preconditions to more effective innovation processes. The investment in R&D in Croatia is rather modest and stagnant, both in public and private sector. The role of universities in economic development is weak while the overall productivity of Croatian scientists (mainly concentrated in universities) was beyond the average productivity in the world (Podobnik and Biljakoviæ, 2008). It decreases not only the technology transfer mechanisms but also threatens the research excellence and the international recognition of the Croatian universities and science. Both inward and outward mobility of researchers in Croatia is unsatisfactory.

Although the number of Seventh Framework Programme projects with Croatian participants is increasing, much more can be done. By the end of 2011 total of 203 Croatian subjects have participated in 165 FP7 projects and contracted €36.65 mil.€. In the same period (Jan 2007 – Dec. 2011) Croatia has contributed with €25,7m for its participation in FP7 (€14m out of those €25.7 came from IPA and PHARE funds and the rest from the State Budget). Therefore, in the first five years of FP7 Croatian participants have contracted €1.42 for each 1€ contributed to the FP7 budget.

These trends call for reforms of the universities, especially in terms of financial and functional integration and new models of institutional funding of both universities and public research organisations based on objective and independent evaluation. Although the reforms of the entire research and higher education sectors have been initiated and quality assurance system of RTOs and university departments have been implemented², the standard practice of funding and fostering science excellence have not significantly changed. Therefore, the main challenge is to overcome a stalemate in reforming the research and higher education sector and strength international cooperation that is a key factor of scientific merits and excellence.

5. Weak regional innovation systems

Various national institutions collect and process data on innovation performance (primarily CBS). However, statistics are usually published as aggregate indicators on the national level, which results in a lack of data on sectoral or regional aspects of innovation performance. Still, on the basis of available evidence it can be concluded that regional innovation systems are weak. This is related to the overall centralisation of the country, as well as to limited role of regional actors (e.g. regional development agencies and academic institutions) in innovation policy. The role of universities as vehicles of regional development has so far been only partially recognized – partly due to the lack of university integration which would lead to a unified strategy and the development of common interfaces that would link university and its environment. A more systematic and coherent approach to regional policy is needed, which will enable the development of policies to address regional labor markets, entrepreneurship, industrial structures, foreign direct investments and, correspondingly, regional innovation systems. The key instrument for regional development – the IPA programme should be used more intensively.

Assessment of the national innovation strategy

National research and innovation priorities

The main strategic documents for the national socio-economic development in general and scientific, higher education and innovation system in particular, were mainly created in the period 2006-2008. The current period is rather stagnant regarding policy developments in science and innovation, as well as in

² Evaluations of research institutions have been carried out by the Agency for Science and Higher Education since 2007.

strategic visions research priorities. One of the reasons is that Croatia has been affected by the worst economic crisis in the last two decades and is faced with many uncertainties and strategic ambiguities to define secure policies and priorities. The most recent strategic document is the Economic Recovery Programme adopted by the Croatian Government in April 2010. Among ten priority areas, it has defined 15 important goals for reforming science and education (e.g. harmonisation of education with labour market, fostering education in engineering and math, consolidation of universities, enlargement of RTOs, state graduation, etc.) which are accomplished to a small extent.

In the context of the economic crisis, the policy debates related to innovation and science have been scarce. Therefore, the mid-term policy documents like "Strategic Development Framework 2006–2013" (SDF) and the "Strategic Coherence Framework 2007-2013" (SCF) are still the main strategic documents for the overall development. Due to the process of European integration, the Pre-accession Economic Programme³ is produced each year to assess the economic progress and needs for improvements. These documents replace the "National Reform Programme" since Croatia is obliged to produce them as a candidate country. The documents define ten priority areas for the forthcoming period. Among others, knowledge, education, science and information technologies have a prominent role.

Despite the expiration of the "Science and Technology Policy 2006 – 2010" and related documents ("Action plan for the implementation of the science and technology policy 2007-2010" and the "Action Plan to Encourage Investments in Science and Research"), no new strategic documents have been developed to replace them.

The main goals of these documents have not been achieved and implemented. The main goals were defined, as follows:

1. Increase investment in research and development towards the "3% target" to overcome low investments in R&D (0.76% of GDP in 2006); it assumes an increase in funding for R&D in both the private and public sectors at a rate of at least 25% annually; increase investments in private business to reach a 1:1 ratio of public vs. private sector investment in R&D by 2010;
2. Reform the Croatian science system in order to integrate research potentials and increase the efficiency since the management of scientific research at the RTO is obsolete while universities suffer the functional and financial disintegration;
3. Strengthen cooperation among science, government and industry when creating new knowledge and goods in order to increase the level of capitalisation of scientific research, to overcome weaknesses in the sectors of high technology and foster innovative SMEs;
4. Increase participation of Croatian scientists in EU framework programmes since ERA is of growing significance for the national science policy and financing of research projects.

Although the investment plan for R&D (e.g. 3% of GDP) is mainly understood as the motivational factor than realistic strategic goal, its implementation turned out to be more distant today than in 2006, since the GERD in 2010 is lower than in 2006 (0.73% of GDP vs. 0.76% in 2006). The BERD has slightly increased from 0.28% of GDP in 2006 to 0.32% of GDP in 2010 but the public – private ratio has not changed and amounts to 60:40 per cent in favour of public sector. Some additional targets defined by the "Action Plan to encourage investments in science and research" such as 10% annual increase for GERD, 15% annual increase of BERD, 20% annual increase of value of R&D contracts between science and industry, have also not been accomplished.

The "Science and Technology policy 2006-2010" recognises the research priorities in biotechnology, new synthetic materials and nanotechnologies as well as in the nation-specific research themes such as understanding of humanity and national identity or preservation of natural wealth and cultural heritage. However, no calls for thematic priorities have been launched since science policy is still focused on horizontal measures in order to support harmonised development of all scientific disciplines. The structural challenges identified in the previous chapter have not been tackled in systematic way and formulated as national research priorities or special programmes. Instead, some topics like basic

³ <http://www.mfin.hr/adminmax/docs/2010%20-%20Pre-Accession%20Economic%20Programme.pdf>

economic deficiencies, technological capabilities of companies, etc. are regular subjects of individual research projects.

The global and societal challenges related to the fresh and sea waters, soil, agriculture, air and climate change are addressed in Croatia by Croatian Environment Agency. The ageing of the society is a topic of many projects related to demographic studies and reforms of pension system. The new Energy Strategy of Croatia adopted in June 2009 fully recognised the EU climate and energy targets by 2020, known as the "20-20-20" targets. Generally, there is lack of specialised research programmes aimed at major national and global societal changes. However, within the SEE-ERA.NET PLUS programme the two societal challenges - ICT and food – are selected for financing by the Joint call for European research projects in the period 2009-2013.

The most progress is accomplished in regional development due to the IPA programme III c aimed at regional development and competitiveness. Act of the Croatian Regional Development was adopted in September 2009.

In terms of reforming the science and higher education system the new management staff of the MSES established after the general election in December 2011 has withdrawn from the parliamentary procedure the proposals of the three laws initiated by the previous Government: the Law on Science, the Law on Universities and the Law on Higher Education. Instead, the new Government has proposed a Draft law amending the Law on Science and Higher Education from 2003, which is currently in the process of public debate. Since one of the main criticisms concerned the lack of strategy that would provide the framework and rationale for the proposed bills, the new Government has initiated the "National Strategy for the Croatian innovation development 2013-2020". The Memorandum of understanding and cooperation with the OECD experts who should carry out the Strategy was signed on 9th May, 2012.

The main challenges of policy making in the period 2009-2011 were focused on international mobility of researchers and their participation in the EU Framework programmes, which is estimated as rather low and unsatisfying. Several action plans are adopted within this framework: Action plan for overcoming obstacles and enhancing international mobility in education for the period 2010-2012⁴, Action plan for mobility of researchers 2009 – 2010 and Action plan for mobility of researchers 2011 – 2012⁵) The main goals are twofold: (1) removing the obstacles for inward and outward mobility of researchers and (2) increasing the international and inter-sectoral mobility. Measures within these two goals include: (1) Employment of foreign researchers on science and science-educational working places; (2) Enhancement of working conditions for researchers; (3) Regulation of residence for the purpose of scientific research; (4) Further development of infrastructure for mobility of researchers; (5) Encouraging inter-sectoral mobility of researchers, and (6) Strengthening the researchers' competences.

Trends in R&D funding

Table 1: Basic indicators for R&D investments in Albania

| | 2008 | 2009 | 2010 | EU average 2010 |
|---------------------------|---------|---------|---------|-----------------|
| GDP growth rate | 2.2. | -6.0 | -1.2 | 2,0 |
| GERD as % of GDP | 0.89 | 0.83 | 0.73 | 2.0 |
| GERD per capita | 95.9 | 85.8 | 75.7 | 490.2 |
| GBAORD (€ million) | 313,93 | 312,446 | 311,863 | 92,729.05 |
| GBAORD as % of GDP | 0.66 | 0.68 | 0.68 | 0.76 |
| BERD (€ million) | 188,472 | 153,861 | 147,791 | 151,125.56 |

⁴ <http://public.mzos.hr/Default.aspx?sec=2510>

⁵ <http://public.mzos.hr/Default.aspx?sec=2127>

| | | | 2008 | 2009 | 2010 | EU average 2010 |
|---|-------|-------|-------|------|------------------|--------------------|
| BERD as % of GDP | 0.39 | 0.34 | 0.32 | | 1.23 | |
| GERD financed by abroad as % of total GERD | 7.82 | 6.99 | 9.99 | | N/A ⁶ | |
| R&D performed by HEIs (% of GERD) | 30.34 | 32.28 | 28.27 | | 24.2 | |
| R&D performed by PROs (% of GERD) | 25.23 | 27.16 | 27.48 | | 13.2 | |
| R&D performed by Business Enterprise sector (as % of GERD) | 44.32 | 40.44 | 44.12 | | 61.5 | |

In 2010 the investments in research and development (R&D) have significantly decreased due to the stagnation of national economy during the last four years, which was additionally affected by the global financial and economic crisis. The total gross expenditures on R&D (GERD) in 2010 have reached its lowest level since 2000 and amounted to 0.73% of GDP (€330m). This is not only 36% of the EU-27 average in 2009 (2.01% of GDP), but also 0.69% of the national investments in 2004 of 1.05% of GDP.

Both public and business resources for R&D are low and decreasing. The public resources amounted to 0.4% of GDP in 2010 (€184m), which is a decrease compared to 2009 (€196m) and 2008 (€208m). This is also far from the national target of 1% of GDP of public resources for R&D defined in the Science and Technology Policy 2006-2010.

Business R&D expenditures are low and continue to decrease. In 2010 the business sector investments in R&D have decreased in comparison to the previous year in absolute terms (from €155m in 2009 to €128m). In relative terms, R&D performed by business enterprise sector as a share of GERD increased from 40.44% of GERD in 2009 to 44.12% of GERD in 2010) mostly due to the significant decrease of total GERD. Total investments of business enterprises in R&D amounted to 0.32% of GDP (0.34% in 2009 and 0.39% in 2008). Government budget appropriations or outlays on R&D — GBAORD amounted to €312m or 0.69% of GDP in 2010. The majority of GBAORD is spent on institutional funding of universities and Research and Technology Organisations (RTOs). Approximately 10% is spent on grants for research and technology projects and approx. 3.6% is spent on international research cooperation. The share of resources from abroad has increased from 6.99% of GERD in 2009 to 9.99% of GERD in 2010. They are mostly coming from private business (82%) while EU funds contribute with 5.5%

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Due to the economic crisis and budget deficits, the MSES carried out the evaluation of projects financed from the State budget and reduce already scarce public resources. The funding for about 10% of projects has been terminated while 52% of projects received reduced financing. The remaining 40% of projects are funded in the same amount because they achieved good results.

The financial crisis mostly threatened the PhD students with a status of young researchers whose scholarships have been temporarily abolished. Besides, the contracts for permanent position usually provided to them after completion of their PhD have not been issued in many cases exposing young doctors of science to the dysfunctional labour market and high unemployment rate.

MSES has also temporarily suspended the financing of activities on FP and financial incentives for scientific excellence

The current funding mechanisms include both subsidies (competitive research grants, institutional funding) and indirect funding (e.g. tax incentives). The institutional funding including salaries for researchers makes the substantial part of R&D funding while the share of competitive grants is much lower. The balance between these funding mechanism has not be changed significantly in the last three years since the total amount for both institutional and competitive research grants have been shrunk as well as business investments for contract research.

⁶ 8.4 (2009), 9.04 (2005)

However, the financial crisis brought a revocation of most tax incentives to companies. Policy measures include the tax incentives for subjects of the Law on Profit Tax – based on eligible project costs. The recent analysis (Aralica et al., 2011) reveals that tax incentives are more generous form of state aid for R&D than subsidies. Namely, several large business R&D performers claim tax incentives that exceed the overall public R&D subsidies. Evidence can be found in corporate financial reports. For example, in 2009 subsidies amounted to less than a third of aid granted by the tax incentives. Although over 270 companies used tax incentives, 90% of the total tax incentives were realized by a small number of companies: 9 in 2008 and 27 in 2009. This indicates that the a few companies conduct large research projects and the concentration of tax incentives into the small number of users is present. However, tax incentives have proven to be of large assistance to companies and have the effects of increasing the investments of companies in R&D.

The share of collaborative funding is small and involves a few specialized programmes for science-industry cooperation managed by the BICRO and the Croatian Science Foundation.

GBAORD amounted in 2010 to €312m or 0.69% of GDP. The majority of GBAORD is spent for institutional funding of universities and RTOs. Around 10% is spent on grants for research and technological projects and around 3.6% is spent on international research cooperation.

In the period June 2009 – June 2011, the budgets for research and innovation have significantly decreased. In addition, some foreign financial resources like the World Bank loan within the Science and Technology project have reached the planned end date and no new plans are currently established for continuation.

Public-private partnerships still have no significant effect on innovation funding in Croatia. However, this form of financing is gradually becoming the first choice for financing of (e.g. science/technology parks), and is expected to gain importance in innovation financing also.

Concerning the EU funding Croatia will become eligible for the structural funds like the European Regional Development Fund (ERDF) and European Social Fund (ESF) upon accession expected in July 2013. The innovations and research are financed mostly through Seventh Framework Programme (FP7), European Cooperation in Science and Technology (COST) and EUREKA programmes. The orientation towards Instrument for Pre-Accession assistance (IPA) IIIc programmes related to the regional development also has an important role in financing of research and innovation of large scale programmes and science – industry cooperation. The IPA programme currently includes the Science and Innovation Investment Fund (SIIF) and the Biosciences Technology Commercialisation and Incubation Centre – BIOCcentre. The financial resources for SIIF amount to €5m while the BIOCcentre is a greenfield investment of approximately €18m.

The new EU Framework Programme for Research and Innovation – Horizon 2020 is expected to run from 2014 to 2020. Within the public consultation process which led to the Horizon 2020, the Croatian Government issued the Position on Green Paper “From Challenges to Opportunities: Towards a Common Strategic Framework for EU Research and Innovation Funding”, with recommendations that should be included in the Framework Programme. Main recommendations include the following:

- simplification of the programme’s administrative and financial procedures, in order to ease the procedures for the beneficiaries;
- rather than funding large-scale projects exclusively, small to medium-scale cooperative projects should be retained in order not to exclude smaller actors;
- preservation of bottom-up funding to balance out top-down activities;
- emphasis on human resources should be maintained through continued implementation of Marie Curie Actions;
- COS and EUREKA programmes should supplement the new strategic framework, but their roles should be made clear, their activities should not overlap and should be mutually supportive;
- with reference to the increasing number of initiatives and bodies related to the ERA, it is essential to clearly define mandates of each individual body and ensure that their work is complementary and not overlapping;

- more focus should be placed on research output and uptake, contributing more broadly and significantly to innovation, competitiveness, growth, social cohesion and sustainable development;
- creation of synergies with other instruments, programmes and policies;
- international cooperation with third countries and opening up the ERA to the rest of the world;
- the results and outcomes of EU funding should be made more visible and presented to the public.

Evolution and analysis of the policy mixes

Since 2001 the Croatian government has introduced a plethora of new policy instruments that complements standard science policy and today presents a policy mix to stimulate research in innovation. It can be divided in the following categories:

- Policy measures for national scientific excellence which include public programmes for competitive research grants, institutional funding, support for young researchers (PhD students), introduction of a quality assurance system and accreditation of RTOs and university departments, etc.;
- Policy measures for mobility that addresses the international inward and outward mobility of researchers (e.g. "Brain Gain" programme of CSF, EUROAXESS portal) and attracting Croatian scientific Diaspora while the inter-sectoral mobility between science and industry is quite deficient.;
- Science – industry cooperation measures include different programmes like Technology oriented projects (TEST) managed by the HIT, Collaborative research development (IRCRO) managed by the BICRO, newly established "Science and Innovation Investment Fund" developed under the IPA;
- Fiscal measures encourage private companies to invest in R&D following the Law on profit tax based on eligible project costs. Since 2007 it turned out to be an important incentive instrument for companies and total amount greatly exceeds subsidies for R&D to invest;
- Measures aimed at the innovation-based companies involve mainly BICRO's programmes, like RAZUM (Development of the knowledge-based companies), KONCRO programme (Competitiveness and technology process advancement) and Proof of Concept (PoC);
- Measures aimed at technology and innovation infrastructure include the TECHRO programme of BICRO aimed at development the infrastructure for science – industry cooperation like technology parks, transfer centres, etc. and the supporting programmes of the Ministry Entrepreneurship and Crafts for innovation infrastructure like of entrepreneurial zones, business incubation centres, development agencies, clusters, etc.;
- Measures for the development of the venture capital include a single programme "VENCRO" run by the BICRO which is still not in a full function.

Unfortunately, the effects of these measures on innovation and socio-economic development remain fairly modest, probably due to the overall framework conditions which do not favour research and innovation for development and growth. Besides, the aforementioned five structural challenges (see Chapter 2) which hinder innovation are not appropriately addressed within the policy mix.

If we take into account the Self-assessment tool of the Innovation Union Flagship initiative (EC, 2010) that consist of the ten features for well-functioning of the national innovation system, the performance of the Croatian Innovation system is largely unsatisfactory.

Research and innovation are not considered as key drivers of the competitiveness and job creation. They are pushed to the margins of other priorities such as budget deficits, wage insurance and pensions, European integration, agricultural policy, fight against corruption, etc. The policy debates about the role of innovation are underestimated in policy circles and often restricted to academic and professional communities. This is due to the low awareness of political and business elites about the critical role of innovation and insufficient communication among key innovation stakeholders about knowledge-based

strategic development and visions. Many administrative burdens and pointless regulation hinder innovation in the companies.

The formal infrastructure for steering innovation and research development at the highest political levels has been in place since 2008 when the Strategic Council for Science and Technology (SVEZNATE) and the National Innovation System Council of MSES (VNIS) were established. The bodies are established to intensify inter-governmental cooperation in planning and monitoring science and innovation policy but up to now they have not appeared as active stakeholders in innovation policy.

The public sector itself is not a driver of innovation while the public demand and procurement policies are not usual practice for fostering innovation and advanced technologies. The biggest progress was made by establishing the e-healthcare system which has simplified various administrative and medical procedures.

The concept and role of social innovation in Croatia, even within the research community is not widely recognized and acknowledged. The main probable reason is the novelty of the concept that emerged as a field of research in the 2011 Work Program in the Thematic Program Social Sciences and Humanities of the FP7 (Hochgerner, 2011).

The research on social innovation in Croatia mainly addresses (although not under this label) the topics of social policy issues, income and social inequalities, skill levels, education, health protection, vulnerable groups, poverty, homeless people, ageing in terms of demographic research, unemployment, socio-cultural and religious aspects of changing family life, etc.

The trends in R&D funding (Chapter 3.2) reveals that public investments in research and innovation is fairly small but steady and have worryingly downward trends. Research and innovation are not only constantly under-invested (below 1% of GDP) but further budget restrictions and financial crisis threaten the maintenance of the national knowledge base, professional expertise and education. The out dated economic model based on defensive inter-sectoral restructuring, imports of goods, domestic market consumption, low-tech/cost FDI and long-term state borrowing, does not provide incentive framework for private investments in R&D and innovation. Private sector investment in innovation is probably the biggest challenge for efficient innovation policy in addition to the lack of strategic development visions. Public support to research and business is difficult to gain. Despite, there is a thin layer of export oriented companies to which innovation is a critical factor for survival and expansion that should serve as a model for innovation development.

It is commonly perceived that the needs of the labour market are not systematically assessed by the university education. There is large inertia in setting up enrolment quotas for programmes with higher employability rates, especially with respect to the portion of students financed by public resources.

Proportion of people with a postsecondary education degree in the active labour force (age 25-65) is rather low (15.2%). By contrast, over 95% of youth in Croatia (aged 20-24) completed some kind of upper secondary school (EU-27 average is 79%) and need incentives for higher education and perspectives for employment.

Fostering the excellence of RTOs and higher education has officially come into force by introduction of the quality assurance system managed by the Agency for science and higher education in 2007. Unfortunately, due to the scarce financial resources which allows primarily operational funding of organisations (per capita investment in research is around 18% of EU-27 average) and the lack of diversified research funds the results of evaluation are not yet used as an instrument for fostering scientific excellence (e.g. via institutional funding).

Assessment of the policy mix

Table 2: Policy measures and assessments

| Challenges | Policy measures/actions ⁷ | Assessment in terms of appropriateness, efficiency and effectiveness |
|------------|--------------------------------------|--|
|------------|--------------------------------------|--|

⁷ Changes in the legislation and other initiatives not necessarily related with funding are also included.

| Challenges | Policy measures/actions ⁷ | Assessment in terms of appropriateness, efficiency and effectiveness |
|---|--|--|
| 1. The lack of strategic, coherent and integrated policy framework | <p>New science and technology policy is being planned.</p> <p>EU accession and implementation of regional (NUTS 3) development strategies for the period 2011 - 2013 provide some stimuli to innovation policy development.</p> <p>The programme of the new government is expected to include improvements in innovation policy development and implementation.</p> | <p>The former Science and Technology Policy 2006 – 2010 was not implemented in an adequate way, despite its expiration in 2010. The new government elected in December 2011 has initiated the development of new strategic documents: the Guidelines for strategy of teaching, education, science and technology</p> <p>The Memorandum of understanding and cooperation between MSES and OECD, signed on 9th May, 2012, marked the beginning of carrying out the new "National Strategy for the Croatian innovation development 2013-2020".</p> <p>However, the improvements in regional development policies and EU accession have had a beneficial effect on policy framework. Regional innovation actors have become more coordinated than in the past. However, it is too early to assess efficiency and effectiveness of these developments.</p> |
| 2. Business environment is not conducive to innovation | <p>State administration reform has been initiated but it has progressed very slowly.</p> <p>Anti-corruption activities have improved the quality of business environment.</p> <p>Government attempted to fill in the gaps in the availability of credit and equity financing (through programmes of the Croatian Bank for Reconstruction and Development and co-financing of equity Funds for Economic Cooperation).</p> <p>The Draft law amending the Law on Science and Higher Education from 2003 has been initiated by the new Government elected in December 2011 to reform the science and higher education sectors.</p> | <p>Due to the complexity of business environment, policy response needs to be comprehensive and coordinated. In the case of Croatia, policy response has been fragmented and partial. Consequently, it has not reached the required level of appropriateness, effectiveness and efficiency.</p> <p>State administration reform and further anti-corruption efforts remain as important task for the new government.</p> <p>The availability of credit and equity financing for innovation is still insufficient.</p> <p>Reform of science and higher education sectors has not been adequately prepared and discussed.</p> |

| Challenges | Policy measures/actions ⁷ | Assessment in terms of appropriateness, efficiency and effectiveness |
|--|---|--|
| 3. Low technology capability and R&D expenditures of companies | <p>Key innovation policy measures (e.g. Proof of Concept, IRCRO, RAZUM) aim to increase R&D and technology capability.</p> <p>Tax exemptions have been introduced in order to facilitate R&D expenditures in companies.</p> | <p>The policy measures in this domain have been appropriately designed. Exploratory research related to RAZUM and IRCRO undertaken by the Institute of Economics indicates that these measures contribute to increases in R&D activities. Effectiveness of policy measures is constrained by their limited budgets.</p> <p>Tax exemptions are mostly claimed by medium-sized and larger companies, as it has been demonstrated by the Institute of Economics. This measure is appropriate, efficient and effective. It been particularly important for international competitiveness of several Croatian subsidiaries of transnational corporations. Tax exemptions are conducive to their parent companies allocating their R&D budgets to Croatia.</p> |
| 4. Inadequate research performance and technology transfer mechanisms | <p>Research performance can only be facilitated indirectly. Internal and external quality assurance mechanisms are being developed through activities of the Agency for Science and Higher Education. Increases in available resources are constrained by budgetary issues.</p> <p>Technology transfer institutions and mechanisms are being facilitated through Science and Innovation Investment Fund. Intellectual property rights regime at universities is not sufficiently regulated.</p> | <p>Policy response to this structural challenge needs to be improved, but this can only be done through a comprehensive reform of science and higher education sectors.</p> <p>The key areas of potential improvements include internal quality assurance mechanisms, and university integration and development of new institutional funding for both universities and public research organisations.</p> <p>Underdeveloped intellectual property rights regime and fragmented support to technology transfer through Science and Innovation Investment Fund are unlikely to bring about efficient improvements.</p> <p>Science and Innovation Investment Fund is only one mechanism for the facilitation of the Technology Transfer institutions and mechanisms. Technology transfer Institutions and mechanisms have been facilitated through variety of sources (both international and domestic). However, their level of funding is inadequate to achieve satisfactory results.</p> <p>Examples of financial sources for technology transfer are World Bank S&T project (Rudjer Innovations), IPA (Science and Innovation Investment Fund), European Enterprise Network (Former Component B – Technology Transfer (BICRO), state budget (BICRO, HIT), internal funds of Universities etc.</p> <p>Labour Act on the national level established a basic set of rules for dealing with employee inventions and technical advancements, while Copyright and Related Rights Act establish rules for dealing with employee copyright issues. These rules consequently apply to all University employees.</p> |

| Challenges | Policy measures/actions ⁷ | Assessment in terms of appropriateness, efficiency and effectiveness |
|---|---|---|
| <p>5. Weak regional innovation systems</p> | <p>Regional development strategies (at NUTS 3 level) for the period 2011 - 2013 include measures related to research and innovation - usually through enterprise development, science-industry cooperation and development of technology infrastructure.</p> <p>Some national innovation policy measures (e.g. Proof of Concept) are implemented at the regional level.</p> <p>Analysis of regional labour market has been undertaken in late 2010 by the Croatian Employment Office.</p> <p>The Network of Higher Education Institutions was defined in 2011 by the National Council for Higher Education.</p> | <p>The current policy measures are appropriate, but are in an early stage of implementation. It is likely that these measures will be insufficient to facilitate a stronger development of regional innovation systems.</p> |

National policy and the European perspective

National policy mix is becoming increasingly aligned with ERA pillars and objectives. However, more efforts need to be taken in order to address the strategic challenges outlined above and achieve further alignment with the ERA. Some of the key challenges include increasing inward and outward mobility of researchers, increasing the proportion of researchers in the private sector, developing research infrastructures and securing their efficient utilisation, reforming research and higher education (through improved funding mechanisms, quality assurance, and accountability), developing science – industry collaboration and internationalisation.

Table 3: Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

| | ERA dimension | Main challenges at national level | Recent policy changes |
|---|---|--|--|
| 1 | Labour Market for Researchers | <p>Remove barriers for employment of foreign researchers in Croatia;</p> <p>Make the labour market for researchers into function by overcoming concentration of researchers in the public sector (80%) and by strengthening weak research workforce in the private sector (only 22% of the EU average (0.13% in Croatia versus 0.62% in the EU-27); Harmonise educational programmes with market needs</p> | <p>The participation of foreign scientists in research programmes in Croatia was simplified in 2008 with the adoption of the Ordinance on Determining the Requirements for Granting Temporary Residence to Foreigners for the Purpose of Scientific Research (Official Gazette No. 42/08).</p> <p>By October 2010, 32 institutions included in Croatia's education system had signed the Declaration of Commitment to the Principles of the European Charter for Researchers</p> <p>The MSES established in 2009 the Committee for the Hosting Foreign Researchers in Croatia to assist the process of hosting foreign researchers</p> <p>The Ordinance on the registry of scientists with regard to the registration of foreigners have been relaxed since the Croatian citizenship will no longer be required for registration</p> |
| 2 | Cross-border cooperation | <p>Strengthen Croatian participation in the European cross-border cooperation like HERA, SEE-ERA NET-PLUS and assure financial means for such cooperation; use the IPA funds for cross-border cooperation</p> | <p>There have been no recent policy changes.</p> |
| 3 | World class research infrastructures | <p>Strength and enlarge participation of Croatia in ESFRI initiatives (like DARIAH, CLARIN, ESS) and research infrastructures (like CERN, EMBL);</p> <p>Make a national roadmap in the field of research infrastructures; involve IPA and FP funds in establishing large infrastructure in Croatia;</p> | <p>Through the Component IIIc of the IPA the two programmes have been launched which enable also establishing of the new facilities: the Science and Innovation Investment Fund (SIIF) and incubation centre for bioscience technologies (BIOCentre). The latter is a green- field investments that has been recently (February 2011) approved by the European Commission with the total value o €18m.</p> |

| | ERA dimension | Main challenges at national level | Recent policy changes |
|---|--|--|--|
| 4 | Research institutions | <p>Increase public support for RTOs;</p> <p>Implement the new bills for reforming research and higher education in Croatia;</p> <p>Strengthen the system of quality assurance system and connect it with allocation of the block grants</p> | <p>The Draft law amending the Law on Science and Higher Education from 2003 has been initiated by the new Government elected in December 2011 to reform the science and higher education sectors.</p> <p>The Draft law amending the Law on the Croatian Foundation for Science is presently in the final stage of public debate.</p> <p>Law on quality assurance in science and higher education system has been enacted in April 2009 (OG 45/2009). A system of internal and external evaluation of research at RTOs and universities has been established by the ASHE; Three universities (out of seven) have quality assurance offices (Zagreb, Rijeka, Split).</p> |
| 5 | Public-private partnerships | <p>Strengthening science-industry collaboration in joint research projects and industrial PhD research.</p> | <p>There have been no recent policy changes.</p> |
| 6 | Knowledge circulation across Europe | <p>Strengthening international mobility of researchers;</p> <p>Participation of Croatia in the EU mobility programmes such as Marie Curie-People, EURAXESS and opening scholarships schemes for the Croatian undergraduate and graduate (doctoral) students via Scholarship fair and internet portal; participation of Croatia in the EU programmes of the lifelong learning. Enlarged mobility helps the integration of the Croatian youth, researchers and teachers into EU and contributes to knowledge circulation in Europe</p> | <p>Several action plans are adopted in this framework: Action plan for overcoming obstacles and enhancing international mobility in education for the period 2010-2012⁸, Action plan for mobility of researchers 2019 – 2010 and Action plan for mobility of researchers 2011 – 2012⁹.</p> |
| 7 | International Cooperation | <p>Expanding research and innovation cooperation both within Europe and with other international partners</p> | <p>The Action Plan for Mobility of Researchers 2011 – 2012, which was introduced in December 2010, aims to increase international mobility.</p> <p>The Action Plan for Overcoming Obstacles and Enhancing International Mobility in Education for the Period 2010 – 2012 has also been adopted.</p> |

⁸ <http://public.mzos.hr/Default.aspx?sec=2510>

⁹ <http://public.mzos.hr/Default.aspx?sec=2127>

Annex: Alignment of national policies with ERA pillars / objectives

1. *Ensure an adequate supply of human resources for research and an open, attractive and competitive single European labour market for male and female researchers*

1.1 Supply of human resources for research

The labour market for researchers is not fully functional. Researchers are mainly concentrated in the public research sector – universities and public RTOs (over 80%; 52% in HE and 29% in RTOs) while research sector in private businesses is underdeveloped and it employs only 19% of all researchers (CBS, 2010). The share of researchers in the workforce in the business sector amounted to only 0.13% and makes only 22% of the EU-27 average (of 0.62% of researchers in the workforce in the business sector). The lack of interest of business sector for innovation and research threatens not only sustainability of supply-demand for researchers (primarily of new doctors of science who will not be able to continue their scientific/teaching careers at universities and RTOs due to budget restrictions) but also for highly educated persons whose number is steadily growing among the unemployed from 7.3% in 2009 to 8.5% in 2010 (as a percentage of total unemployed) (CBS 2010a). The number of new doctorate graduates per 1,000 population aged 25-34 was 0.8% in 2009 that is only 57% of EU average of 1.4%. However, the trends are positive. In 2007, the number of new doctorate graduates per 1,000 population aged 25-34 was 0.7%

It should be stated that the educational attainment of the labor force has significantly improved in the last few years. A share a highly educated population reached in 2010. 17.2%, while the share of highly educated employees (aged 15-59 years) is 20%, which is close to the plan of 20% of persons with the tertiary degree by the year 2010 envisaged by the Education Sector Development Plan 2005-2010.

In 2009 the number of tertiary graduates (ISCED 5-6) in science and technology per 1000 persons aged 20-29 years was 12.8 (almost double from 2003 when it was 5.6%) but still lower than the EU-27 average of 14.3. The share of students in science and technology was rather constant since 2004 and amounts to 23-24% of all students (EU-27=24.5). Proportion of the population between 30 and 34 years with post-secondary education, which is usually used as an indicator of a country's future capacity to innovate was 20% in 2009% This is well below the European average of 32% and the EU's plan to increase the share of highly educated in this age group over 40% by 2020.

It is commonly perceived that the needs of the labour market are not systematically assessed, especially not by the university education. For example, the growth rate of professionals and scientists in period 2006 - 2010 was 28.9% (from 142,000 to 183,000), while the growth rate of engineers and technicians were zero (their number is around steady 240,000) (Crnković-Pozaić, 2011). There are some initial, but promising projects on harmonisation of education and market needs within the IPA IV component (Human potentials) and coordinated by the Agency for vocational education and training and adult education¹⁰

Less than one third of employers are satisfied with the educational outcomes of young people that they employ as they have no professional experience. Less than 5% of employees attend some form of adult education.

The mobility of teaching staff and students is not very strong. Croatia currently has a very low percentage of inflow of students since only 0.2% of all students are incoming students as reported by Eurostat in 2009 (EU-27=3.1) while 6.4% of all Croatian students study abroad (EU-27=2.7). Based on the questionnaire administered by the MSES in January 2010, higher education institutions in Croatia estimate that in the 2011/2012 academic year they will have a total of 1,036 outgoing students (0.6% of total number of students). The expected number of hosted students in the same academic year is 360

¹⁰ <http://www.aso.hr/default.aspx?id=656>

foreign students, mostly within 4th framework of ERASMUS programme.¹¹ The data on mobility of researchers and university teachers are rather insufficient in Croatia and a comprehensive database or system for monitoring and collecting data on researcher mobility does not exist. Only the University of Zagreb maintains a web-based database on academic mobility but the detailed data are not readily available.

Lack of courses held in foreign languages has been a barrier for potential incoming foreign students at higher education institutions in Croatia. By the end of 2011, the MSES has obliged to ensure that study programmes would be developed and upgraded additionally in foreign languages through specially designed projects financed by EU funds (Component IV of the IPA: Operational Programme for Human Resources Development, and the European Social Fund).

The most important measures for mobility have been implemented within the Bologna process of harmonisation of the Croatian higher education sector with the EHEA and within full participation of Croatia in the ERA in the domain of scientific research. Croatian policy makers have followed the main recommendations and trends in these two framework EU initiatives which have resulted in:

- Launching the new mobility programmes, e.g. “Brain gain-Visitor”, “Fellowships for doctoral students”, “Unity through knowledge fund”, etc.;
- Opening scholarships schemes for the Croatian under-graduate and graduate (doctoral) students via Scholarship fair and internet portal organised by the Institute for the Development of Education (IDE);
- Establishing of ENIC/NARIC office (qualification recognition);
- Establishing the Agency for mobility and EU programmes (in October 2007);
- In 2008 Croatia launched the Action Plan to Encourage Absorptive Capacity of the Republic of Croatia for the FP7 in the period 2009-2010, whereby researchers’ mobility is treated as an instrument to strengthen human capacity;
- Participation of Croatia in the EU mobility programmes such as Marie Curie-People, EURAXESS and Erasmus Mundus (the latter two are open from 2008/2009).

1.2 Ensure that researchers across the EU benefit from open recruitment, adequate training, attractive career prospects and working conditions and barriers to cross-border mobility are removed

Academic staff in Croatia has a status equivalent of civil servants (permanent position). PhD students (research novices) have only temporary contracts and due to the economic crisis many will not achieve permanent position after completion of the doctoral studies that was previously a usual practice. Temporary contracts are subject to social and health contributions.

Salaries are allocated by the State budget and represent a part of institutional funding provided by the MSES. According to the CBS data, the salaries of researchers both in private and public sector are above the national average. However, they are below the average of most EU countries¹², which significantly reduces the demand for inflow of researchers in the country. The faculties can introduce additional stimulus in addition to the monthly salaries due to the scholarships.

By October 2010, 32 institutions included in Croatia’s education system had signed the Declaration of Commitment to the Principles of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers, and 14 have conducted internal analysis on its implementation. With respect to Charter and Code principles’ implementation, a positive example has been set by the University of Rijeka, which was the first research organisation to complete the implementation and earned the acknowledgement of the European Commission and the status „Croatian Excellence in Research“. By March 2011, another three universities (Juraj Dobrila University of Pula, University of Dubrovnik, University of Zadar) and 5 research institutes (Institute for Anthropological Research, Zagreb,

¹¹ The Action Plan for Overcoming Obstacles and Enhancing International Mobility in Education for the Period 2010 – 2012

¹² 2007 EC report „Remuneration of Researchers in the Public and Private Sectors“

Institute for Medical Research and Occupational Health, Institute for Migration and Ethnic Studies, Institute for Social Research, Institute of Economics, Zagreb) have earned the status of the "Croatian Excellence in Research".¹³

The international mobility of researchers is of growing importance for Croatia in the context of the Bologna process in the higher education sector and the enlarged prospects of accession of Croatia to EU and participation in the Framework programmes. Several action plans are adopted in this framework: Action plan for overcoming obstacles and enhancing international mobility in education for the period 2010-2012¹⁴, Action plan for mobility of researchers 2009 – 2010 and Action plan for mobility of researchers 2011 – 2012¹⁵.

The Croatian Agency for Mobility and EU Programmes (AMPEU) has been established in 2007¹⁶ to serve as a hub of all science and research institutions involved in incoming or outgoing mobility with a view of including into the single EU labour market. It is the central national mobility contact point within the Croatian Mobility Centre ([EURAXESS](#)) that assists the process of hosting foreign researchers on research projects implemented at Croatian universities and institutes. In a two year period, a total of 424 queries were processed. In the first half of 2010 alone, 118 queries from 65 researchers were processed. EURAXESS provide assistance to mobile researchers in the following areas: regulation of stay, social security, pension rights, taxation, accommodation, funding opportunities, health insurance, etc.

Another important programme for researchers' mobility is the Marie Curie – PEOPLE.

The participation of foreign scientists in research programmes was simplified in 2008 with the adoption of the Ordinance on Determining the Requirements for Granting Temporary Residence to Foreigners for the Purpose of Scientific Research (Official Gazette No. 42/08). By October 2010, 29 requests from visiting researchers had been approved pursuant to this Ordinance primarily at the Ruđer Bošković Institute, Faculty of Science, University of Zagreb and Mediterranean Institute for Life Sciences. Further plans involve increasing the quota of work permits for foreign scientists who will become permanent residents in the Republic of Croatia.

As reported by the Action plan for mobility of researchers 2011 – 2012, increased transparency in the recruitment of scientists in Croatia is achieved by encouraging science organisations to announce R&D vacancies on the EC EURAXESS portal. By October 2010, 46 institutions had signed up to this service and had by that date announced a total of 113 vacancies.

In 2009 the MSES established the [Committee for the Hosting Foreign Researchers in Croatia](#) to assist the process of hosting foreign researchers on research projects implemented at Croatian Universities and institutes. Foreign researchers are allowed to work in the private and public research and education institutions without the obligation to have a work permit in accordance with the Code of Procedures for the Approval of Temporary Stay. The goal of this initiative is to increase the number of researchers in Croatia, particularly in the private sector, thus creating a sound basis for enhancing competitiveness and fostering economic growth, as well as to encourage further cooperation of Croatian researchers with their international colleagues. At the moment, researchers from Holland, Portugal, China, India, Russia, Finland, Australia, Germany, Bosnia and Herzegovina and Kosovo, are working on science projects in Croatia.

The Ordinance on the registry of scientists with regard to the registration of foreigners have been relaxed. Croatian citizenship will no longer be required for registration, allowing foreigners to be employed on research jobs and to be project managers, thus creating favourable mobility conditions. The foreign academic degrees are recognized by the Croatian research and education system and supports international applications.

The research grants are not portable.

¹³ <http://www.euraxess.hr/sitegenius/article.php?aid=745>

¹⁴ <http://public.mzos.hr/Default.aspx?sec=2510>

¹⁵ <http://public.mzos.hr/Default.aspx?sec=2127>

¹⁶ Act on the Agency for Mobility and EU Programmes (Official Gazette No.107/07)

1.3 Improve young people's scientific education and increase interest in research careers

Croatia is a leading European country in the formal education of young people considering that according to Eurostat data for 2010 over 95% of young people aged 20-24 years completed some kind of secondary education (EU-27=79%). According to formal education Croatia should have an excellent starting point for global competitiveness, what is yet not the case. A further analysis and understanding of the interconnections of the process of education, technological progress and economic growth is indispensable. Educational attainment and increased years of schooling does not necessarily mean a causal relationship with economic growth. More important is adjustment of education system with the needs of the economy. The basic national strategic documents on education – the “Education Sector Development Plan 2005-2010”, explicitly state that the greatest risk of the Croatian education system is precisely the question of adjusting to rapidly changing social needs. The Plan emphasises the role of mathematics, natural sciences, information and communication competencies for future development. It also states that, in addition to traditional skills, such as language skills, literacy and social studies, the understanding of technological skills are the “new basic skills” that every young person and adult need to acquire today. Unfortunately, the skills which are recognised as essential for the knowledge economy like creativity, technical and ICT skills, teamwork, problem identification and solving analytical thinking, etc., are not well supported within schooling system. According to PISA 2009, our students won 36th place in reading literacy, the 37th place in natural subjects and 40th in math.

Some professional schools, colleges and universities enrol too many students in relation to labour market needs, while others enrol fewer students than market demands (e.g. physicians, ICT experts).

More than half of students (54%) graduated in social sciences and humanities, and the number of graduates in natural sciences, medicine and engineering have decreased by about 10% in the last 10 years. The reasons are both in the privatisation of higher education and revenue maximisation strategy of universities. About two thirds of students of private professional schools established in the last decade graduated in social sciences and humanities (e.g. business management and economics). Universities also prefer “cheaper” and therefore more lucrative studies in the social sciences and humanities. Both trends created distortions in the university-educated segment of the labour market and marked a process of shifting the entire higher education towards social sciences and humanities. One reason is probably the lower social and economic status of engineers, physicians and natural-scientists in relation to managers, financial experts and other employees in various service sectors.

The basic mechanism of supporting and motivating students for mathematical skills and science literacy in the primary and secondary schools is the system of facultative and elective courses. The courses are aimed at gifted students who want to take a part in the school competitions that are organised on the local, regional and national level. There are also other actions for public communication of science especially to youth like the “Science festival” and the “Open days of research institutes and universities.

Vocational education is the responsibility of the Agency for Vocational Education and Training and Adult Education. One of the tasks of the Agency is to Reform and develop a modern vocational education and training (VET) system in Croatia and is based on the [Vocational Education and Training System Development Strategy of the Republic of Croatia 2008-2013](#) and the Vocational Education and Training Act. On the other side, the Agency creates conditions for the competitiveness improvement of adult learners in the labour market in order to enhance their economic and social status. The majority of funds are coming from the IPA Component IV – Human Resources Development and previously from the CARDS programme. In order to reform education curricula by taking into account aspects such as creativity, critical thinking or teamwork the [Croatian National Educational Standard](#) has been created and implement since 2005 in elementary schools. The entrepreneurship training is still not widely included in the curricula. At the level of university education, the initial steps are made within the TEMPUS project [FoSEntHE](#) focused on development of the teaching programmes for enterprises and entrepreneurship.

The EU programmes of the lifelong learning (LLL) are being carried out in Croatia since 2009 by the AMPEU, which implements the following lifelong learning programmes (LLPs): Comenius (pre-school and school education), Erasmus (higher education), Leonardo da Vinci (vocational education and training), Grundtvig (adult education) as well as Transversal Programme Jean Monnet programme (European

integration in the area of LLL). The implementation of the LLPs is additionally supported by the aforementioned action plans for mobility carried out by the MSES.

1.4 Promote equal treatment for women and men in research

The main policies that promote the equal treatment for men and women in science are formulated in the framework documents – the National policy for the promotion of gender equality 2006-2010¹⁷ and the Gender Equality Act passed in July 2003. Regarding access to education and research occupation no gender gap has been recorded.

With 50% women employed in the research and development sector, Croatia has reached gender parity and made significant progress. In 2010 there were 16 102 persons in full- and part-time employment engaged in R&D-related jobs, out of which 50.2% were women. The share of women among researchers was 47.0%. There were 55.2% of doctors of science among researchers and the share of women among researchers, holding a degree of doctor of science, was 42.9%.

The fastest growth of female participation in the research sector has occurred in the business sector where they now account for 44%. In the government research sector women prevail, representing 52% in total employment. Turning to higher education, with 44% of the total number of academic staff being women, Croatia nearly reached equal representation. However, female representation at the full professor rank is lower and increases from the rank of lecturers and assistants where women make up 53%. In higher education institutions only 14% of women hold rector, and 17% dean positions. Despite this, the number of women holding leading positions in public research institutes is notably better, where 40% of directors are women.

Male and female students are equally represented at all levels of education. However, women do prevail in the total number of students who enrol universities (with 55%), as well as in the total number of students who graduate (with 58%). It is important to add here that 52% of doctorates of science degrees (PhD) are held by women. This increasing trend of highly educated women has been continuous for the last forty years. If this development continues, significant changes in the labor market-for the benefit of women can be expected.

Nevertheless, the choice of occupation for many women in Croatia is still influenced by traditional gender roles. For instance, among university graduates, women are still underrepresented in the field of computer sciences (16.2%) and engineering (20.4%), although data shows a slow, but growing trend in this area. However, by way of contrast, women make up 73% of all mathematics and statistics graduates.

The maternity leave and maternity rights have been regulated by the Labour law (Official Gazette No. 149/09) and by the new Law on Maternity and Parental Benefits (Official Gazette, No. 85/08 and 110/08) enacted on January 1, 2009. Women researchers who have a permanent job status are rather protected in relation to maternity leave since they are guaranteed to return to work and have the same status. The level of protection of those with the fixed-term contract is much lower and depends on the need of the employer.

2. Facilitate cross-border cooperation, enhance merit-based competition and increase European coordination and integration of research funding¹⁸

The special policy approaches supporting the cooperation and coordination between national R&D programmes are not developed. Only the Croatian Science Foundation runs the programme “Collaborative Research Programmes” that requires a number of content-related research projects – minimum of three research groups of which at least 2 are coming from different legal entities. It is estimated (Bečić and Švarc, 2011) that Croatia has a bundle of mainly horizontal supporting programmes

¹⁷ http://www.lida-sisak.hr/uploads/lida-sisak/dokumenti/national_policy_gender_equality.pdf

¹⁸ Promote more critical mass and more strategic, focussed, efficient and effective European research via improved cooperation and coordination between public research funding authorities across Europe, including joint programming, jointly funded activities and common foresight.

- Ensure the development of research systems and programmes across the Union in a more simple and coherent manner.
- Promote increased European-wide competition and access of cross-border projects to national projects funding

that sometimes creates rivalry among the public institutions and programmes and leads to a lack of synergy and efficiency of the public policies.

National research programmes are open only to participation of foreign individual researchers regardless the resident country, and not to foreign legal entities. The Croatian Science Foundation implements three types of programmes which enable foreign researches to compete for conducting research in Croatia, as follows: Brain Gain (HRZZ installation grants & Postdoc), Training of doctoral students (Fellowships for Doctoral Students). The aim is to stimulate the development of research groups with state-of-the-art and internationally competitive themes. The number of such programmes was greater in the past. (e.g. UKF programmes). After their expiration in 2011, the new financial means have not been provided for continuation.

The cross-border research cooperation is carried out within the ERA-NET initiative such as HERA, HERA-JRP, ERACOBUILD, SmartGrids, etc. However, the most important is the Southeast European Era-Net (SEE-ERA.NET)¹⁹ and its successor the [SEE-ERA.NET PLUS](#) programme which launched a Joint call for research projects in order to enhance the integration of the Western Balkan Countries into the European Research Area. The programme is targeted at two research themes - ICT and food. The budget is €3.5m for the period 2009-2013.

Croatia also participates in the FP7 (Capacities) [WBC.INCO-NET](#) project, a regional consortium project with the aim of supporting research and innovation cooperation and enhanced integration of the Western Balkan Countries (WBCs) in the ERA.

Beside the SEEERA NET/SEERA NET PLUS, Croatia has actively participated in the project [ERA-IB](#) "Towards an ERA in Industrial Biotechnology" whose aim is to reduce the fragmentation of national research efforts in the area of Industrial Biotechnology. Within the ERA-IB framework, two joint calls for proposals resulted in 18 European research projects with a total budget of over €20m. Croatia has participated in the Second Joint Call launched in December 2009 with €200,000. As a result, two projects with Croatian partners were granted (one of them represented through coordinator from Croatia). The project ERA-IB ended in December 2011, but it's activities will be continued through ERA-IB 2. The Ministry of Science, Education and Sports of Croatia has joined the consortium of ERA-IB 2 as well.

3. Develop world-class research infrastructures (including e-infrastructures) and ensure access to them

Croatia is became a member of ESFRI in October 2010 and participates in three related projects: [CLARIN](#) , [DARIAH](#) and [ESS](#).

The CLARIN will establish an integrated and interoperable research infrastructure for the language technology needed in SSH research, DARIAH supports digital enabled research across the humanities and arts and ESS analyses attitudes, beliefs and behavioural patterns of diverse European populations.

CLARIN was completed on 30th June 2011 and it applied for the ERIC status. ERIC is the Community legal framework for a European Research Infrastructure Consortium (ERIC) which entered into force on 28th August 2009. This is specific legal form designed to facilitate the joint establishment and operation of research infrastructures on the common European supranational level. The first ERIC status commission awards to cross-border databank: SHARE. CLARIN-ERIC was approved by the Commission and officially established on 28th February 2012.

Unfortunately, due to several obstacles deriving from its non-member state status, Croatia did not meet the legal conditions for becoming a founding member of CLARIN-ERIC, but the application for membership is pending. Croatia is also participating in the formation of DARIAH-ERIC and the C-ERIC infrastructure consortium initiated by Sincotrone Trieste, Italy, which are both currently at application stage".

The main goal of ESFRI is to define the strategic roadmap for Europe in the field of research infrastructures and to develop Pan-European infrastructure network. Each member country is also expected to drive such a roadmap on the national level which Croatia has failed to define.

¹⁹ The Southeast European Era-Net – is a networking project within FP6 aimed at integrating EU member states and Southeast European countries (Albania, Bosnia and Herzegovina, Croatia, FYR Macedonia, Montenegro, and Serbia).

The research infrastructure is primarily national. The public research (technological) organisation and the higher education institutions have a large autonomy within the Universities in Croatia, with significant fragmentation of resources including present research infrastructure and equipment. As a result of this process, small research units with research infrastructure tools are dominant. In order to avoid duplication and enable networking and integration, the MSES has established the [Register of the capital equipment](#) (above €30,000).

In addition, the accesses to the large international research infrastructures like CERN, EMBL (European Molecular Biology Laboratory, EUMSTAT (EU meteorological satellites) through the membership and research collaboration is of great importance for achieving scientific excellence.

The IPA - Regional Competitiveness Operational Programme has an important role in funding of development of research infrastructure. The EU FP is also an important resource for procurement of scientific equipment (e.g. particle detector system at IRB of around €1.5m, while the Medical School in Rijeka received €1.8m for the equipment).

In the last few years a broader approach to research infrastructure has emerged primarily in the ICT sector where a top down approach has been initialised by the Government. "e-Hrvatska", the institution responsible for ICT infrastructure development in Croatia, implemented two programmes relating to research infrastructure in addition to Broadband Internet and HitroNet aimed at building centralized network of public services. Moreover, MSES has been constantly improving the CARNET network implementing the programme of distant learning. In addition, MSES, jointly with CARNET and the Rudjer Bošković Institute launched the "Centre for on-line data base" project ensuring a network approach to commercial databases and providing free databases for the science and research communities in Croatia (scientists, assistant and students).

The realisation of the MEDILs project i.e. foundation of the life science institute in 2005 and initialisation of Bio-science incubator within the Regional Competitiveness Operational Programme as an Instrument for Pre-Accession Assistance Programme represent a bottom up approach in building research infrastructure and at the same time a result of a long tradition as well as scientific excellence in biomedicine. Moreover, financing the research infrastructure in order to implement ESFRI (European Strategy Forum on Research Infrastructures) road map has not yet been planned in Croatia.

4. Strengthen research institutions, including notably universities

There are two types of Higher education institutions (HEI). The first type includes universities, the faculties and the academies of arts which provide university higher education and perform scientific research. The second type consists of polytechnics and schools of professional higher education which organise professional studies and educational programmes.

The HEIs can be public or private. All universities and faculties in Croatia are presently public while the polytechnics and schools of professional higher education are private and public. All the HEIs in Croatia are non-profit institutions and perform their activities as public service. There are currently around 146 higher education institutions in Croatia, 105 are public and remaining are private.

The university studies are organised within seven universities. The largest one is the University of Zagreb which accounts for 28 faculties and employs more than 50% of all academic staff, and educates almost 50% of all students. In August 2011 the University of Zagreb has for the first time been listed at the [2011 Academic Ranking of World Universities \(ARWU\)](#), commonly known as the Shanghai ranking and is one of the best known rankings of world-class universities. This is the first time that a university from Croatia has ranked among the top 500 world universities.

No important changes have occurred in the last three years in relation to the HEI landscape.

Universities and their faculties as educational and scientific legal entities within universities have a large degree of autonomy. Recent report Progress in higher education reform across Europe - Governance reform, (EC, 2011) ranking Croatia as country with high level autonomy of universities in financial and teaching policy, research and staff recruitment.

Recruitment is the responsibility of the faculties. The faculties select and employ professors and other personnel and design their education programmes. However the faculties cannot set a basic salary for their employees who receive income from the MSES directly. Instead, the salary represents a part of the

block grant, as financial incentives and also a source of revenue for the scientific institutions. The faculties can introduce additional stimulus in addition to the monthly salaries. Research institutes are the responsibility of the MSES and are not university units. Similar to faculties, the institutes select and employ scientists and other personnel and design their scientific activities. The faculties are responsible for the design of educational and scientific programmes, finance and applications for international projects. The autonomy is tightly connected with responsibility of the university towards students, ensuring the quality education as well as accountability towards the public, society and the local community.

Institutional funding (block grant) provided by the State budget and allocated by the MSES is the most important source of research financing. The grants cover employee salaries plus additional social costs relating to employees and material costs within the research Institutions where the main criteria include the number of employees within the scientific organisations. There is no clear connection between scientific excellence measured by bibliometric indicators, number of patents and block financing. The flexibility in redirecting block funds is rare. The importance of competition based research projects has grown in the last few years. The procedure regarding evaluation is increasingly stringent, thus the percentage of approved projects has been decreasing in the last five years (reducing from 90% to 70%). The financial resources allocated in this project scheme as a percentage of total MSES budget has been growing in the last few years.

The system of quality assurance and external evaluation of RTOs and HEIs has been established in 2007 with an aim to become an important factor to improve higher education and scientific work. The University of Zagreb for instance established the Quality Assurance Office in 2006 with the mission of promoting high education standards and facilitating active support to the faculties in order to improve the quality of scientific and education work.

The Law on quality assurance in science and higher education system has been enacted in April 2009 (OG 45/2009). It regulates the system of ensuring and improving the quality in science and higher education institutions and study programmes. The Law involves the procedures of periodic external independent assessment of the internal quality assurance system (audit), initial accreditation procedures, re-accreditation and thematic evaluations of study programmes. The Law also regulates the status, activities and organisation of the Agency for Science and Higher Education (ASHE) as the pillar institution of the national system of quality assurance and evaluation in Croatia.

The external evaluation includes self-evaluation report carried out by the scientific and higher education organisations according to the templates adopted respectively by the National Council for Science and National Council for Higher Education. It also includes a site visit of experts nominated by the national councils as well as interviews with representatives of scientific organisations. On the basis of evaluation and response from the scientific organisations, the national council adopts final recommendation along with the measures quality improvements and sends it to the Minister of science, education and sports who, based on this, issues or denies license, or issues a letter of expectation. All final evaluation reports are published at the website of the Agency for Science and Higher Education as well as recommendations (<http://www.azvo.hr/en>).

Although many intuitions have already passed external evaluation until now this has made no significant impact on their financing. However the block grants based on formal criteria of the number of research/teaching staff remains the most important financial source for research activities.

5. Facilitate partnerships and productive interactions between research institutions and the private sector

A scientific community is oriented primarily towards scientific outputs due to the present methods of evaluation of scientific work which stimulate standard scientific work (publications). Important reasons are hidden by socio-cultural and political factors. A special problem is science-industry cooperation or technological outputs which are not recognised as factors of scientific promotion. Therefore, in spite of many efforts to promote public – private partnership, some recent analyses (Radas and Vehovec, 2006; Švarc at al, 2011) reveal that the interaction between universities and industry in Croatia is still rather limited and needed to be explicitly looked at and enforced.

The activities essential for the development of a knowledge-based economy are carried out under the responsibility of the Business Innovation Centre of Croatia (BICRO) and the Croatian Institute of Technology (HIT).

The policy measures of innovation which have a significant impact on research activities include TEHCRO (a technology infrastructure managed by BICRO), RAZUM (development of technology-based companies), Proof of Concept (co-financing of the initial phase of innovative science-entrepreneurship projects, also managed by BICRO), establishment of biotechnology infrastructure with an incubator and a central laboratory (BIOCentre) and the launching of the Science and Innovation Investment Fund which is financing technology transfer and associated activities. The last two measures are being financed within the IPA programme.

In addition to the TEHCRO programme, the most important step forward to supporting entrepreneurship activities and establishing of the technology transfer offices (TTOs) at universities is made in the framework of the three TEMPUS projects: CREATE, OPUS and FoSEntHE. The FoSEntHE project is aimed at fostering entrepreneurship education at universities while CREATE and OPUS has supported launching the three technology transfer offices at the universities of Split, Zagreb and Rijeka. The latter has grown into the Science and Technology Park (STeP) attached to the University of Rijeka.

Policy measures related to the intellectual property protection and patents are reasonably developed in Croatia. These activities are regulated by the Act on Patents and related Acts and fall under the responsibility of the Croatian State Intellectual Property Office (CSIPO). However, there are still modest capabilities regarding intellectual property rights (IPR) which require a systematic approach to develop the strategy and policy on this matter. First steps have been taken within the CARDS 2003 project for establishing the IPR infrastructure and strategy entitled Intellectual Property Infrastructure for the R&D Sector - Promoting research institutions - SME interactions. There have been no recent initiatives aiming to promote and facilitate knowledge transfer. Technical assistance within the Science and Innovation Investment Fund project has contributed to the knowledge transfer.

Government-owned research results are not publicly available. In addition, they are not adequately monitored. There are no special legal regulations covering the field of IPR on the Croatian universities. It is likely that many opportunities for commercialisation of research results are not utilised.

The special mobility schemes allowing R&D students/PhDs/ to conduct innovation projects in companies are not widely present. There is only one programme run by UKF Research in industry and academia grant that addresses directly the inter-sectoral mobility, while others are aimed at science-industry cooperation. However, the new Action plan for the mobility of researchers 2011 – 2012 has put a great emphasis on the inter-sectoral mobility of researchers. The measures that are to be implemented by the end of 2012 include: (1) Facilitating the access to research results and encouraging the expansion of their usage; (2) Facilitating access to financial sources; (3) Investments into the mentor capacities for young researchers and (4) Supporting the implementation of the existing and future EU initiatives targeted toward barriers elimination to inter-sectoral mobility.

Research or university spin-off companies are still rather rare in Croatia. This has much to do with the underdevelopment of the technology transfer processes and a low level of intellectual property rights protection. In recent years, TTOs attached to universities and the Rudjer Boskovic Institute has been established across Croatia, but significant efforts are still required in terms of entrepreneurship culture facilitation at academic institutions. A particularly interesting is the case of Rudjer Innovations, which has been set up as a company for innovation services and transfer of technology at the Rudjer Boskovic Institute but which also provides active support to academic entrepreneurship, as well as to research-intensive companies that seek professional assistance. It has launched three spin-off companies.

Furthermore, the Science and Innovation Investment Fund (SIIF) which is carried out within the IPA IIIc Regional competitiveness programme is used for projects aiming to facilitate technology transfer, academic entrepreneurship and engage RTOs and universities in the local and regional development. Seed funding for spin-offs can be obtained through the RAZUM programme, but this programme is primarily used by private companies. On the other hand, there are still no policy measures that attract venture capital and business angels to university spin-offs.

Besides the TTOs, which require capacity building, there are measures of the TEHCRO programme of BICRO (Technology infrastructure development), under which the development of the six technology

centres or parks is currently being supported. Together, these institutions provide the basic infrastructure for university-industry cooperation and for more intensive involvement of universities in research commercialisation and cooperation with the local economy.

Business sector is rarely involved in the governance of universities and public research organisations (PROs) in Croatia.

6. Enhance knowledge circulation across Europe and beyond

Cross-border cooperation plays a significant role in the development of Croatian regions since most of Croatian territory is located on the international border (18 of 21 counties). The main instrument is the Component II of the IPA focused on the cross – border cooperation between Croatia and the EU countries (Slovenia, Hungary, and Italy) and non EU countries (Serbia, Montenegro and Bosnia and Herzegovina as well as IPA ADRIATIC CBC. With the exception of the Priority 1 of the IPA ADRIATIC CBC (<http://www.adriaticpacbc.org/>) that includes Measure 1.1. Research and innovation, other programmes are mostly aimed at development of economic and social cross-border activities, solving common infrastructural or communal problems, cultural cooperation, tourism, etc. However, it can also include knowledge circulation within single projects such as cross-border university cooperation (e.g. Croatia – Hungary).

The SEE-ERA.NET PLUS programme could be considered as a sort of cross border cooperation since it is aimed for enhancing the integration of the Western Balkan countries with a Joint call for European research projects.

There are no recent measures that support the development of a sustainable, efficient and effective European scientific information system.

Considering policy measures aimed to enhance open knowledge circulation across national borders and to open access to research outputs (publications and data) of researchers and general society, the key initiative is Hrcak - the central portal of Croatian scientific journals (<http://hrcak.srce.hr/>). Hrcak provides the access to academic journals following the Open Access Initiative.

7. Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world

Croatia does not have a special strategy for international research cooperation. However, several policy documents related to more intensive participation in the EU framework programme and mobility could serve this purpose (see Chapter 3.1 National research and development priorities).

Croatia has a long tradition in intergovernmental bilateral agreements with third countries on educational, scientific and cultural cooperation. Most of these agreements are dated back in the '80s such as with Japan, India, China and the USA, while the agreements with Canada, Russia and Ukraine have been concluded in the late 90s.

The cooperation usually involves the establishment of a joint committee that decides about common research priorities, (e.g. disaster prevention and materials science with Japan), common funds, funding/evaluation research projects, scholarships, exchange of doctoral students, post-doctoral studies in scientific institutions, etc. The mobility schemes for researchers from third countries are part of the bilateral research and educational agreements and usually include scholarships, exchange of doctoral students and post-doctoral studies in scientific institutions. There is no specific rules regulating the national collaborations with third countries

In last ten years Croatia has signed more than 200 intergovernmental bilateral agreements and executive cooperation programmes with countries all over the world in the area of science and research. The majority of bilateral agreements are established via the MSES (see the Bilateral cooperation of the MSES). One of the key aspects within the bilateral agreement is a research project cooperation in local science and research infrastructure. In 2010 Croatia had 215 joint research and development projects with 12 countries. There are no specific research fields or countries prioritised for the cross-border collaboration. However, based on mutual interest the most important partner is Slovenia followed by Serbia, Austria, Hungary and Germany. In the period 2001 – 2005 Croatia developed 119 projects with

Slovenia mainly in natural sciences (98) while the remaining were in agriculture (8), humanities (7) and medical sciences (6).

Within the framework of Joint Croatia-Israeli Scientific Research Program, six R&D projects were financed in total amount of \$600,000.

Croatia's educational, scientific, research and sport institutions and nongovernmental organisations participate in the global, European and regional organisations' multilateral programmes which includes initiatives such as the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the Council of Europe, the OESCE, the Adriatic and Ionian Initiative, the AlpsAdriatic Working Group, Quadrilaterale, the OECD (Organisation for Economic Cooperation and Development) and NATO (North Atlantic Treaty Organisation). Multilateral activities also take place with CERN (European Organisation for Nuclear Research, Geneva), ESF (European Science Foundation), EMBO (European Molecular Biology Organisation), IIR (International Institute for Refrigeration), ICGEB (International Center for Genetic Engineering and Biotechnology).

Croatia continues to cooperate with multilateral regional organisations as ERI SEE (Education Reform Initiative of South Eastern Europe), the Task Force Fostering and Building Human Capital (TFBHC) of the Regional Cooperation Council (RCC). Croatia has joined, with continuation of collaboration, the Central European Exchange Programme for University Studies (CEEPUS) the CEEPUS III Agreement. These programmes focus on studies of exchange students and academic staff, provide institutional capacity building measures and foster stronger academic regional links.

As members of EMBL/EMBO, the Humanities in the European Research Area (HERA), the European Forest Institute (EFI), the International Centre for Genetic Engineering and the Biotechnology (ICEGEB), the Union for the Mediterranean and the recently established EU Strategy for the Danube Region Strategy, Croatian scientists take full advantage of the knowledge, mobility schemes and use of scientific equipment provided by these organisations.

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List of Abbreviations

| | |
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| AMPEU | Croatian Agency for the Mobility and EU programmes |
| ASHE | Agency for Science and Higher Education |
| BERD | Business Expenditures for Research and Development |
| BICRO | Business Innovation Agency of Croatia |
| CERN | European Organisation for Nuclear Research |
| COST | European Cooperation in Science and Technology |
| CSF | Croatian Science Foundation |
| CSIPO | Croatian State Intellectual Property Office |
| EHEA | European Higher Education Area |
| ERA | European Research Area |
| ERA-NET | European Research Area Network |
| ERDF | European Regional Development Fund |
| ERP Fund | European Recovery Programme Fund |
| ESA | European Space Agency |
| ESF | European Social Fund |
| ESFRI | European Strategy Forum on Research Infrastructures |
| EU | European Union |
| EU-27 | European Union including 27 Member States |
| FDI | Foreign Direct Investments |
| FP | European Framework Programme for Research and Technology Development |
| FP7 | Seventh Framework Programme |
| GBAORD | Government Budget Appropriations or Outlays on R&D |
| GDP | Gross Domestic Product |
| GERD | Gross Domestic Expenditure on R&D |
| GOVERD | Government Intramural Expenditure on R&D |
| GUF | General University Funds |
| GVA | Gross Value Added |
| HE | Higher Education |
| HEI | Higher education institutions |
| HERD | Higher Education Expenditure on R&D |
| HES | Higher education sector |
| HIT | Croatian Institute of Technology |
| ICT | Information and Communications Technology |
| IP | Intellectual Property |
| IPA | Investment for the Pre-Assessment Assistance |
| IPE | Institute for the development of education |
| IPR | Intellectual property rights |
| IRCRO | Collaborative research development Programme |
| ISCED | International Standard Classification of Education |
| KONCRO | Competitiveness and technology process advancement Programme |
| LLL | Lifelong Learning |
| LLP | Lifelong Learning Programme |
| MEC | Ministry of Entrepreneurship and Crafts |
| MELE | Ministry of Economy, Labour and Entrepreneurship |
| MLPS | Minister of Labour and Pension System |

| | |
|----------|---|
| MoE | Ministry of Economy |
| MSES | Ministry of Science, Education and Sports |
| NCHE | National Council for Higher Education |
| NCS | National Council for Science |
| OECD | Organisation for Economic Co-operation and Development |
| PoC | Proof of Concept |
| PRO | Public Research Organisations |
| R&D | Research and development |
| RAZUM | Development of the knowledge-based companies Programme |
| RI | Research Infrastructures |
| RTDI | Research Technological Development and Innovation |
| RTO | Research and Technology Organisation |
| S&T | Science and technology |
| SCF | Strategic Coherence Framework 2007-2013 |
| SDF | Strategic Development Framework 2006–2013 |
| SF | Structural Funds |
| SIIF | Since and Innovation Investment Fund |
| SME | Small and Medium Sized Enterprise |
| SSH | Social Sciences and Humanities |
| STeP | Science and technology |
| SVEZNATE | Strategic Council for Science and Technology |
| TEST | Technology oriented projects Programme |
| UKF | Unity through Knowledge Fund |
| VC | Venture Capital |
| VET | Vocationla Educationail and trainings |
| VNIS | National Innovation System Council of Ministry of Science, Education and Sports |
| WBCs | Western Balkan Countries |

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Abstract

The main objective of the ERAWATCH Annual Country Reports is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. EW Country Reports 2011 identify the structural challenges faced by national innovation systems. They further analyse and assess the ability of the policy mix in place to consistently and efficiently tackle these challenges. The annex of the reports gives an overview of the latest national policy efforts towards the enhancement of European Research Area and further assess their efficiency to achieve the targets.

These reports were originally produced in November - December 2011, focusing on policy developments over the previous twelve months. The reports were produced by the ERAWATCH Network under contract to JRC-IPTS. The analytical framework and the structure of the reports have been developed by the Institute for Prospective Technological Studies of the Joint Research Centre (JRC-IPTS) and Directorate General for Research and Innovation with contributions from ERAWATCH Network Asbl.

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.



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