



# Science and higher education in Croatia at the verge of entering the EU

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## Abstract

*At the verge of entering the European Union, the scientific and higher education system of the Republic of Croatia is characterised by challenges and inherited unsatisfactory levels in some of the key performance indicators. In this short presentation, some of these characteristics will be outlined and the measures foreseen by the Ministry of Science, Education and Sports in tackling these shortcomings will be delineated.*

## 1. INTRODUCTION

As already happened in most of the central and eastern European transition countries and is yet to happen in others, Croatia is facing exciting new opportunities by its accession to the European Union (EU) in a couple of months. One of these opportunities is also a stronger integration into the European Research and European Higher Education Areas (ERA & EHEA). The latter will imply, however, also that all the performances of Croatia's science and education will be increasingly compared and measured with respect to those of the current 27 EU member states. In this short review, the current challenges and inherited levels of some of the performances of the Croatian scientific and higher education sector will be presented. A set of concrete measures implemented by the current government and especially by the Ministry of Science, Education and Sports (MSES) will be given and the expected outcomes will be outlined.

## 2. CURRENT PERFORMANCES OF CROATIAN SCIENCE

The program of the Government of the Republic of Croatia for the years 2011–2015 aims at aligning and harmonising the goals and achievements of the scientific and higher education sectors to those of the *Europe 2020* strategy (1) fostering intelligent, sustainable and inclusive growth. However, Croatian current levels in some of the key performance indicators are still showing improvement potential. In fact (2–4):

- Croatia devotes merely 0.75% of its GDP to R&D activities which is far below the average of EU member states which is currently at 2.03%. Moreover, contrary to what happens in the most developed EU countries, the majority of these funds (i.e. 55%) are public expenditures. This is, obviously, due to a large extent to the structure of the Croatian economy where 93% of all companies are micro-companies with an average of 1.9 employees. It is clear

that this structure presents a very limited innovation and R&D investment potential. However, what is encouraging is that in the last 5-6 years in absolute terms the sum of money devoted to scientific activities (scientific projects, junior researchers, Croatian Science Foundation (CSF), EU framework program FP7 national contributions, scientific conferences, national scientific journals and books, ...) is constant at about 75 million Euros per year.

- Although the average innovation index shows an improvement from 0.260 in the year 2007 to 0.302 in the year 2012, Croatia is still ranked as a "moderate innovator with a below average performance" lagging behind transition countries such as e.g. Hungary (average innovation performance indicator in 2012 at 0.323) or Slovenia (0.508).
- According to Eurostat data, for the time being Croatian applicants register at the European Patent Office (EPO) less than 6 patents per million inhabitants per year, while the average for the EU member states is almost 110 patents and the most successful countries reach more than 1,000 patents per year.
- Although the success rate of Croatian applications to the EU framework program FP7 projects is 17.25%, i.e. below the EU average of 21.77%, Croatian scientists have succeeded in attracting through these applications funding of little more than 59 million Euros. This constitutes 38% more money than the Croatian contribution to the FP7 scheme so far was.
- The share of population aged 30-34 who have successfully completed tertiary education in Croatia is at 24.5% while the EU average is at 34.6%.
- In Croatia only 3% of working population (aged 25-64) has been actively involved in some form of lifelong learning, while in EU countries the average involvement is at 10% and in some EU countries this indicator reaches even 30%.
- The quality assurance of Croatian scientific and higher education sectors, coordinated via the activities of the Croatian Agency for Science and Higher Education (ASHE) (member of the ENQA – European Association for Quality Assurance in Higher Education), has developed to a leading position in the region.
- The number of Croatian higher education institutions has grown from 6 universities, 7 colleges and 15 polytechnics in the year 2003, up to 10 universities, 15 colleges and 30 polytechnics in 2012. In the same time span the number of higher education study programs has grown from 400 to 1,200. However, only 6% of higher education study programs and only 7% of the students are at private higher education institutions.
- It is noteworthy also that of the roughly 200,000 higher education students (in the year 1990 this number was at 70,000), about 60% are enrolled in social science and humanities study programs, about 25% in technical programs and less than 10% in each of the natural sciences, biomedical and biotechnological study programs. This is completely uncorrelated to the needs of the labour market and is one of the meaningful causes of the unemployment rates of young people with tertiary education which in Croatia reaches 14%. In this regard among the EU countries only Greece and Spain have higher unemployment rates of highly educated citizens. There is also a significant increase of the number of students who decide to follow the whole higher education study program abroad.
- The increase of the number of students has implied also an increase in the number of faculty staff which, albeit often without structured institutional staffing policies, has reached 26% in the last 5 years alone. Moreover, in the public higher education and scientific system the rules for the advancement in the scientific ranks from junior to senior positions are set in such a way that almost 40% of all the scientific staff is at the highest rank. The advancements in the scientific hierarchy are fast and quite easy so that, in a community of roughly 6,000 FTE scientists, there are almost 1,500 advancements per year (of which more than 60% prior to the regular 5 year advancement period) and several researchers in their mid-thirties or early forties are already at the highest possible scientific and academic ranks. What is more, although in the legislation this is defined as an exception, almost 80% of all scientific and faculty staff reaching the retirement limit of 65 years of age, remain employed in their institutions virtually blocking the entrance of younger scientists. In turn, the latter, according to relevant data, are scientifically more productive than their senior counterparts both in terms of the number of scientific publication and in the impact of these publications. All of this generates also a perpetual increase of the share of the total budget devoted to science and higher education which is used up by the wages. In fact, the wages make up already 81.5% of the total budget with relative increase rates of up to 5% per year. This is, obviously, an unsustainable trend.
- The scientific projects financed through the state budget have also peculiar characteristics: they have an application success rate of 85%, there are currently almost 2,000 projects being financed and followed, but in average they have less than 2.5 active scientists and 1.2 junior researcher (Ph. D. or post-doc) per project and receive in average merely 6,500 Euros annually for all the planned activities. The resulting fragmentation of the research potential in also unsustainable and is one of the significant causes of the rather unsatisfactory output of the scientific sector (see below).
- Although the number of scientific publications present in relevant databases amounts to roughly 0.8 publications per researcher (FTE) and year and it can be considered pretty satisfactory and com-

mensurate to the investments in R&D, especially when the steady increase in this number is taken into account, the quality of the scientific production is not appropriate. In fact, only 3% of Croatian scientific papers are published within the 10% most cited scientific publications worldwide, while the average in the EU member states for this EU indicator is at 11%. In the number of citation per scientific publications or the H-index, the impact of Croatian scientific output is also markedly less prominent than that of other transition countries such as Hungary, Slovakia or Slovenia. Moreover, less than 400 Croatian scientific publications per million inhabitants are a result of international co-publications and less than 30 Croatian publications per million inhabitants are a result of public-private co-publications. In turn, Island or the Scandinavian countries reach 1,250 to 2,500 international co-publications per million inhabitants and the EU average for public-private co-publications is at 53 publications per million inhabitants.

- Some recent studies indicate meaningful occurrences of scientific, professional and student misconduct in the Croatian scientific and higher education system. In fact, data indicate that up to 60% of students cheat during the exams, some students have even been asked financial retributions as a condition for passing exams, 9% of the faculty indicate that they have been offered money to let the students pass the exams, 50-60% of faculty staff is aware of undeserved authorships of scientific publications (cca. half of them justifying it by the pressure put onto them by the obligation to advance in the scientific rank), 30% of the staff is aware of plagiarism, 53% is aware of occurrences of nepotism and 20% of political favouritism. Most tragically, 80-90% of the staff aware of the cited misconducts did nothing to disclose them. These findings are, unfortunately, corroborated by some police activities which have disclosed cases of exams sold and paid for with significant money involved and even several faculty staff and students legally accused of such acts. Some of these people have also been found guilty in courts of law for the assumed criminal acts.

### **3. MEASURES TAKEN BY THE CURRENT LEGISLATION IN TACKLING THE CHALLENGES AT THE VERGE OF CROATIAN FULL MEMBERSHIP INTO THE EU**

In order to address the above situation, since the beginning of the current legislation started at the very end of the year 2011, in the past 15 months MSES has carried on a number of concrete steps aimed at aligning and harmonising the Croatian scientific and higher education system with the best practices of the most developed EU member states and other western democracies. In line with Albert Einstein's statement that "We can't solve problems by using the same kind of thinking we used

when we created them", these measures include but are not limited to (5):

- The amendments to the Act on the CSF have been proposed by MSES and the Government and adopted in July 2012 by the Croatian Parliament. In virtue of the amendments, the CFS finally becomes the central independent seat for the concentration of the national financial instruments of support for the scientific project activities. In this way a strong boost to the transition from state management to state supervision of the scientific sector in Croatia is achieved. An increase of the size and relevance of the scientific projects, support to excellent researchers and projects, set-up of national user labs, establishment of a matching funds scheme for EU framework programs, installation grants for young scientists and synergies with the Unity through Knowledge Fund (UKF – see below) are only some of the provisions implied in the new Act.
- Part of the money devoted in the state budget to scientific activities will be given directly, via multi-year performance based contracts, to the autonomous disposal of public universities and public research institutes, thus increasing their responsibility and accountability and, once more, promoting the abandonment of direct state management of science activities. Three-year performance based financing contracts in the value of almost 90 million Euros have already been signed with all public higher education institutions guaranteeing the coverage of the tuition fees to all successful tertiary education students.
- Two distinct companies aimed at managing state-supported technological activities, including technology transfer from academia to industry, set-up of start-up, spin-off and spin-out companies and similar activities, have been joined via a Government decree in a single state agency administrated jointly by MSES and the representatives of the industrial sector, of the academic sector as well as of the Ministry of Economy, the Ministry of Entrepreneurship and Crafts and the Ministry of Regional Development and EU Funds – thus establishing the Business Innovation Agency of the Republic of Croatia (BICRO) (6).
- MSES actively supports and collaborates also with the StartUp Croatia initiative, the Croatian business angel association CRANE, the Entrepreneurial Incubator Zagreb (ZIP) initiative as well as numerous other technological initiatives.
- The National Council for Science (NCS), the highest independent strategic body for science in Croatia, constituted by excellent scientists and appointed by the Croatian parliament (7), has adopted in early 2013 the criteria for the establishment of the first national scientific centres of excellence.
- NCS has recently also adopted new precise and clear rules and procedures for the advancement in

- the scientific ranks aiming at increasing their level at least to that of neighbouring transition countries, as well as at fostering the international relevance, the visibility but also quality control of Croatian scientific production.
- In collaboration with the Ministry of Economy and the OECD, MSES is working on drafting the National Innovation Strategy of Croatia for the period 2013–2020. MSES is active also in drafting the Western Balkan Regional Innovation Strategy.
  - In collaboration with the Croatian Academy of Sciences and Arts and stakeholders from academia, the guidelines for the National Strategy of Education, Science and Technology have been written. These constitute the basis for the drafting of the respective National Strategy coordinated by a governmental body headed by the Croatian Prime Minister and operatively being led by the counsellor for science of the Prime Minister, Prof. Dr. Neven Budak.
  - Intense activities on the usage of EU pre-accession instruments (IPA) in science are also being pursued. In this frame a Science and Innovation Investment Fund, financing several projects, is up and running, while a major project aimed at building in Zagreb a biotechnological incubator named the BioCenter is in its most active construction phase. Through these instruments almost 30 million Euros are being invested in scientific infrastructure. This is, however, only the learning phase for the usage of structural and other EU funds which will be available to Croatia at its accession to EU member state on July 1st, 2013. In this frame the respective operational programs are being set-up, an indicative list of infrastructural projects is prepared and regularly updated, while the first infrastructural investment, that in equipping the laboratories at the campus of the University of Rijeka, should be initiated by the end of this year.
  - MSES has also sent in the year 2012 a formal Croatian scientific attaché to the Croatian EU mission in Brussels, thus promoting the active participation of Croatia in all relevant EU science forums and bodies, the exchange of relevant information, better formulation of Croatian standpoints and their harmonisation with EU policies and other similar activities.
  - In collaboration with the International Bank for Reconstruction and development (the World Bank – WB), the preparatory phase for the Second Science and Technology Project (STP 2) is being carried out. The active part of the project, worth totally 24 million Euros and lasting up to four years, will commence in July of this year and is aimed at boosting the knowledge-based technological and innovation sectors in Croatia as well as at increasing the absorption capacities for the EU funds. Part of the funds will also be dedicated to the programs of the UKF – a fund created to promote the cooperation between Croatian scientists inland and those working currently abroad. The fund has already established itself, among others, through official recognition of the International Labour Organisation (ILO) and the European regional economic forum (EREF), as an example of good practices in the broader southern-European region and beyond (8).
  - Towards the end of the year 2012, MSES had the honour of signing the 100th Marie Skłodowska Curie COFUND project worth 7 million Euros aimed at fostering the mobility of young outgoing and incoming scientists as well as the repatriation of Croatian scientists.
  - In early 2013 MSES, the Ministry of Labour and Pension Funds, the Ministry of Regional Development and EU Funds and the Government proposed, and the Croatian Parliament adopted the final version of the Act on the Croatian Qualifications Framework (CQF). CQF harmonises and interrelates Croatian qualifications with those of the common European Qualifications Framework (EQF), the qualifications Framework of the European Higher Education Area (QF-EHEA) as well as the qualifications of (not only) other EU countries. CQF sets thus further basis for the implementation of learning programs fully based on learning outcomes and the needs of the labour market, criteria for the validation of non-formal and informal learning, promotion of lifelong learning and quality assurance in achieving all qualification levels.
  - The amendments to the Act on Science and Higher Education, proposed by MSES and the Croatian Government, are in the parliamentary procedure. The amendments define the provisions for the institution of a single expert strategic body for the synergistic definition of all relevant national policies in science, higher education and the innovations – the National Council for Science, Higher Education and Technological Development. The amendments also define clearer procedure for the advancements in scientific and teaching ranks, provide in full detail the definitions for the exception in remaining in the system upon reaching the retirement age and provide a better definition for the election of post-docs. The Act also defines better the types of study programs in all forms of higher education studies, defines an obligation for the institutions to formalise databases on studies, students and other forms of institutional activities and defines the authority of the Minister of higher education in defining the living and tuition standards for the student in public higher education institutions. Finally, the Act enforces the roles and the authorities of the Board for Ethics in Science and Higher Education appointed by the Croatian Parliament so as to foster professional responsibilities and the reputation of the Croatian academic community inland and abroad.

- Activities aiming at achieving for Croatia the status of a CERN associate member state have also been initiated at MSES and should be completed towards the begging of the year 2014.

In all these activities the key terms of MSES aspirations are: responsibility and accountability, transparency with clear and consequent criteria, competitiveness, efficiency, quality, priority setting and implementation, poly-centric development of Croatia, social dimension and social inclusiveness of education and science as well as internationalisation and mobility.

#### 4. INSTEAD OF A CONCLUSION

Croatian science and higher education at the verge of Croatian accession to full membership into the EU are facing several challenges, but also numerous fascinating opportunities. MSES see its role in this process as a service to the students and the academic community. MSES can only set-up the pace of some measures and

policies, but their successful implementation in promoting Croatia as a "small country for big brains" can only happen if a large portion of all relevant stakeholders get actively involved in all the phases of this process. MSES is sincerely convinced that the large majority of the Croatian society shares this aspiration.

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