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Research and Innovation Observatory Country Report 2016 Croatia

The 2016 series of the RIO Country Report analyses and assesses the development and performance of the national research and innovation system of the EU-28 Member States and related policies.

It aims at monitoring and evaluating the EU policy implementation as well as facilitating policy learning in the Member States.

Contents

Foreword	3
Acknowledgements	4
1 Main R&I policy developments in 2016	5
1.1 Focus on National and Regional Smart Specialisation Strategies	5
2 Economic context	6
2.1 Structure of the economy	6
2.2 Business environment	7
2.3 Supply of human resources	7
3 Main R&I actors	7
4 R&I trends	9
4.1 Public allocation of R&D and R&D expenditure	9
4.2 Private R&D expenditure	10
4.3 Public sector innovation and civil society engagement	11
5 Innovation challenges	12
5.1 Challenge 1 Increasing the R&I funding and improving the absorption of ESIF	12
Description	12
Policy Response	12
Policy Assessment	13
5.2 Challenge 2 Building a coherent and integrated R&I policy framework	13
Description	13
Policy Response	14
Policy Assessment	14
5.3 Challenge 3 Strengthening the private sector's R&I capability and improving the business innovation environment	15
Description	15
Policy Response	15
Policy Assessment	16
5.4 Challenge 4 Strengthening the public R&I capacity	16
Description	16
Policy Response	17
Policy Assessment	17
6 Focus on creating and stimulating markets	18
References	20
List of abbreviations and definitions	22
Factsheet	23
List of figures	23

Foreword

This report offers an analysis of the R&I system in Croatia for 2016, including relevant policies and funding, with a particular focus on topics of critical importance for EU policies. The report identifies the main challenges of the Croatian research and innovation system and assesses the policy responses implemented. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites, etc. The quantitative data are, whenever possible, comparable across all EU Member State reports. Unless specifically referenced all data used in this report are based on Eurostat statistics available in January 2017. The report contents are partly based on the RIO Country Report 2015 (Račić, Švarc, Hristov, 2016).

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HIGHLIGHTS

- In 2015, Croatia reversed the long-lasting (2009-2014) negative GDP growth rate and the real GDP expanded by 1.6%. These positive indications are further projected in 2016 and 2017.
- The employment in high- and medium-tech manufacturing (3.2%) and in knowledge-intensive services (32.53%) remains below the EU28 average (4.69% in 2013 and 36.95% in 2014).
- The R&I governance and funding system is centralised, with several public bodies involved.
- The system is characterised by low R&D intensity, with the direct public support to R&D expenditures having decreased during the post-crisis fiscal adjustment period.
- The 2014-2020 programming period is Croatia's first full cycle with access to ESIF. That will provide an important source of financing for both public and private sectors.
- On 11 September 2016, parliamentary elections were held, due to a motion of no confidence against the previous government in June 2016, after just five months in power. The new government was sworn in on 19 October.

MAIN R&I POLICY CHALLENGES

- **Increasing the R&I funding and improving the absorption of ESIF.** Despite the efforts and actions undertaken, Croatia struggles in increasing the R&I investment and lags behind the 2020 R&D target of 1.4% of GDP. It is expected that the country will take advantage to leverage its R&I investments through ESIF.
- **Building a coherent and integrated R&I policy framework.** The reforms undertaken to tackle fragmentation have led to certain improvements of R&I governance. The adopted strategic documents provide an impetus to the reform of the national education, research and innovation systems. However, their implementation remains to be seen.
- **Strengthening the private sector's R&I capability and improving the business innovation environment.** Creating innovation-friendly business environment, strengthening the links between science and business and developing the "smart" skills to meet the business needs are among the key targets of the Smart Specialisation Strategy and the Strategy for Fostering Innovation. The overall funding provided to the business sector is still insufficient.
- **Strengthening the public R&I capability.** Implementation of reforms has started and initial results are mostly promising. Research grants are now awarded on the basis of rigorous evaluation that should lead to a smaller number of high quality research projects. Performance-based institutional funding should also strengthen the financial responsibility of R&D institutions.

MAIN R&I POLICY DEVELOPMENTS IN 2016

- [Strategy for Smart Specialisation \(S3\)](#) adopted.
- First calls funded by ESIF issued and a seed co-investment fund for innovative SMEs launched.
- Initiated establishment of the Innovation Network for Industry.
- The Ministry of Economy and the Ministry of Entrepreneurship and Crafts merged into the Ministry of Economy, Entrepreneurship and Crafts.
- New [Public Procurement Act](#) adopted.

1 Main R&I policy developments in 2016

<p>Launch of a Seed co-investment fund as one of the components of Innovation and entrepreneurship venture capital project (04/2016)</p>	<p>The HAMAG-BICRO launched a new programme for seed co-investments in innovative SMEs. The budget of the programme is €2.5m.</p> <p>6th call of the Proof of concept program (PoC) under STP II completed with 62 projects contracted from private and public sector and contracted amount of € 2.5 mil.</p>
<p>The new Public Procurement Act (04/2016, 12/2016)</p>	<p>The new Public Procurement Act introduced a new procurement procedure – Partnership for Innovation.</p>
<p>Strategy for Smart Specialisation (S3) (04/2016)</p>	<p>In April 2016, the government adopted the Strategy for Smart Specialisation (S3) (Official Gazette, 32/2016).</p>
<p>First calls funded by the ESIF issued (under OPCC) (05/2016, 08/2016, 11/2016)</p>	<p>The Ministry of Economy and the Ministry of Entrepreneurship and Crafts (now merged into the Ministry of Economy, Entrepreneurship and Crafts) published the first calls funded by the ESIF (Competency and development of SMEs, Innovations in newly established SMEs, Commercialisation of innovation in entrepreneurship, Increasing the development of new products and services resulting from R&D activities, Support to the development of centres of competence). In November 2016, Ministry of Science and Education launched a restricted call for the Centres of research excellence performing excellent science project proposals for development of frontier research and capacity strengthening.</p>
<p>Innovation Network for Industry (05/2016)</p>	<p>Establishment of the Innovation Network for Industry has been initiated within the Strategic project for support the establishment of innovation network for industry. The network will consist of Innovation Council for Industry and eight thematic innovation councils, centres of competence which will be established and funded by ESIF, and national competitiveness clusters.</p>

1.1 Focus on National and Regional Smart Specialisation Strategies

Description and timing: The Croatian Smart Specialisation Strategy (S3) was adopted only recently: in April 2016 (Official Gazette 32/2016). It focuses on the following thematic areas: health and quality of life, energy and sustainable environment, transport and mobility, security, food and bio-economy. KETs and ICT have been identified as horizontal themes linked to the afore-mentioned areas. The S3 was published together with the Action Plan for 2016 and 2017, which envisages a series of actions such as: mapping of R&I capacities in research and business sectors, establishment of Innovation Network for Industry, thematic innovation councils, thematic innovation platforms, centres of competence, etc. The appointment of National Innovation Council and Inter-ministerial working group are foreseen to manage S3 and establish a system of evaluation and monitoring.

New developments: The adoption of the S3 has opened the possibility to tap into ESIF 2014-2020. The Ministry of Economy (MoE) and the Ministry of Entrepreneurship and

Crafts (MEC) (now Ministry of Economy, Entrepreneurship and Crafts - MEEC), as well as Ministry of Science and Education (MSE, previously Ministry of Science, Education and Sports) have launched their first calls ([Competency and development of SMEs](#), [Innovations in newly established SMEs](#), [Increasing the development of new products and services resulting from R&D activities](#)) by which they began the realisation of the Action plan for the implementation of the S3 in 2016 and 2017. In August 2016, a restricted call for project proposals for grants to [Support to the development of centres of competence](#) has been published. Public tender for consultancy services related to supporting the Ministry of Economy, Entrepreneurship and Crafts in the process of establishment and operational functioning of the national innovation system was published in September 2016 and cancelled in December same year. The aim of the tender was, with consultancy support, the establishment of the Innovation Network for Industry (including Innovation Council for Industry, thematic innovation councils, and innovation web platform).

In November 2016, a restricted call was published to support research projects of [centers of research excellence](#), which were founded in 2014 and 2015. MSE also continued financing of project pipeline documentation for research infrastructure projects from ESIF funds (OPRC 2007-2013) and Science and Technology Project II. MSE also prepared several calls within OPCC that will be launched in 2017 (grant schemes for research projects conducted by research organizations, science – industry collaboration projects, modernization of research infrastructure, science and technology foresight etc.), all of them increasing capacities of R&D sector to perform excellent research and to serve the needs of economy.

Outstanding issues: Many of the activities envisaged in the Action plan have been delayed due to different factors. Several important bodies, including the National Innovation Council, which has been envisaged as the pillar institution for co-ordination of S3 implementation, have not yet been established.

2 Economic Context

In 2015 the Croatian economy started to grow again, after a long period of decline in economic output (2008-2014). GDP per capita amounted to €10,400 (PPS €16,700) which is significantly below EU-28 level (€28,800) but represents an increase compared to 2013 (HR: €10,200 / PPS €15,800; EU-28: €26,700) and 2014 (HR: €10,200 / PPS €16,100; EU-28: €27,500). At the same time, the Total Factor Productivity (TFP) is in decline since 2006 and in 2014 it plummeted to 83.6% of the level recorded in 2006 (Feenstra, et al., 2015). In 2008-2015 Croatia's labour productivity level was among the five lowest in the EU (Eurostat). Nevertheless, in 2015 the real GDP increased by 1.6% and the positive indications are further projected in 2016 (2.6%), 2017 (2.5%) and 2018 (2.3%), mainly due to investment, consumption and exports. General government debt has been increasing constantly since 2008 (49% of GDP), reaching 86.7% of GDP in 2015, but is set to decline gradually to 82.8% in 2018. Budget deficit has decreased to -3.3% of GDP in 2015 with positive forecast for the next years. The unemployment, a long lasting structural problem in Croatia, saw a first decrease since years in 2015 (16.3%) and is projected to go further down to 10.3% in 2018, backed by accelerated economic activity and shrink of labour force (EC, 2016a).

2.1 Structure of the economy

In 2014, the gross value added (GVA) of services accounts for 69.2% (EU-28:74%) of the total GVA and the share of knowledge intensive services corresponded to 34.5% of the total GVA (EU-28: 23.61%). Manufacturing comprised 14.65% of GVA (EU-28: 15.5%), while the share of high-tech manufacturing industries, which has been declining since 2010, rose to 3.9% in 2014 (EU-28: 7.2%). The majority of the companies are qualified as SME and 91.7% of them employ up to 9 persons (EU-28: 93%). Only 0.28%

of the total firms employ more than 250 people (EU-28: 0.19%). The share of employment in high and medium-high technology manufacturing has decreased from 3.7% of total employment in 2011 to 3.2% in 2015, while the employment in knowledge-intensive sectors has been gradually increasing from 28.4% of total employment in 2011 to 32.5% in 2015.

2.2 Business environment

Croatia ranks 43rd in 2016 with regards to the "Ease of doing business" indicator in the Doing Business ranking (World Bank, 2016). Despite the fact that in the last few years Croatia invested numerous efforts to create an environment favourable for conducting business, such as reducing notary fees, introducing a new form of limited liability company with a lower minimum capital requirement and simplification of incorporation procedures the current position remained almost unchanged (in 2014 the country held 39th rank and in 2015 40th). In the Ease of starting a business index (GII, 2016), the country ranks 64th in 2016 (73rd in 2015). Furthermore, it seems that "ease of getting credit" in Croatia has become more complicated since the country moved from 56th in 2015 to 63rd position in 2016 (GII, 2016).

2.3 Supply of human resources

Unemployment rate amounted to 16% of labour force in 2012, increased to 17.3% in 2013, remained at the same level in 2014, then decreased to 16.3% in 2015 and latest data (2016Q2) indicates further decrease: 13.4% (although seasonal factors also play a role here). A positive development is that the number of new doctorate graduates (aged 25-34; per thousand of population) almost doubled from 0.41 in 2009 to 0.81 in 2015. Nevertheless, the number of researchers per thousand of population remained almost unchanged, even slightly decreased from 2.67 in 2011 to 2.62 in 2013. The number of people employed in science and technology rose from 13.6 % in 2010 to 15.3% in 2015 (EU28: 20.2%). The slowest growing indicator of human resources in science and technology is the share of scientists and engineers in total population, which amounted to 2.6% in 2015 (2010: 2.0%), when the EU average was 4.4% (2010: 3.2%). At the same time, the new graduates in science, math, computing, engineering and manufacturing per 1000 population remained unchanged in the last few years (2014: 1.94) and below the EU28 average (2014: 2.3).

3 Main R&I actors

The governance of R&I system in Croatia is centralised at the state level (weak regional dimension). R&D policy falls mainly within the scope of the **Ministry of Science and Education** (MSE) (until recently: Ministry of Science, Education and Sports) with innovation aspects are dealt by the **Ministry of Economy, Entrepreneurship and Crafts** (two separate entities until recently: Ministry of Entrepreneurship and Crafts and the Ministry of Economy). The afore-mentioned bodies together with the **Ministry of Regional Development and European Funds** acquire increasingly important role because of the growing role of the European Structural and Investment Funds for financing R&I activities. The main funding body for competitive research projects is the **Croatian Science Foundation**, responsible for improving competitiveness, visibility and integration of the Croatian research area into European Research Area (ERA). The highest advisory body for the research, higher education and technology is the **National Council for Science, Higher Education and Technological Development**. The **Agency for Science and Higher Education** is responsible for setting up a national network for quality assurance and evaluation of scientific research and higher education. The **Croatian Agency for Small Business, Innovation and Investment** (HAMAG-BICRO) is responsible for implementation of all business R&I related ESIF measures as

well as for providing support in implementation of S3 as well as Strategy for Fostering Innovation in the form of technical secretariat. In addition HAMAG-BICRO implements EUREKA/Eurostars programmes and is part of EEN network coordination innovation related activities within Croatia.

There are 184 scientific organisations registered in Croatia for scientific activity and recorded in the Register of scientific organisations¹. These include 25 public research institutes and 91 higher education institutions. Besides, there are several research institutes in state ownership oriented to market research. There are around 25 private research organisations which are either independent institutes (e.g. the Mediterranean Institute for Life Sciences) or belong to corporations (e.g. Ericsson Nikola Tesla). Several small research-based companies were founded over the last years, some of which are not present in the Register of research organisations. In the private business sector R&D is concentrated in a few large multinational companies: PLIVA (pharmaceuticals), Ericsson Nikola Tesla (ICT), Podravka (food industry) and Končar – Electrical Engineering Institute (electrical engineering).

A limited number of private foundations provide grants for projects in research and culture and students' scholarship of which the most significant is the ADRIS group. The "Prof. dr. Marijan Hanžeković Trust" provides funds to promote the financial sciences mainly by encouraging young experts through awards and scholarships. There are also some foreign private foundations² with offices in Zagreb.

There are several research and technology institutions with the main mission of fostering science – industry cooperation and commercialisation of research results, such as the Science and Technology Park of the University of Rijeka, TERA Tehnopolis (co-founded by the University of Osijek), the Centre for Research, Development and Technology Transfer of the University of Zagreb and the Centre for Science and Technology Development of the University of Split. Important measures for improvement of the national innovation system include, among others, further strengthening of technology transfer offices at universities, establishment of the Innovation Network for Industry, creation of Thematic Innovation Platforms and the centres of competence.

On the initiative of the government, thirteen competitiveness clusters (as non-profit organisations) have been established in order to provide sector specific synergies to increase national competitiveness. Although their role is still rather limited, they are expected to be integrated in the Innovation Network for Industry and to have an active role in the overall national innovation system. Clusters are also responsible for award of the status of projects of national interest, which is a requirement for applying in public calls of centres of competence. Establishment of thematic innovation platforms related to Smart Specialisation Strategy (S3)³ priorities has also been envisaged. This should be initiated within the Strategic project for support the establishment of innovation network for industry and thematic innovation platforms, which started in May 2016 and is expected to last for four years, together with the establishment of the Innovation Council for Industry and eight thematic innovation councils (linked to the thematic and cross-cutting themes of S3).

Based on the proposal of the National Council for Science, Higher Education and Technology Development, MSE established thirteen centres of research excellence in 2014 and 2015. They gather the best researchers in particular (sub-)fields of science and are focused on contemporary research topics. There are expected to act as internationally competitive and recognizable research groups in terms of quality and scope of scientific production and to engage in effective international cooperation.

¹ All legal persons performing scientific activity pursuant to the Scientific Research and Higher Education Act are entered in the Register. <http://public.mzos.hr/Default.aspx?art=5489&sec=2167>

² For example, the German Konrad Adenauer Foundation and the Friedrich Ebert Foundation

³ <http://s3platform.jrc.ec.europa.eu/regions/HR/tags/HR>

4 R&I trends

The total gross domestic expenditure on R&D (GERD) amounted to almost €375m in 2015. There are three main sources of R&D funding: the business sector (€175m), the government (€136m), and foreign funding (€54m) (Eurostat, 2016).

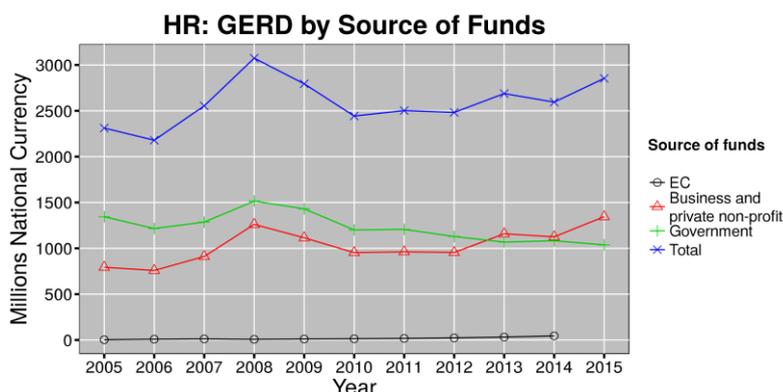


Figure 1 Trend of GERD by sources of funding
Data source: Eurostat, 2016

There is an increase compared to 2014 when GERD accounted to €340m. The increased GERD is mainly due to the stronger investment from the business and the financial inflows from abroad (Eurostat, 2016). In 2015, GERD intensity increased to 0.85% (0.79% in 2014) but still below the pre-crisis level (0.88% in 2008). Compared to investments in the EU-28 (2.03%), Croatia is considerably lagging behind (Eurostat 2016). This is significantly below the national target of 1.4% by 2020, set in the Economic Programme of Croatia from April 2013, nevertheless is a positive sign. According to the European Innovation Scoreboard (EC, 2016d), turnover from innovation decreased from 10.5% of overall turnover in 2010 to 10% in 2012.

Significant expectations have been put to absorption of available EU funding for R&D activities and infrastructure for 2014-2020 as a mean to support and increase R&D funding in Croatia. However, increasing the R&D expenditures to 1.4% of GDP by 2020 still remains a challenge. Overall, last several years have been characterised with the introduction of structural reforms in R&I system stemming towards improvement of resources' allocation efficiency and the framework conditions for business. Main reforms in this area included changes in the allocation of research grants, development of new strategic development documents, re-organisation of both instruments and institutions for allocation of R&I grants. Since the European Structural and Investment Funds (ESIF) acquire increasing importance in R&I funding, the budget cycles are supplemented with these dynamics.

4.1 Public allocation of R&D and R&D expenditure

The Croatian post-crisis fiscal adjustment did not start up until 2011 and it has still not been accomplished. Since 2009 GERD decreased nominally and in percentage terms from 2008 (0.88% of GDP) to 2010 (0.74% of GDP) but it gave a positive sign in 2015 (0.85% of GDP). . GBAORD started at 1.53% of total government expenditure in 2011 to drop to 1.3% in 2014. A notable increase in GBAORD is announced in Eurostat for 2015 (1.77% of GDP) which might be a sign of recovery and reflects the government engagement towards R&I policy. However, government funded GERD remained on the same level from 2010 on 0.21%. The direct public support to R&D expenditures decreased during the post-crisis fiscal adjustment period. On the other hand, despite budget resources being scarce they are have been allocated regularly. The Croatian post-crisis fiscal adjustment has come at an expense of direct public support to R&D expenditures through significant cuts in R&D budgets. On the other hand, indirect support to R&D through tax incentives may have played a role in maintaining the total

public support, although they tend to be disproportionately utilised by a relatively small number of companies.

Increase in the public R&I funding is expected mainly from the ESIF. R&I calls published in 2015/2016 include: [Innovations in newly established SMEs](#), [Increasing the development of new products and services resulting from R&D activities](#), [Support to the development of centres of competence](#) and [Centres of research excellence performing excellent science](#). Financing of documentation preparation for implementation of research infrastructure projects was significant in 2016. It is thus planned that in 2017 the opportunities for ESIF funding of R&I projects and research infrastructure modernisation will expand significantly.

Croatia offered indirect support through R&D tax incentives for eligible expenditures of R&D projects' costs. This measure corresponded to a subsidy of about 20% for investments in R&D. In 2014 the total amount of R&D tax incentives (16,6 mil EUR)⁴ corresponded to 5,3% of the total Government Budget appropriations or outlays spent for R&D activity (340 mil EUR⁵) which means that Croatia is not among countries with significant relative importance of tax incentives in the overall financial effort incurred by governments for R&D (like Ireland (43%), Hungary (34%) or France (28%)⁶) in the same year. According to the evaluation of the R&D tax incentives, they "have increased the number of firms having R&D expenditures, although not necessary the value of expenditures itself" (Aralica et al., 2011). Despite its relative generosity, there are estimations that the tax incentives tend to be of little relevance to SMEs and to favour incumbent firms to the detriment of entrants (World Bank, 2015). This scheme has ended in December 2014 and new legislative framework for R&D tax incentives is being prepared in line with General Block Exemption Regulation (GBER).

4.2 Private R&D expenditure

BERD intensity in Croatia remained low (in the range 0.3-0.44% of the GDP) in the last decade. It was 0.39% of GDP in 2008 and stagnated in the aftermath of the financial crisis at around 0.34%. There were some signs of recovery in 2013 (0.41%), followed by a decrease in 2014 (0.38%) to reach the highest score in 2015 (0.44%). The R&D intensity was 0.85% in 2014 and BERD amounted to more than the half of it.

The business sector is the main funder of the Croatian BERD. In nominal value, the funding from abroad has followed a growing trend until 2013. In 2015, it amounted to about 16% of the total BERD. The main source of funding within the abroad R&D is the foreign business sector. The increased BERD is mainly due to the stronger investment from the business. Despite the recent increase, the low investments of business sector in R&D are of particular concern since it hinders development of comprehensive innovation system needed for international competitiveness and economic recovery. Medium and large companies invest more than 90% of the R&D. A little below 8% of private investments come from micro and small enterprises (OPCC, 2014).

⁴ National Annual State Aid Report for 2014 published by the Ministry of Finance

⁵ Source: Croatian Bureau of Statistics: www.dzs.hr/HRV-Eng/publication/2015/08-02-02_01_2015.htm

⁶ Source: OECD, R&D Tax incentive Indicators: <http://oe.cd/rdtax> and Main Science and Technology Indicators 2016/1: www.oecd.org/sti/msti.htm, and Eurostat R&D statistics: <http://ec.europa.eu/eurostat/web/science-technology-innovation/data/database>

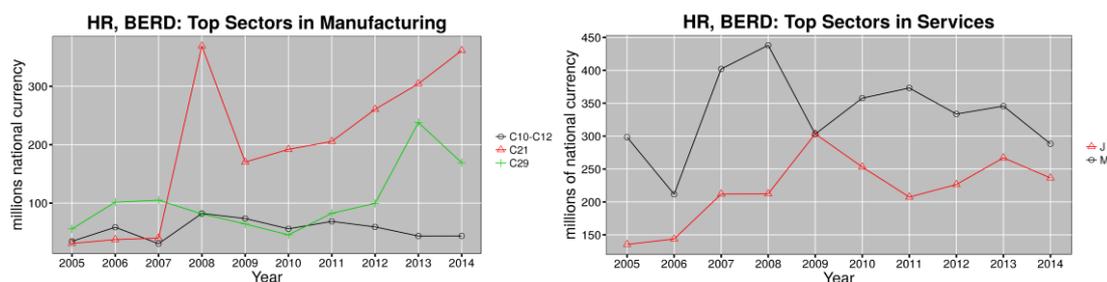


Figure 2 Top sectors in Manufacturing (C10-C12= Manufacture of food products; beverages and tobacco products, C21=Manufacture of basic pharmaceutical products and pharmaceutical preparations, C29= Manufacture of motor vehicles, trailers and semi-trailers). Top service sectors (J=Information and communication, M=Professional, scientific and technical activities).
Data source: Eurostat, 2016

While the BERD intensity in the services sector remained essentially stable, it was only in 2013 when the manufacturing reached again the pre-crisis intensity. Within the services, in 2014 business expenditures are mainly focused in scientific R&D sector (almost 52%) and information and communication sector (42.7% of total services). Croatia has long-standing tradition in the ICT sector, which was in decline in the post-crisis period but started to recover after 2011. International companies operating in the field are Siemens, Ericsson, IBM, SAP, Microsoft, ENVOX. Ericsson Nikola Tesla institute is the largest provider in the region of telecommunication products and services.

Pharmaceuticals (55% of total manufacturing) and automotive industry (26% of total manufacturing) are accounting for more than two thirds of the manufacturing sector. The automotive industry in Croatia relies on companies that produce and supply spare parts for the world's top automobile manufacturers (PSA, GM, Fiat, BMW, Audi – Volkswagen Group, Ford, Renault, Toyota, Volvo, etc). Croatia also boasts in the production of electric cars (e.g. Rimac Automobili)⁷. This is probably the main reason for the upward trend in the recent years.

There are a number of private companies operating in the pharmaceutical sector: PLIVA (Teva), GlaxoSmithKline, Hospira, Fidelta (Galapagos), ACG Lukaps, Farnal (pharmaceuticals). However, there is no reliable data on the actual R&D spending of these multinationals in Croatia.

4.3 Public sector innovation and civil society engagement

The concept of innovation in public innovation sector is still a new concept in the Croatian public policy, not very well described or empirically verified. However, Croatia made a large progress since 2014 by initiating new regulations, strategies, and activities to improve public services by use of ICT.

In the European Public Sector Innovation Scoreboard (EC, 2013) Croatia is represented with 10 out of a total 22 indicators. Croatia turned out to be better than the EU average in three indicators: 1) Employment share of „creative occupations“; 2) Improvement in public services for business and 3) Introduction of innovative public services for business which have had a significant impact on their performance. The Global competitiveness report 2016-2017 (WEF 2016) ranks Croatia 129th out of 138 countries (last in EU) in the indicator Government procurement of advanced technology products. This is a slight decline in comparison with the previous period when Croatia ranked 124th out of 134 countries. According to the United Nations E-Government Development (EGDI) Index (UN 2014) Croatia scores 0.6282 comparing to the EU average of 0.7300 (Regional average of 0.6936 and the World average of 0.4712). Croatia is ranked 47th out of a

⁷ <http://www.aik-invest.hr/en/sectors/automotive-industry/>

total of 193 United Nations Member States in 2014 which however is lower than in 2010 (35th).

In the e-public sector innovation culture which includes among others the co-design and co-creation of innovative solutions of e-policies and services jointly with citizens, the biggest step forward is made by launching the e-Consultation Portal (e-Savjetovanja)⁸ which enable all interested stakeholders to take a more active part in shaping new legal initiatives and laws.

Civil society has been increasingly active in the areas of social entrepreneurship and social innovation. Most of relevant social innovations have been launched by NGOs and social entrepreneurs have gradually developed their own supporting structures and institutions, which use the funds available to NGOs (from domestic and EU sources) and their own resources to develop projects, share knowledge and facilitate co-operation. The public support for social innovation has been sporadic.

5 Innovation challenges

Main structural challenges of the Croatian R&I system have remained the same as in the previous years, but a new emphasis is on the low absorption of the ESIF. The following challenges can be identified:

5.1 Challenge 1 Increasing the R&I funding and improving the absorption of ESIF

Description

Croatia's GERD amounted to 0.85% of GDP in 2015 which is almost the level the country held in 2008. Compared to EU Member States, Croatia depicts one of the lowest levels of R&D intensity. At the same time, the national target of 1.4% of GDP to be achieved by 2020 is far. Still, in 2004, when GERD amounted to 1.03% of GDP, the new target seemed realistic. The European Semester Country Report 2014 states that a "major challenge for Croatia is to build up research and innovation capacities through targeted public investment from ESI funds and national resources to leverage private investment". The year before, the Country Report 2013 concluded that "Productivity growth and a faster transition to a knowledge-based economy are hampered by a low level of spending on research and development".

Policy Response

Croatia's efforts in the last years have been geared towards improving the overall framework of funding for R&I. Important documents adopted have given high priority to ESIF absorption (e.g. the Smart Specialisation Strategy) and overall R&I framework (the Strategy for Fostering Innovation and the Strategy for Education, Science and Technology). Political commitment to create conditions for increasing of R&I investments is expressed through various channels, including the afore-mentioned strategic documents.

In the light of the reduced R&D funding, the Croatian government has reviewed and consolidated the grant schemes and renewed a number of instruments to support business R&I investment. Several funding programmes were integrated in the Business Impulse Programme (IRCRO, RAZUM and Proof of Concept), funded by STP II. The programme also envisages several measures aiming towards facilitating access to capital, including seed and early stage capital schemes. Proof of Concept 6th call completed in June 2016 was the last envisaged business R&I call through STP II

⁸ <https://vlada.gov.hr/e-consultation-portal-launched-for-citizens-to-take-more-active-part-in-law-making/16865>

programme. The first grant schemes for R&I activities, funded through the ESIF, have also been launched (e.g. Competency and development of SMEs⁹, Innovations in newly established SMEs¹⁰, Increasing the development of new products and services resulting from R&D activities¹¹, support to Centers of research excellence¹²). These schemes will be implemented by the Ministry of Economy, Entrepreneurship and Crafts and the Ministry of Science and Education.

MSE has prepared several ESIF calls to be launched in 2017, including project pipeline preparation, several grant schemes for investments into organisational reform and infrastructure of R&D&I sector (public research infrastructure), research projects including collaborative science-industry projects and support to technology transfer offices.

In addition to direct funding programmes, Croatia offered the possibility to use R&D tax incentives to the business sector. In December 2014 the R&D tax incentives have been discontinued because of the discrepancies of the Croatian legal framework and EU regulations. However, a new legislative framework for R&D tax incentives was prepared by the MSE in 2016 in line with General Block Exemption Regulation (expected to be adopted in 2017).

Policy Assessment

Croatia still lags considerably behind the target of 1.4% of GDP for R&D. Despite the efforts and actions undertaken, the country struggles in increasing the R&I investment and the situation has not changed much after the country's accession to the EU. It has to be noted that Croatia had only access EU funds for a limited period of time in the 2007-2013 cycle. Nevertheless, based on the past programming experience, Croatia will need to invest more efforts to ensure adequate capacities for absorption of ESIF for the benefits of national development (EC 2015). Expectations are high that the country will take maximum advantage to leverage its R&I investment in the current period. However, this is linked to administrative capacity (see challenge 2) and absorptive capabilities of the business (see challenge 3). The nationally funded support measures (e.g. R&D tax incentives) had a relative success in many regards and probably contributed to maintaining the level of funding, but did not bring about tangible result in increasing the R&I intensity (see challenge 3).

5.2 Challenge 2 Building a coherent and integrated R&I policy framework

Description

Croatia is the youngest member of the European Union and has a relatively young R&I system. The country has been for long characterised by a lack of sustained political commitment to innovation (OECD, 2014). One of the recommendations in the framework of the European Semester 2015 stated that "building a performing national innovation system and benefiting from EU funds will require an overhaul of the governance of public and publicly funded research" (EC, 2015). The ES 2016 confirmed that policies "in support of innovation are characterised by the lack of a coherent and integrated R&I policy framework" (EC, 2016c). The present science and innovation policy suffers also from the insufficient level of coordination and synergy between government bodies responsible for research and innovation policy (Ministry of Science and Education, Ministry of Economy, Entrepreneurship and Crafts (which recently succeeded two separate ministries) and Ministry of Regional Development and European Funds).

⁹ <http://www.strukturnifondovi.hr/natjecaji/1248>

¹⁰ <http://www.strukturnifondovi.hr/natjecaji/1193>

¹¹ <http://www.strukturnifondovi.hr/natjecaji/1158>

¹² <http://www.strukturnifondovi.hr/natjecaji/1315>

Croatia's R&D&I policy has been characterised by lack of co-ordination and continuity. Low commitment has contributed to low levels and high volatility of R&D funding and has hampered long-term orientations as regards human resources, and investment in innovation (OECD, 2014, p. 16). A reflection of this situation could be found in the low levels of R&D intensity (see challenge 1). This is further reflected in the weak innovation performance (efficiency) of Croatia, which is ranked 26th according to the SII 2016 (EC, 2016b) and 27th when calculating the ratio between innovation output and input (Edquist and Zabala-Iturriagoitia, 2015). Also, this has resulted in delays in the drafting and implementation of several important strategic documents.

Policy Response

In the past few years, the R&I landscape has been reshuffled. In the search for better integration and coordination some institutions were merged. This resulted in the creation of the National Council for Science, Higher Education and Technological Development, (highest advisory body in the system) and the Croatian Agency for Small Business, Innovation and Investment – HAMAG-BICRO (main SMEs agency). In addition, the former Ministry of Economy and Ministry of Entrepreneurship and Crafts have been merged in the Ministry of Economy, Entrepreneurship and Crafts (MEEC) and the former Ministry of Science, Education and Sports became the Ministry of Education and Science (MSE).

Several important documents were adopted (Strategy for Education, Science and Technology¹³, Strategy for Fostering Innovation 2014-2020¹⁴, Croatian Research and Innovation Infrastructures Roadmap 2014-2020¹⁵). In April 2016, the Smart Specialisation Strategy (S3) was adopted. The S3 is seeking to unify all the relevant aspects from the various national strategies in one strategic framework. It acknowledges that implementing such policy is very complex and requires commitment of relevant institutions and strong policy capabilities at national and regional level. The strengthening of the national innovation system is set as a priority in the Croatian National Reform Programme 2016.

Furthermore, for the first time, Croatia drafted its national European Research Area Roadmap: Implementation Plan of the Republic of Croatia 2016-2020 (October 2016). The Implementation Plan gives an overview of the national strategic framework and guidelines for further development of science and technology, as well as a brief overview of the current situation in Croatia within each of the ERA priorities.

During 2016, MSE drafted a strategic project proposal Science and Technology Foresight whose implementation planned in the period 2017-2021. One of the main project outcomes is the establishment of a comprehensive and coherent overview of the Croatian R&I system. This will be achieved by creating a legal framework for the national research data management (in line with open science policies), an integrated ICT system (Croatian Current Research Information System – CroRIS) and by implementing mapping and foresight activities.

Policy Assessment

The reforms undertaken have led to certain improvement and advancement in the R&I governance. It could be expected that the merger of some key intermediary institutions (i.e. HAMAG-BICRO) and the rationalisation and connecting of the offices for EU projects in various ministries (Račić, D., Švarc, J., 2015) would bring about better synergy between institutions. Furthermore, this is in line with the conclusions of the analytical report in the framework of the ES 2015 (EC, 2015b). The recent merger of Ministry of

¹³ <http://www.novebojeznanja.hr/>

¹⁴ <http://www.mingo.hr/page/donesena-strategija-poticanja-inovacija-republike-hrvatske-2014-2020>

¹⁵ <http://public.mzos.hr/Default.aspx?art=13111>

Economy and Ministry of Entrepreneurship and Crafts should integrate the government approach towards the private sector.

The adopted strategic documents (Strategy for Fostering Innovation Strategy and Strategy for Education, Science and Technology) provide a significant breakthrough in reforming the national education, research and innovation systems. However, most measures boil down to administrative measures, administrative reshuffling, drafting and enacting of new documents, strategies, etc. This raises the question on their actual implementation. The innovation and research parts seem scattered and development goals to be achieved by 2020 might appear overly ambitious. Interim and ex-post evaluation are envisaged, but in general the Croatian evaluation system seems rather weak in this aspect. A positive development in the area of evaluation is S3 (2016) where a number of analytical documents with impact assessment were drafted during the preparation phase.

5.3 Challenge 3 Strengthening the private sector's R&I capability and improving the business innovation environment

Description

Overall business environment in Croatia creates disincentives to innovation due to the lack of coordination in the design of support instruments for innovation, access to finance and the inadequate framework conditions (OECD 2014; CEU 2015; EC 2015). There is still room for improvement in the regulation of product markets, facilitation of firm entry and exit and there are some delays and difficulties in obtaining licences and in contracting utilities (CEU, 2015).

Innovation capacity is negatively affected by several factors. Private investment on R&I and public funding for business R&I remains low. Croatia is lagging behind in several output indicators i.e., designs and trademarks, SMEs innovating in-house, SMEs introducing any type of innovation etc. (EC, 2016b). All this has resulted in a "low-level equilibrium", where "business sector's weak innovation capabilities and low investment in R&D&I leads to little effective demand for and supply of innovation-related services and research" (EC, 2015). This represents also an important obstacle to public-private collaboration (indicator).

According to the World Bank Doing Business 2016 report (WB 2016), Croatia's overall rank on the ease of doing business is 43rd (39th in 2015) and 21st in EU. Out of ten topics rated to determine a country's rank, Croatia recorded a progress in six, and a decline in one areas. The largest decline of (26 ranks) was in the area of getting credit.

Croatia suffers from mismatches between labour demand and supply and skills profile that is unfavourable to innovation, since "business innovation capability depends crucially on specialised skills in design, engineering, marketing and information technology, among others, and on the innovation demands and activities that the presence of such skills generates in firms" (OECD, 2014). CSR 2016 goes even further by saying "implementation of policies to improve the labour market relevance of education is slow".

Policy Response

Creating innovation friendly business environment for SMEs, strengthening the links between science and business and developing the necessary "smart" skills to meet the business need are among the key targets of the S3 and the Innovation Strategy and the other R&I related strategic documents. Human resources issues are addressed in the Strategy for Education, Science and Technology and the so-called advanced labour market information system (EC, 2016c). Several R&I support "infrastructures" are envisaged in the S3 Action Plan, such as competitiveness clusters (which have been set up), centres of competence (the call was launched in August 2016) and centres of research excellence (restricted call launched in November 2016).

The Croatian government is trying through different channels to incentivise business activities and to encourage investment in R&I. Different direct funding schemes (HAMAG-BICRO) were put in place and various instruments to improve access to finance. The new supporting schemes funded by the ESIF include action targeting the development of new products and services resulting from research and development activities, innovation in start-ups. In addition, indirect support was provided through R&D tax incentives but this instrument is being revamped (see challenge 3).

Policy Assessment

The overall funding provided to the business sector is low. In order to facilitate greater participation of the private sector in ESIF, a comprehensive evaluation of lessons learnt from previous public calls could be helpful for eliminating unnecessary administrative burden which hinders or slows down project application. It is important that measures are designed in a way to correspond to actual needs of potential applicants and the evaluation process adhere to international standards. This implies building competence and maintaining organisational stability in the agencies, dealing with R&I related ESIF (see challenges 1 and 2).

Evaluating the needs of the business sector and putting in place new instruments using ESIF and in the light of the S3 have the potential to further nurture R&I private activities and to help Croatia exit the trap of "low-level equilibrium" (World Bank, 2015). As for the indirect measures, according to the evaluation of the R&D tax incentives, they "have increased the number of firms having R&D expenditures, although not necessary the value of expenditures itself"(Aralica et al., 2011). There are estimations that the tax breaks tend to be of little relevance to SMEs and to favour incumbent firms to the detriment of entrants (World Bank, 2015). This indicates that a thorough evaluation of this instrument would be useful before the adoption of the new legislative framework. As for the human resource mismatch, the implementation of the reforms seems rather slow. Taking into account the changes proposed involve only minor funding from the business sector, achieving tangible results depends mainly on EU funds absorption (EC, 2016c). Also, curricular reform with more emphasis on relevant competencies and subjects could also be useful in the long term, combined with ESIF usage.

5.4 Challenge 4 Strengthening the public R&I capacity

Description

Despite the fact that some of the Croatian universities are big in size¹⁶, they remain mostly fragmented and faculties are usually organised as individual legal entities. This may be an obstacle for implementing coherent strategies and long-term planning. It also might be an obstacle for enrolment quota setting and matching between academic curricula and labour market (e.g., increasing the number of graduates in Science, Technology, Engineering and Math (STEM)) although Croatia has the lowest share of early school leavers and performs well on upper secondary education attainment. Most of 25 public institutes are carrying out research in Social Sciences and Humanities. At the same time, public research is largely underfunded and funding arrangements are rather fragmented. Public research funding was insufficiently linked to performance and evaluation of HEIs/PROs was largely underused until 2013. As pointed out in the Country Report Croatia 2016 (EC, 2016c) "Subcritical scale, fragmentation, relative isolation and a mismatch between academic curricula and labour market needs continue to affect public research".

This has negatively affected the level of integration of Croatian HEIs and PROs in the European Research Area (ERA), especially when it comes to possibility of fast adaptation to international competition and achieving excellence – Research excellence composite

¹⁶ For example, University of Zagreb hosts more than 72 000 students.

indicator score is still very low compared to EU28 47.8 in 2012, with only Romania (13.2) and Lithuania (14.1) performing worse than Croatia (18.89). There are also significant obstacles when it comes to commercialisation of research results and development of science-industry linkages. Public-private co-publications decreased by 9.37%, performance has worsened in PCT patent applications and linkages and entrepreneurship by 9.3% and 9.4% (EC, 2016b).

In the period of 2013-2017 MSE implements the new International Fellowship Mobility Programme for Experienced Researchers in Croatia – NEWFELPRO, a fellowship project funded from the FP7-MSCA-COFUND. The long-term objective of the NEWFELPRO is to raise the presence of research-qualified individuals by providing them with new opportunities to gain relevant international experience, and thus contribute to the further development of international scientific networks.

Policy Response

The model for public R&D funding is focused on awarding multi-annual (three-year basis) block grants for HEIs and PROs from the State budget by MSE, using performance-based indicators.

The responsibility for financing competitive research projects was transferred from MSE to the Croatian Science Foundation (CSF). New procedures include more rigorous project evaluation process aimed at selection of fewer high quality research projects. MSE allocated € 5.3m (HRK 40m) in 2013, and € 10.5m (HRK 79m) annually in the period 2014-2016 to the Croatian Science Foundation (CSF). Conditions are being put in place to support collaborative research, including internationally and to raise absorption capacity for EU funds and Horizon 2020.

Thirteen centres of research excellence were established in 2014 and 2015 relied solely on state budget funding until 2016. Additional resources for the centres are planned through ESI Funds, in line with S3 (see S3 Implementation Plan¹⁷), and the call was launched in November 2016.

Science and Technology Foresight project (2017-2021) aims to establish an institutional framework which is important for evidence-based policy making and more effective investments in public R&D&I sector from national and European sources.

The Strategy for Education, Science and Technology (2014) includes numerous measures to improve the R&D&I ranging from changing the HEIs and PROs management and funding, developing science-business collaborations including to measures for sufficient supply of (post)graduates in science, technology, engineering and mathematics.

The Government started to plan the process of restructuring of the public research institutes in order to rationalize the resources and raising the quality of research, as well as the accountability of public research institutions.

Policy Assessment

The initial results of the proposed reforms are rather promising. The institutional funding in combination with the process of re-accreditation of the PROs and HEIs contributed significantly to strengthening the financial accountability of the public research organisations.

The awarding of project research grants includes a rigorous evaluation process that should end with a smaller number of high quality research projects¹⁸, up to 250 per call

¹⁷ <https://vlada.gov.hr/UserDocsImages/Sjednice/2016/12%20sjednica%20Vlade/12%20-%201.pdf> (Annex 4)

¹⁸ The University of Zagreb made it again to the top 500 world's best universities after two consecutive years of absence (Shanghai ranking, 2016)

per year. However, this can put at risk some segments of the national scientific base, since research funds have proved to be insufficient to cover all the needs of researchers especially in natural, medical and technical sciences (Račić, D., Švarc, J., 2015). In a situation of budget restraints, efficient use of ESIF and H2020 funding could diversify the source and increase the inflow of funding into the system (see challenge 1).

There are positive examples in preventing the loss of research potentials due to cuts in funding. For example, a special decision of the government to continue funding the young scientists in derogation of the changes in the Act on Science and Higher Education¹⁹ allowed them to remain and work in the system. This surely contributes to strengthening the scientific base and preventing the loss of financial resources invested in their education.

6 Focus on creating and stimulating markets

Stimulating innovation through demand-side policies is still not a general practice in Croatia, regardless of the fact that their importance and potential positive effects has been recognised by relevant national authorities, primarily the Ministry of Economy, Entrepreneurship and Crafts. The Strategy for Fostering Innovation 2014-2020 encompasses measures stemming towards creating demand for development of innovative products, processes and services. This surely reflects the recognition of the need and an initiative for development of demand-side innovation policies. However, all the measures are still either in the pipeline or their implementation is at an early stage.

These measures include revision of the Public Procurement Act in a way to favour functional requirements over the detailed technical specifications, enable green procurement and alleviate common administrative and financial demands of public procurement procedures which prevent SMEs to participate in tendering.

The newly adopted Public Procurement Act²⁰, introduced a new procurement procedure – the Partnership for Innovation, which should be used in the cases where the contracting authority requires innovative product, service or works which cannot be purchased on the market. Proposed new procedure is based on the rules applicable in the competitive procedure with negotiation, with special emphasis on the criteria related to the ability of tenderers in the area of research and development, and implementation of innovative solution.

As for regulations and standards, the establishment of the Innovation Network for Industry within the Ministry of Economy, Entrepreneurship and Crafts has been initiated within the Strategic project for support the establishment of innovation network for industry and thematic innovation platforms, which started in May 2016 and is expected to last for four years. The project is expected to provide comprehensive monitoring and evaluation of innovation policy performance and enable upgrades of regulations and standards fostering innovation development and performance in Croatia. Strengthening of RDI system should also be facilitated through the Science and Technology Foresight project, developed by the Ministry of Science and Education to be implemented in the period 2017-2021. Close cooperation between MEEC and MSE in the implementation of

¹⁹ A large cohort of young scientist at universities in the status of post-doctoral degree, teaching assistant or assistant professor were expected to terminate their job contracts with universities in 2015 and succeeding year, primarily due to the changes introduced by the Act on Amendments to the by which funds for employment of research novices provided by the MSES are terminated (article 43).

²⁰ http://narodne-novine.nn.hr/clanci/sluzbeni/full/2016_12_120_2607.html

these projects is important for addressing the fragmentation of national research and innovation system.

Main supporting measures aiming at increasing the internationalisation of companies, primarily SMEs, include several grant schemes which are to be funded by ESIF within the Operational Programme Competitiveness and Cohesion 2014-2020. As in other areas, supporting companies entering new markets is significantly relying on ESIF funding. Although the planned measures are relatively well designed, their efficiency and actual results remain to be seen in the future, especially in the context of the parliamentary elections in September and potential changes in the overall research and innovation system. When it comes to FDI attraction, currently there are no specific active measures or policies aiming at facilitating RDI related foreign direct investments.

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List of abbreviations and definitions

BERD	Business Expenditures for Research and Development/ Izdaci poslovnog sektora za istraživanje i razvoj
CSF	Croatian Science Foundation/Hrvatska zaklada za znanost
DESI	Digital Economy and Society Index
ERA	European Research Area/Europski istraživački prostor
ESIF	European Structural and Investment Funds/Europski strukturni i investicijski fondovi
EU	European Union/Europska unija
EU-28	European Union including 28 Member States/ Europska unija uključujući 28 država članica
FDI	Foreign Direct Investments/Izravna strana ulaganja
GBAORD	Government Budget Appropriations or Outlays on R&D/ Proračunska izdvajanja za istraživanje i razvoj
GDP	Gross Domestic Product/Bruto domaći proizvod
GERD	Gross Domestic Expenditure on R&D/ Bruto domaći izdaci za istraživanje i razvoj
HAMAG-BICRO	Croatian Agency for Small Business, Innovation and Investments/Hrvatska agencija za malo gospodarstvo, inovacije i investicije
HEIs	Higher education institutions/Institucije visokog obrazovanja
IRCRO	Collaborative Research & Development Programme
MEEC	Ministry of Economy, Entrepreneurship and Crafts / Ministarstvo gospodarstva, poduzetništva i obrta
MSE	Ministry of Science and Education / Ministarstvo znanosti i obrazovanja
OECD	Organisation for Economic Co-operation and Development/Organizacija za ekonomsku suradnju i razvoj
OPCC	Operational Programme Competitiveness and Cohesion 2014-2020 / Operativni program Konkurentnost i kohezija 2014-2020
OPRC	Operational Programme Regional Competitiveness 2007-2013 / Operativni program Regionalna konkurentnost 2007-2013
PoC	Proof of Concept Programme/ Program provjere inovativnog koncepta
PROs	Public Research Organisations/Javne istraživačke organizacije
RAZUM	Development of Knowledge-based Enterprises Programme/Program razvoja na znanju utemeljenih poduzeća
R&I	Research and innovation/Istraživanje i inovacije
R&D	Research and development/Istraživanje i razvoj
S&T	Science and technology/Znanost i tehnologija
SF	Structural Funds/Strukturni fondovi
SIIF	Science and Innovation Investment Fund/Fond za ulaganje u znanost i inovacije
SME	Small and Medium Sized Enterprise/Mala i srednje velika poduzeća
S3	Smart Specialisation Strategy
UKF	Unity through Knowledge Fund/Fond "Jedinstvo uz pomoć znanja"
VC	Venture Capital/Rizični kapital
VET	Vocational Education and Training System/Sustav strukovnog obrazovanja i osposobljavanja

Factsheet

	2009	2010	2011	2012	2013	2014	2015	2016
GDP per capita (euro per capita)	10500	10500	10400	10300	10200	10200	10400	
Value added of services as share of the total value added (% of total)	67.28	68.07	68.31	68.45	68.99	69.23		
Value added of manufacturing as share of the total value added (%)	14.44	14.16	14.39	14.48	14.12	14.65		
Employment in manufacturing as share of total employment (%)	17.33	16.57	17.2	17.44	17.1	17.14	16.72	
Employment in services as share of total employment (%)	57.86	58.51	57.68	60.08	61.82	63.67	64.14	
Share of Foreign controlled enterprises in the total nb of enterprises (%)		2.32	2.73	2.79	2.72			
Labour productivity (Index, 2010=100)	98.6	100	103.8	106.3	108.7	106.3	110.2	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	0.41		0.62	0.71	0.78	0.81	0.8	
Summary Innovation Index (rank)	29	29	28	28	29	29	32	
Innovative enterprises as a share of total number of enterprises (CIS data) (%)				37.9		39.7		
Innovation output indicator (Rank, Intra-EU Comparison)			26	26	27	27		
Turnover from innovation as % of total turnover (Eurostat)		10.5		10				
Country position in Doing Business (Ease of doing business index WB)(1=most business-friendly regulations)						39	40	43
Ease of getting credit (WB GII) (Rank)						56	63	
EC Digital Economy & Society Index (DESI) (Rank)						24	25	24
E-Government Development Index Rank		35				47		37
Online availability of public services - Percentage of individuals having interactions with public authorities via Internet (last 12 months)	17	19	17	26	25	32	35	36
GERD (as % of GDP)	0.84	0.74	0.75	0.75	0.82	0.79	0.85	
GBAORD (as % of GDP)	0.69	0.72	0.75	0.72	0.62	0.62	0.83	
R&D funded by GOV (% of GDP)	0.43	0.37	0.36	0.34	0.32	0.33	0.31	
BERD (% of GDP)	0.34	0.33	0.34	0.34	0.41	0.38	0.44	
Research excellence composite indicator (Rank)				26				
Percentage of scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country		3.94	4.57	4.05	4.54			
Public-private co-publications per million population	24.36	28.59	31	23.15	14.31	10.6		

List of Figures

Figure 1 Trend of GERD by sources of funding 9

Figure 2 Top sectors in Manufacturing (C10-C12= Manufacture of food products; beverages and tobacco products, C21=Manufacture of basic pharmaceutical products and pharmaceutical preparations, C29= Manufacture of motor vehicles, trailers and semi-trailers). Top service sectors (J=Information and communication, M=Professional, scientific and technical activities)..... 11

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