ERA ROADMAP

THE IMPLEMENTATION PLAN
OF THE REPUBLIC OF CROATIA 2016-2020

Republic of Croatia

Ministry of Science, Education and Sports
Content

1 THE EUROPEAN RESEARCH AREA ................................................................. 3
  Creation of the Implementation Plan for the period 2016-2020 ........................................ 4
  Overview of the national strategic framework .................................................................... 4
  Guidelines for further development of the science and technology system ............................. 6

2 THE IMPLEMENTATION PLAN OF THE REPUBLIC OF CROATIA 2016-2020 ........... 7
  ERA PRIORITY 1 – EFFECTIVE NATIONAL RESEARCH SYSTEMS .................................. 7
    Background ...................................................................................................................... 7
    Objectives, measures and activities .................................................................................... 7
  ERA PRIORITY 2(A) - JOINTLY ADDRESSING GRAND CHALLENGES ................................. 8
    Background ...................................................................................................................... 8
    Objective, measures and activities .................................................................................... 9
  ERA PRIORITY 2(B) - OPTIMAL USE OF PUBLIC INVESTMENTS IN RESEARCH INFRASTRUCTURES .... 9
    Background ...................................................................................................................... 9
    Objective, measures and activities .................................................................................... 10
  ERA PRIORITY 3 - AN OPEN LABOUR MARKET FOR RESEARCHERS ................................ 10
    Background ...................................................................................................................... 10
    Objective, measures and activities .................................................................................... 11
  ERA PRIORITY 4 - GENDER EQUALITY AND GENDER MAINSTREAMING IN RESEARCH ........ 12
    Background ...................................................................................................................... 12
    Objective, measures and activities .................................................................................... 13
  ERA PRIORITY 5 (A) – OPTIMAL CIRCULATION AND TRANSFER OF SCIENTIFIC KNOWLEDGE - Knowledge Transfer .......................................................... 13
    Background ...................................................................................................................... 13
    Objective, measures and activities .................................................................................... 14
  ERA PRIORITY 5(B) – OPTIMAL CIRCULATION AND TRANSFER OF SCIENTIFIC KNOWLEDGE - Promoting Open access ...................................................... 15
    Background ...................................................................................................................... 15
    Objective, measures and activities .................................................................................... 15
  ERA PRIORITY 6 – INTERNATIONAL COOPERATION ......................................................... 16
    Background ...................................................................................................................... 16
    Objective, measures and activities .................................................................................... 17

3 MONITORING OF THE IMPLEMENTATION PLAN ..................................................... 18
  Governance and evaluation ................................................................................................. 18
  Financial framework of the Implementation Plan .................................................................. 18
  Quantitative and qualitative indicators of progress ............................................................... 18

Appendix 1: Chart of quantitative indicators with values ..................................................... 20
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Associated Countries</td>
</tr>
<tr>
<td>AMPEU</td>
<td>Agency for Mobility and EU Programmes</td>
</tr>
<tr>
<td>CoRE</td>
<td>Center of Research Excellence</td>
</tr>
<tr>
<td>CRHR</td>
<td>Croatian Research and Innovation Infrastructures Roadmap 2014-2020</td>
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<tr>
<td>CSF</td>
<td>Croatian Science Foundation</td>
</tr>
<tr>
<td>DABAR</td>
<td>Digital Academic Archives and Repositories</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>EFSI</td>
<td>European Fund for Strategic Investment</td>
</tr>
<tr>
<td>ERA</td>
<td>European Research Area</td>
</tr>
<tr>
<td>ERAC</td>
<td>European Research Area and Innovation Committee</td>
</tr>
<tr>
<td>ERDF</td>
<td>European Regional Development Fund</td>
</tr>
<tr>
<td>ESF</td>
<td>European Social Fund</td>
</tr>
<tr>
<td>ESFRI</td>
<td>European Strategic Forum for Research Infrastructure</td>
</tr>
<tr>
<td>ESIF</td>
<td>European Structural and Investment Fund</td>
</tr>
<tr>
<td>e-Sources</td>
<td>Increasing access to electronic sources of scientific and technical information project</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>Foresight</td>
<td>Science and Technology Foresight project</td>
</tr>
<tr>
<td>FP7</td>
<td>EU’s 7th Framework Programme for activities in the field of research, technological development and demonstration (2007-2013)</td>
</tr>
<tr>
<td>GBAORD</td>
<td>Government budget appropriations or outlays for research and development</td>
</tr>
<tr>
<td>GBER</td>
<td>General Block Exemption Regulation</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>HAMAG-BICRO</td>
<td>Croatian Agency for SMEs, Innovation and Investments</td>
</tr>
<tr>
<td>Horizon 2020</td>
<td>8th Framework Programme for Research and Innovation 2014–2020</td>
</tr>
<tr>
<td>HR</td>
<td>Human resources</td>
</tr>
<tr>
<td>HR ZOO</td>
<td>Croatian scientific and educational cloud project</td>
</tr>
<tr>
<td>INI</td>
<td>Innovative Networks for the Industry</td>
</tr>
<tr>
<td>IP</td>
<td>Implementation Plan of the Republic of Croatia 2016-2020</td>
</tr>
<tr>
<td>MEC</td>
<td>Ministry of Entrepreneurship and Crafts</td>
</tr>
<tr>
<td>MoE</td>
<td>Ministry of Economy</td>
</tr>
<tr>
<td>MS</td>
<td>Member States</td>
</tr>
<tr>
<td>MSCA</td>
<td>Marie Skłodowska Curie Actions</td>
</tr>
<tr>
<td>MSES</td>
<td>Ministry of Science, Education and Sports</td>
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<tr>
<td>NSCHETD</td>
<td>National Council for Science, Higher Education and Technological Development</td>
</tr>
<tr>
<td>NRP</td>
<td>National Reform Programme</td>
</tr>
<tr>
<td>NUL</td>
<td>National and University Library</td>
</tr>
<tr>
<td>OA</td>
<td>Open Access</td>
</tr>
<tr>
<td>OPCC</td>
<td>Operational Programme Competitiveness and Cohesion 2014-2020</td>
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<td>OPEHR</td>
<td>Operational Programme Efficient Human Resources 2014-2020</td>
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<tr>
<td>PRIs</td>
<td>Public research institutes</td>
</tr>
<tr>
<td>PRO</td>
<td>Public research organisations</td>
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<tr>
<td>RDI</td>
<td>Research, development and innovation</td>
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<tr>
<td>RFO</td>
<td>Research funding organization</td>
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<tr>
<td>RPO</td>
<td>Research performing organization</td>
</tr>
<tr>
<td>S3</td>
<td>Smart Specialisation Strategy</td>
</tr>
<tr>
<td>SAHEA</td>
<td>Scientific Activity and Higher Education Act</td>
</tr>
<tr>
<td>SCRDI</td>
<td>Strengthening Capacities for Research, Development and Innovation</td>
</tr>
<tr>
<td>SECT</td>
<td>Strategy for Education, Science and Technology</td>
</tr>
<tr>
<td>SFIC</td>
<td>Strategic Forum for International Science and Technology Cooperation</td>
</tr>
<tr>
<td>SIIF</td>
<td>Science and Innovation Investment Fund</td>
</tr>
<tr>
<td>SIPO</td>
<td>State Intellectual Property Office</td>
</tr>
<tr>
<td>TIP</td>
<td>Thematic Innovation Platform</td>
</tr>
<tr>
<td>TTO</td>
<td>Technologies Transfer Office</td>
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</table>
1 THE EUROPEAN RESEARCH AREA

The creation of the European Research Area (ERA) was put forward by the European Commission (EC) in early 2000 in order to establish a unified research area open to the world based on the internal market, in which researchers, scientific knowledge and technology circulate freely. Through ERA, the Union and its Member States (MS) will strengthen their scientific and technological bases, their competitiveness and their capacity to collectively address grand challenges. In order to achieve this objective, the EC established the European Research Area and Innovation Committtee (ERAC). Croatia started participating in ERAC in 2010.

In 2007 the EC decided to give renewed impetus to build ERA by publishing the Green Paper\(^1\), which seeks to eliminate the fragmentation of the European research landscape. Then, in 2008, MS and the EC launched a new political cooperation, called the Ljubljana Process, in order to overcome fragmentation and build powerful ERA. Following the suggestions of the EC, the MS have launched "partner" initiatives to increase cooperation in five areas:

1. career, working conditions and mobility of researchers;
2. joint design and implementation of research programs;
3. creation of state-of-the-art European research infrastructures;
4. knowledge transfer and cooperation between public research and industry, and
5. international cooperation in the field of science and technology.

Furthermore, in 2011 the European Council invited the MS and interested parties to resolve the remaining gaps and complement the ERA until 2014, in order to create a genuine single market for knowledge, research and innovation. The document "A Reinforced European Research Area Partnership for Excellence and Growth\(^2\)" identified five priorities for taking action in 2012:

1. effective national systems of research and development,
2. optimal transnational cooperation and competition,
3. open labor market for researchers,
4. gender equality and gender mainstreaming in research,
5. optimal circulation, access to and transfer of scientific knowledge.

Conclusions of the Competitiveness Council from February 2014 on the ERA Progress Report 2013\(^3\) called on MS to work closely with the EC, taking into account the opinion of ERAC and workin within ERAC in order to develop a plan for the ERA at the European level by mid-2015 with the aim of facilitating and strengthening the efforts undertaken by the MS.

At its meeting on 29 May 2015 the Competitiveness Council of the EU adopted the \textit{ERA Roadmap 2015-2020} in response to the request from the Council Conclusions from February 2014 to develop a kind of guide at the European level which will serve in facilitating and strengthening the efforts undertaken by MS in the unification of the research area. The ERA Roadmap identifies a limited number of key enforcement priorities at national and European level, allowing MS to decide on the form of their national plans. Identified priorities are the following:

<table>
<thead>
<tr>
<th>PRIORITY 1</th>
<th>Effective national research systems</th>
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<tbody>
<tr>
<td>PRIORITY 2A</td>
<td>Jointly addressing grand challenges</td>
</tr>
<tr>
<td>PRIORITY 2B</td>
<td>Optimal use of public investments in research infrastructures</td>
</tr>
</tbody>
</table>

\(^1\) https://ec.europa.eu/research/era/pdf/era_op_final_en.pdf
\(^2\) http://ec.europa.eu/euraxess/pdf/research_policies/era-communication_en.pdf
The ERA Roadmap was developed to guide MS in structuring the manner of implementation of ERA at national levels, and will therefore be regularly updated and improved. The text of the Council Conclusions on the ERA Roadmap 2015-2020\(^4\) clearly states that the implementation of the process described by the ERA Roadmap is the responsibility of MS/AC.

### Creation of the Implementation Plan for the period 2016-2020

Given the current strategic documents, instead of making a national strategy for the ERA, the Ministry of Science, Education and Sports (MSES) has developed the Implementation Plan of the Republic of Croatia 2016-2020 (IP) based on the already adopted ERA Roadmap.

The IP 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 - stating the objectives, measures and activities that should contribute to the development of science, as a driver of long-term economic and social development, and the objectives set out in the framework of the ERA by 2020. It covers the period from 2016 to 2020 and might, if necessary, be further revised.

### Overview of the national strategic framework

In the period from 2013 up to now a number of strategically important documents which set the framework for the adoption of public policies in the field of research, development and innovation (RDI) were adopted. Measures that contribute to the realization of the ERA are also being implemented through the National Reform Programme (NRP).

Croatian Research and Innovation Infrastructures Roadmap 2014-2020\(^5\), which was adopted in April 2014 and revised during 2016, includes the identification of scientific and research potential of the Republic of Croatia and national priorities in the field of science and technology. Its aim is to guide the further development of research infrastructures. The Roadmap contains the definition, classification and funding measures for research infrastructure, guidelines on the recording of scientific research equipment, as well as guidelines related to the co-financing, monitoring and evaluation of the membership of Croatia and Croatian research organizations in the international scientific and research bodies. The purpose of the Roadmap is to support the realization of the objectives of key strategic documents in the field, encourage synergy of different sources of investment in infrastructure, ensure the sustainability of investments in infrastructure, create a foundation for long-term planning of financial investment in infrastructure, and ultimately increase the cooperation of the scientific community and industry to the shared resources found and made solutions that can be competitive in the global market and contribute to solving social challenges.

In October 2014 the Strategy for Education, Science and Technology\(^6\) (SECT) (for the period 2014 - 2020) was adopted. It follows the vision of long-term development of the system and aims at comprehensive, flexible and effective education system that connects all levels and types of


\(^6\) [http://www.novebojeynania.hr/](http://www.novebojeynania.hr/)
education and research into a harmonious and transparent entity, based on shared positive values, principles and objectives. Introducing the concept of lifelong learning, SECT covers the entire educational system of early and pre-school education, primary and secondary education to higher education and adult education, and includes a system of science and technology. The chapter on Science and Technology presents six objectives which seek to provide mechanisms and means to achieve a higher quality of science, to establish centers of research excellence and to promote the collaboration between industry and science:

1. Fast changes in the system of higher education and science;
2. International competitive public universities and public research institutes (PRIs) in the Croatian higher education and research area that create new scientific, social, cultural and economic value;
3. Environment that enables and encourages interaction and transfer mechanisms of cooperation and research community with innovative economy and social activities;
4. Universities, polytechnics and research institutes involved in the processes of smart specialization and associated guidelines of technological development;
5. National research and innovation infrastructure with public access, included in the European infrastructures and connected with them;
6. Growth of investment in research and development by improving the system of public funding and encouraging investment by business and social sectors in research and development.

In December 2014 the Strategy for Innovation Encouragement of the Republic of Croatia 2014 – 2020 was adopted. SIERC will serve as a guide for the development of long-term and systematic promotion of innovation as the core value of the economy and society as a whole. It will also improve the innovation system, the associated legal and fiscal framework, and establish means of communication and models of cooperation among public, research and business sectors and the manner of applying the results of scientific research in the economy.

In March 2016 the Smart Specialization Strategy (S3) was adopted. S3 is the main document on innovation policy in Croatia covering all relevant aspects of different national strategies in the strategic framework for the long-term perspective (by 2025). Its purpose is to focus on policies and investments in key priority areas and issues identified at the national level, to identify competitive advantages and potential for excellence, to strengthen the innovation support system and the involvement of all stakeholders in order to achieve economic transformation of the Republic of Croatia. In the process of S3 drafting the existing benefits of the research and business sectors, as well as key areas for improvement and development, were identified. The identification was based on a comprehensive analysis of macroeconomic performance and productivity, the competitiveness of the business sector and indicators of the RDI system, including KET analysis. The following priority thematic areas of smart specialization have been identified:

1. Health and Quality of Life
2. Energy and Sustainable Environment
3. Transportation and Mobility
4. Security
5. Food and Bioeconomy

In addition, multidisciplinary (horizontal) themes have also been identified: key development technologies (KET technologies) and information and communication technologies (ICT).

Two operational programmes describe and elaborate on measures and activities for effective implementation and use of European Structural and Investment Funds (ESIF):

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Operational Programme Competitiveness and Cohesion 2014-2020\(^8\) (OPCC) is a planning and programming document which describes and elaborates on measures and activities for effective implementation and use of the European Regional Development Fund (ERDF) in detail. One of the priority areas is strengthening the economy by applying research and innovation. The total allocation of EU funds is 6.881 billion euros, and more than 2.7 billion euros will be allocated to 5 priorities focused on competitiveness.

The total indicative allocation of EU funds under the Operational Programme Efficient Human Resources 2014-2020\(^9\) (OPEHR) is 1.582 billion euros, out of which nearly 930 million euros (61.34 %) of the European Social Fund (ESF) allocation was allocated to five priorities focused on access to employment and strengthening of labour mobility, the integration of young people into the labour market, improving access to social and health services, tertiary education and lifelong learning.

**Guidelines for further development of the science and technology system**

Consistent policy coordination and its implementation at the national level, networking opportunities and the efficient use of clear and strong information base in decision-making are essential features for achieving better results in the field of RDI. Development measures for science and technology policy should therefore lead to transfer of research results into new goods, services and processes, but also play a key role in defining the response to the challenges of social development, culture and environmental concerns. These measures should enable structured and directed development of the research sector, its continuous alignment with international framework of science and technology and at the same time provide the necessary conditions for the establishment of the Croatian research area, compatible with the ERA.

Given the current unfavourable economic conditions for the development of RDI system, the development is primarily based on the growth and efficiency increase of the existing infrastructure and human resource (HR) potential, and their continuous guidance toward greater quality, relevance and structure. The aim of the development measures for science and technology is, therefore, to stimulate research excellence and international recognition of public research institutes and universities, as well as to adopt and implement evidence-based public policies based on the achieved results and scientific productivity.

ESIF will also be used for increasing investment in RDI, especially through the business sector and by encouraging public-private partnerships. The need for the development and improvement of the institutional framework for innovation and increased productivity of the Croatian economy through the research institutions has strongly been emphasized.

\(^8\) [http://www.strukturnifondovi.hr/op-konkurentnost-i-kohezija-2014-2020-779](http://www.strukturnifondovi.hr/op-konkurentnost-i-kohezija-2014-2020-779)

ERA PRIORITY 1 – EFFECTIVE NATIONAL RESEARCH SYSTEMS

Background
The Croatian share of GDP intended for research and development activities in the period from 2002 to 2014 fell from 0.95 percent to 0.79 percent of GDP (EU average is 2.03 percent). In 2014, 0.79 percent of allocations was intended for research and development activities, out of which 41.7 percent pertained to the public sector, 42.9 percent to the private sector, 2.1 percent to the higher education sector, 0.5 percent to non-governmental sector and 12.8 percent to foreign investments. These averages are much lower than the average of other MS. In addition, contrary to trends in most developed EU countries, most of these funds are public expenditure.

Table 1 – Gross domestic expenditure on research and development (GERD), % of GDP

<table>
<thead>
<tr>
<th>Year</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>Cilj 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator</td>
<td>0.75</td>
<td>0.75</td>
<td>0.82</td>
<td>0.79</td>
<td>1.4</td>
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</table>

Expenditures for research and development can also be seen as a percentage of total expenditures in the state budget allocated to financing research and development. According to the Eurostat data for 2014, the percentage of budgetary funds allocated for research and development was 1.3 percent. In addition, funds from the state budget financed about 74 percent of research activities at universities and 87 percent of research activities at public research institutes. On the other hand, funds from the state budget financed only 0.46 percent of research activities in the business sector, while most of the costs for research and development were covered by companies themselves (65.6 percent), and 20 percent of the funds originated from abroad.

MSES allocated 40 million kuna in 2013, 79 million in 2014, 79 million in 2015, and 79 million in 2016 to the Croatian Science Foundation (CSF), the central body responsible for financing competitive research projects. The main role of the CSF is to improve competitiveness, visibility and integration of the Croatian research area into ERA.

On the other hand HAMAG-BICRO provides financial support to innovative and technology-oriented companies in Croatia by increasing commercialization of knowledge and raising awareness of the importance of innovation, supporting the transfer of knowledge and technologies from the research sector into the economy.

The multi-annual institutional funding of research activities in public research institutes and universities in the period 2013 - 2015 developed a new model of public financing of research and development, aimed at providing multi-annual funds from the state budget on the basis of institutional performance indicators. The proposed financing model of scientific activity enables the systematic monitoring of scientific activities and allocation of financial resources in accordance with the results achieved by the implementation of agreed indicators of scientific activity.

In 2014 seven Centers of Research Excellence (CoRE) were established based on the evaluation conducted by the National Council for Science, Higher Education and Technological Development, followed by the establishment of six additional CoREs in 2015.

Objectives, measures and activities

Objectives:
(1) Achieving better coordination of national and European policies and to improve the competitive funding, while respecting the need for a satisfactory balance between the competitive and institutional funding, with a view to optimal use of public investment in research and innovation.

(2) Increasing the effectiveness and efficiency of national research and innovation system with a view to the adoption of evidence-based policies.

(3) Applying the basic principles of international peer-to-peer evaluation in all applicable cases in order to raise international competitiveness and create added value.

**Measures:**

- Growth of investment in research and development by means of improving the system of public funding and encouraging investment by business and social sectors in research and development.
- Internationally competitive public universities and public research institutes in the Croatian academic and research area that create new scientific, social, cultural and economic value.
- Strengthening HR for innovation and helping create an attractive environment for internationally competitive researchers.

**Activities:**

- Achieving an increase in investment in research and development of 1.4% of GDP, 0.7% of which via the State / public funding by directing expenditures towards research and innovation and SMEs and the strengthening of financing of research and development carried out by the business sector and other national and foreign sources.
- Awarding grants for start-up and spin out, basic and applied research and experimental development and feasibility studies.
- Improving the collection, processing, interpretation and publication of statistics and other indicators of RDI.
- Strengthening financial and managerial autonomy of public universities and public institutes and their responsibility for the implementation of the research mission and social role, while strengthening the supervisory function of the founders by monitoring the quality and mission accomplishment. Improve international evaluation of public universities and institutes, and establish mechanisms of influence of research activity evaluation results on institutional funding through program contracts.
- Providing support to the CoREs to conduct research that is above any individual scientific result and at the highest level in terms of measurable scientific production and technological innovation. Establishing a system of evaluation of researchers, research and research institutions that will affirm and encourage research excellence and international visibility, mutual cooperation and collaboration with users of research results and the social relevance of research.
- Introducing peer-to-peer evaluation (peer review) in proceedings of scientific selection and promotion of university professors and researchers.

**ERA PRIORITY 2(A) - JOINTLY ADDRESSING GRAND CHALLENGES**

**Background**

One of the objectives of Horizon 2020 is jointly coping with grand challenges that Europe is facing today. Improved cross-border cooperation in the field of RDI among national stakeholders should reduce fragmentation and duplication of effort, improve the use of resources and assist in the provision of benefits needed to solve problems that require major concerted efforts. However, transnational cooperation programmes involving joint programming, joint research programmes, joint calls and funding are not sufficiently developed in the RDI system in Croatia.
A more intensive transnational cooperation is expected with the support of ESIF involving transnational cooperation programmes such as INTERREG MEDITERANA 2014 - 2020. According to the Partnership Agreement, Croatia will be involved in 13 territorial cooperation programmes in the period 2014 - 2020 under ESIF. These transnational programmes include various aspects of cooperation - exchange of information, joint research programmes, joint calls, joint programming, and also provide for the common evaluation procedures.

Croatia also participates in transnational research programmes involving the coordination of research priorities, plans and objectives, but does not include cross-border flow of funds. Such transition programmes are EUREKA - research and innovation projects driven by industry and COST - one of the longest European transnational cooperation programmes in the field of science and technology. Croatia is a full member of the EUREKA initiative, as well as EUROSTARS and COST, and is currently involved in around 300 projects / activities. Croatia has a quite extensive international research cooperation network established through bilateral, multilateral and transnational projects and programmes.

**Objective, measures and activities**

**Objective:**

(4) Building the capacity of public research organizations while jointly addressing grand challenges

**Measures:**

- Building the capacity of public research organizations to jointly address grand challenges

**Activities:**

- Providing infrastructure support to grant beneficiaries of Horizon 2020: Teaming, Twinning and ERA Chair projects
- Strengthening HR in Croatian research organizations by conducting continuous seminars on EU funds absorption

**ERA PRIORITY 2(B) - OPTIMAL USE OF PUBLIC INVESTMENTS IN RESEARCH INFRASTRUCTURES**

**Background**

National priorities for future infrastructure investments are described in the previously mentioned CRIIR which provides general guidance for the development of research infrastructure based on an existing national research e-infrastructure and respecting the principles of smart specialization. The CRIIR also provides principles and criteria for selecting projects for RDI infrastructure, identifies national priorities in the development of RDI infrastructure to areas of research (in accordance with the criteria for improving research base and research excellence) and describes the Croatian participation in the pan-European research infrastructures. In accordance with the CRIIR, a plan of investments in research infrastructure was made on an annual basis for the period from 2014 to 2020 (see table 2 below). In 2016 the CRIIR was revised and aligned with the S3 priorities.

**Table 2 - Planned national and European funding for research infrastructure 2014 - 2023 according to Operational Programme Competitiveness and Cohesion 2014 – 2020, TO 1, Investment Priority 1a, in million €**

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<tr>
<td>National contributio n (€)</td>
<td>2,685,122</td>
<td>7,360,466</td>
<td>9,528,742</td>
<td>10,138,569</td>
<td>10,612,880</td>
<td>10,883,914</td>
<td>10,138,569</td>
<td>7,292,707</td>
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<tr>
<td>EU fonds (€)</td>
<td>10,924,310</td>
<td>29,625,680</td>
<td>38,298,790</td>
<td>40,738,101</td>
<td>42,635,342</td>
<td>43,719,480</td>
<td>40,738,101</td>
<td>29,354,653</td>
</tr>
</tbody>
</table>

Source: OPCC 2014-2020

In the forthcoming period, special emphasis should be placed on the development of e-infrastructure that should be included in the basic tenets of the development of infrastructure. On one hand, this allows functional connection of all components of the system, and, on the other hand, it provides adequate software according to the requirements of modern e-Science. Namely, research e-infrastructure can serve as a framework for the establishment of the Croatian research area, as well as ERA, in compliance with the current strategic framework. The coordination and financing of the development and the maintenance of the infrastructure were conducted by the Croatian Academic and Research Network CARNet and the University Computing Centre – Srce, while the Ruđer Bošković Institute made a significant contribution to the data infrastructure. National research and education networks are integrated into a common pan-European research and education network - GÉANT, which allows researchers to connect with other international e-infrastructure components.

Croatia also participates in the Mapping of the European Research Infrastructure Landscape project (MERIL). On the MERIL portal Croatia provides a list of best research infrastructures (RIS) in Europe. Five Croatian infrastructures are included: Cloud Infrastructure Services (IaaS): Virtual Computing Lab / Virtual Private Servers, Croatian National Grid Infrastructure, Data Services Infrastructure, the Institute of Oceanography and Fisheries and cluster Isabella.

**Objective, measures and activities**

**Objective:**

(5) Optimizing public investment in research infrastructure by aligning national priorities with ESFRI priorities and criteria, taking into account the long-term sustainability

**Measures:**

- Ensuring national research and innovation infrastructures with public access, inclusion in the European infrastructures and connecting with them
- Improving the infrastructure and capacity for research and innovation in order to achieve success in research and innovation, and promoting centers of competence, in particular those of European interest

**Activities:**

- Joining large international consortiums and infrastructures
- Establishing and providing competitive mechanisms to equip existing and new laboratories
- Strengthening organizational reforms and infrastructure capacity of research organizations
- Strengthening innovation infrastructure and fostering centers of competence

**ERA PRIORITY 3 - AN OPEN LABOUR MARKET FOR RESEARCHERS**

**Background**

The labour market for researchers in Croatia was partially reformed in 2013 with the amendments to the Scientific Activity and Higher Education Act (SAHEA), more precisely with the separation of research titles from research job positions, and a clear stipulation that the recruitment of researchers in a public research organization must be conducted on the basis of a
public tender published in the Official Gazette of the Republic of Croatia (Narodne novine), the official website of the research organization, as well as on the official website - EURAXESS jobs portal.

The majority of Croatian research organizations support the Charter and the Code, have signed the Declaration of Commitment to the Principles of the Charter and the Code, and are striving towards improving HR strategy for researchers in accordance with these principles. The main principles of the Charter and the Code have been transposed in national legislation, i.e. the SAHEA currently in effect. In addition, 16 organizations undertook further steps in the implementation of these principles, and their efforts have been recognized and rewarded by the EC for Human Resources Excellence in Research. These results put Croatia at the very top of the EU, namely the third place (behind Great Britain and Spain) in the number of organizations awarded for excellence in HR in research.

Croatia has made great progress in the last four years with regard to open, transparent and merit-based recruitment. Furthermore, temporary employment and residence for visiting foreign researchers in Croatia is regulated by the Ordinance on Determining the Requirements for Granting Temporary Residence to Foreigners for the Purpose of Scientific Research, which significantly facilitated the participation of foreign researchers in research activities in Croatia compared to other foreign workers. As of 2013, international mobility is one of the success criteria when evaluating the performance of public research organizations.

In 2013 MSES launched a programme named International Fellowship Mobility Programme for Experienced Researchers in Croatia – NEWFELPRO 2013 - 2017, a joint project of the Croatian Government and MSES, co-financed by Marie Curie FP7-PEOPLE-2011-COFUND programme. The aim of NEWFELPRO is to increase the long-term presence of qualified researchers by providing them with new opportunities to acquire relevant international experience, and thus contribute to the further development of international research networks.

Besides MSES, the CSF also conducts several programmes aimed at enhancing mobility: the “Installation research projects programme” looks to help young researchers establish independent research careers, and the Unity through Knowledge Fund’s “Connectivity Programme” enables short-term mobility of researchers, with focus on young researchers abroad participating in excellent research, improving their skills working at development facilities in order to establish cooperation and / or acquire new skills necessary to improve competitiveness in Croatia.

Objective, measures and activities

Objective:

(6) Use of open, transparent and merit-based employment practices with regard to research positions

Measures:

- Encouraging the development of new skills required for research, technological development and innovation
- Fostering strategic cooperation of industry, science and education system

Activities:

- Encouraging the development of new skills required for research, technological development and innovation
- Encouraging international mobility (incoming and outgoing) of researchers and students, encouraging participation in international programmes and networks
- Doubling the number of researchers in the business sector by providing incentives to the employers
- Encouraging post-graduate studies in areas relevant to the industry

**ERA PRIORITY 4 - GENDER EQUALITY AND GENDER MAINSTREAMING IN RESEARCH**

**Background**
Gender equality and non-discrimination in research is included in the Croatian Constitution and accompanying laws governing scientific activity and higher education, work, gender equality, non-discrimination, as well as in the National Policy for Gender Equality 2011 – 2015. Croatia has made substantial progress in establishing a political framework for women’s rights and gender equality, contained in the legislative and policy documents. Office for Gender Equality was also established as the main institutional mechanism for gender equality. Research organizations are responsible for monitoring and evaluating the implementation of the gender equality policy.

With overall 49.9 percent of women in research and development (50.8 percent in FTEs), Croatia has achieved significant progress with regard to gender equality in research activities. In higher education, 51.3 percent of the total number of academic staff (academic year 2014/2015) were women, and here Croatia has reached equal representation. The share of women in the total number of employees was slightly lower and reached approximately 49.9 percent of total researchers. According to data from 2015 women dominate the public research sector, where they make up 52 percent of employees, and the fastest growth of women participating in research has been recorded in the business sector, where women make up 38.3 percent of employees.

Following the principles of gender equality, the emphasis is not on reaching the same outcomes for women and men, but on dealing with inequalities between genders with regard to the existing and available resources, including the differences in how the science and technology system meets their specific demands. This is recognized in the Science and Society Action Plan (2013). The main objective of this Action Plan issued by MSES is a systematic approach to science as a social value, communication, promotion and affirmation of science, both in government and institutional affirmation policies of science in society. The Action Plan emphasizes the need to amend gender rates in the research system, especially at management level (a minimum of 1/3 of women in national councils, regional councils, general boards, research and political bodies, etc) as well as to conduct possibility programmes for women scientists with the aim of achieving greater gender equality.

According to the report for 2015 women predominate in the total number of students enrolled at universities (56.8 percent), and the total number of students who complete their studies (58.9 percent). There are slightly more women with higher education in the total population compared to men (16.7 percent of women compared to 16 percent of men). However, career choices for many women in Croatia are still under the influence of traditional gender roles. For example, among graduates, women are still underrepresented in the field of computer sciences (19.5 percent), engineering (18.8 percent) and transportation (33.7 percent), although the data show a slow but growing trend in these areas. In contrast, women make up 77.6 percent of all graduates in life sciences, 72.1 percent of graduates in mathematics and statistics, and about 97 percent in traditional sectors such as training of teachers, and 95.3 percent in social services.

Furthermore, although women are well represented among doctors of science (54.7 percent) and research community in general (47.8 percent), the glass ceiling is, however, present in the field of scientific career advancement. Although the share of women who hold assistant positions is higher (57.4 percent) then that of men, it declines with higher positions. There are 48.5 percent of women among assistant professors, 46 percent among associate professors, and only 31.8 percent among full professors. There are only 14 percent of women among rectors and 17 percent
among deans. This trend is also present in other EU countries where there are only 20 percent of women among full professors and they are still underrepresented at decision-making levels, as well as in research and steering boards or as directors at university colleges. Moreover, there is still a significant gap between salaries of men and women, with women's gross salary amounting to 89.9 percent of men's salary (although the gap in Croatia is smaller, 10 percent than the EU average – 16.4 percent).

It should be noted that since 2007, the Croatian UNESCO Committee, the Ministry of Culture and L’Oréal Adria have been awarding the annual prize for women in science in an effort to raise awareness of outstanding young researchers and reward them for their contribution to science and society. The programme awards four scholarships in the amount of € 5,000 (in kuna equivalent). The award also encourages students to pursue careers in life sciences.

Objective, measures and activities

Objective:

(7) Putting national legislation relating to equality into effective action to address gender inequality at research institutions and decision-making bodies and integrating the gender dimension into research and development policies, programmes and projects

Measures:

- Improved alignment and networking of public policies in regard to gender balance
- Improved systematic support to women’s entrepreneurship
- Introducing women's entrepreneurship into overall institutional infrastructure

Activities:

- Establishing information and data system on women's entrepreneurship
- Developing new models of training for women in business administration (ICT systems, new technologies, creative industries, innovation application, cluster management etc)
- Strengthening support institutions to improve expert support to entrepreneurial projects of women in the field of new technologies and innovation

ERA PRIORITY 5 (A) – OPTIMAL CIRCULATION AND TRANSFER OF SCIENTIFIC KNOWLEDGE - Knowledge Transfer

Background

All three relevant strategies in the field of science, SECT, SIERC and S3 suggest measures that aim at narrowing the gap between the research community and the business sector, and creating a favourable environment for knowledge and technology transfer between the research and the business system. Similar measures have also been set in the strategic documents of the Croatian public universities that hold the responsibility for knowledge and technology transfer, as well as fostering innovation.

In order to boost knowledge and technology transfer, as well as the entire innovation system, the ministries responsible for science, entrepreneurship and economy finance several projects that strengthen the role of technology transfer offices at Croatian universities and public research institutes to promote and implement technology transfer (Programme of Support to Technology Transfer at Universities – TTU), partnership programmes between public research organizations and private enterprises (Partnership in Research Programme) and commercialization of research results and technology transfers, as well as sustainable research development and competitiveness of the business sector (Science and Innovation Investment Fund (SIIF) Phase II) or projects focused on applied research and experimental development in public and private R&D
sector (Strengthening Capacities for Research, Development and Innovation - SCRDI) and innovative start-ups and SMEs (Innovation in Entrepreneurship).

In the programming period 2014 – 2020 the MSES has planned a series of measures within the OPCC 2014 – 2020 primarily aimed at enhancing the transfer of knowledge and technology from research community into the business sector. Funding schemes for covering the costs of labour and activities of the TT offices amount to € 6.3m by 2023. The value of further implementation of the SIIF and a call in SCRDI amounts to € 63.7m by 2023 for both programmes.

The following projects are financed under the Second Science and Technology Project (STPI):

- **Programme II: Development of Knowledge-Based Enterprises (RAZUM)** - 7 projects
- **Programme III: Collaborative Research and Development (IRCRO)** - 19 projects,
- **Programme of Support to TTOs** - 18 projects.

In addition to several programmes aimed at financing innovative activities based on research (eg. RAZUM, PoC and IRCRO), major aid measures aimed at increasing the level of research and development activities are indirect measures that are awarded in the form of tax relief. In 2011, analysis of tax breaks for research and development (Aralica et al., 2011) has led to the conclusion that the tax incentives in Croatia are a more generous form of state aid for research and development than subsidies. Several large business firms report tax incentives that exceed total public research and development subsidies, which can be seen in corporate financial statements. This shows that several companies carried out major research projects and that tax incentives are available only to a small number of users. Since this programme expired in December 2014, a new programme for government incentives for RDI for the period from 2016 to 2020 was drafted during 2015. The new programme is designed to standardize the criteria for awarding incentives in accordance with EU directives (GER), to revise procedures and rules on government subsidies and definitions of monitoring, evaluation and recovery of state incentives. Its entry into force is expected by the end of 2016.

**Objective, measures and activities**

**Objective:**

(8) Fully implementing knowledge transfer policies at national level in order to maximize the dissemination, uptake and exploitation of scientific results. RPOs and RFOs should make knowledge transfer second nature by integrating it in their everyday work.

**Measures:**

- Increasing the capacity of scientific and research sector to implement cutting-edge research that meets the needs of the economy
- Encouraging cooperation and flow of knowledge between the business, the public and the research sector

**Activities:**

- Mapping RDI capacity in public research sector and the business sector
- Preparation of science foresight and strategies on RDI of the business sector for thematic priority areas in the S3
- Establishing the Innovation Network for Industry and the Thematic Innovation Councils
- Facilitating investment of innovative economy in RDI, including joint research projects with public universities and institutes
- Supporting TTOs in capacity strengthening, technology transfer and provision of services to the business sector
- Providing support to investments in applied research projects and connecting science and the business sector through knowledge and technology transfer
ERA PRIORITY 5(B) – OPTIMAL CIRCULATION AND TRANSFER OF SCIENTIFIC KNOWLEDGE - Promoting Open access

Background
Open access (OA) to scientific publications removes barriers for use of scientific information, increasing their visibility and citations, and facilitates the creation of new knowledge. It is believed that the public should be given unimpeded access to the results of publicly funded research. OA is required primarily for those types of scientific papers from which authors-researchers do not generate financial income, which present original results of scientific research: journal articles and conference papers.

One of the benefits of OA is increase in the visibility of scientific publications, which is particularly important for small countries such as Croatia. As early as 2004 a Task Force for OA to Scientific Publications was established within the Croatian Information and Documentation Society, with the aim of spreading the idea of OA in Croatia and creating a social climate for achieving institutional repository and openly available journals. The result of the work of the group is the Hrčak portal, realized in cooperation with the University Zagreb Computing Centre - Srce.

The Croatian Declaration on Open Access was presented in October 2012 with the aim of raising the awareness of all participants in the creation, publication, use and preservation of scientific information in Croatia. This Declaration stresses the fundamental importance of scientific information, the necessity of its availability to all and the obligation of its permanent storage. However, only some of the research organizations have adopted it to this date.

MSES supports the Croatian Science Portal, a project that marked the beginning of OA in Croatia in 2006, and was implemented by the Ruder Bošković Institute Library and SRCE. The portal gathers in one place all information on Croatian researchers, their work, research projects, Croatian journals and research instruments. The aim of the portal is to ensure a closer relationship among researchers, as well as the promotion and popularization of science in Croatia and abroad. The portal offers several information services that provide OA to scientific information derived from publicly funded research, as follows: Croatian Scientific Bibliography - CROSBI, Portal of Scientific Journals in Croatia - HRČAK, Who's Who in Croatian Science and the Register of Large Research Equipment at Universities and Public Research Institutes - ŠESTAR.

In 2015 a digital infrastructure Digital Academic Archives and Repositories (DABAR) was established as a key component of the data layer of the national e-infrastructure which offers technological prerequisites to organizations and other stakeholders from the science and higher education system necessary for systematic care of their digital assets – via a variety of digital content and facilities created as a result of the activities of an institution and its employees. DABAR allows for an easy setting up and maintenance of a large number of reliable and interoperable institutional and thematic digital repositories and archives at no cost to the institutions.

OA to scientific information is nowadays increasingly identified with public research e-infrastructure. Croatia has been developing research e-infrastructure within international cooperation, a part of the European initiative and is involved in projects such as CLARIN, DARIAH and ESS.

Objective, measures and activities

Objective:

(9) Establishing a system of open science, removing barriers and developing research infrastructure for open science and open innovation

Measures:
National research and innovation infrastructures with public access, included in the European infrastructures and connected with them

Establishing better research environment

Activities:

- Establishing a system of OA to existing and new public research infrastructures and equipment
- Joining the pan-European open science initiatives
- Establishing a transparent system of intellectual property management and protection regime of intellectual property rights
- Building an advanced shared e-Infrastructure for Croatian educational and research space (HR ZOO project)
- Supporting access to foreign databases and online journals - supplying and ensuring the availability and use of electronic sources of scientific and technical information, the rational use of funds for procurement of electronic sources of scientific and technical information and achieving optimal conditions of joint procurement, availability and use of electronic sources of scientific and technical information (e-Sources project)

ERA PRIORITY 6 – INTERNATIONAL COOPERATION

Background

MSES and other government bodies and public institutions have yet to develop a structured and integrated international cooperation strategy. All activities so far are only a concoction of various instruments (without previously determined priorities and indicators), including mobility.

A structured approach to international cooperation in the field of research and innovation implies strengthening synergies with other policies that have a strong international dimension, and in particular with external EU policies and activities of the MSs. The Communication from the Commission from 6 October 2010 states that "the European Union and its Member States should treat scientific cooperation with third countries as an issue of common concern and develop common approaches. This should contribute to global approaches and solutions to societal challenges and to the establishment of a level-playing field."

With assistance of research diplomacy, international cooperation in the field of research and innovation can also serve as a mechanism to improve the relations with relevant countries and regions. Also, good international relations can facilitate efficient cooperation in the field of research and innovation.

a) Bilateral cooperation

On the basis of bilateral programmess, and in accordance with common interests and priority areas, the Ministry of Science, Education and Sports supports two-year international research projects with the following countries: Austria, Montenegro, France, China, Hungary, Germany, USA, Slovenia and Serbia. The most common projects are in natural, bio-medical, technical and biotechnical sciences.

b) Multilateral cooperation

The Ministry of Science, Education and Sports provides administrative, expert and financial support to the participation of Croatian scientific research and governmental and nongovernmental organizations in multilateral programmess of global, European and regional organizations and initiatives. This cooperation is realized through multilateral organizations and initiatives, such as the United Nations and its specialized organization for education, science and
The Republic of Croatia participates in international scientific and research organizations and in that way enables researchers access to research infrastructures at the international level. For example: EMBL - European Molecular Biology Laboratory, EMBC - European Molecular Biology Conference, ESF - European Science Foundation, EUREKA - pan-European research and development funding and coordination organization, HERA - Humanities in the European Research Area, ICGEB - International Centre for Genetic engineering and Biotechnology, DARIAH ERIC - Digital Research Infrastructure for the Arts and Humanities European Research Infrastructure Consortium, CIESM - The Mediterranean Science Commission, CERN - Alice Experiment-Maintenance and Operation, category A.

**Objective, measures and activities**

**Objective:**

10) Developing and implementing appropriate joint strategic approaches and actions for international STI cooperation on the basis of national priorities

**Measures:**

- Enhancing strategic planning
- Fostering bilateral cooperation
- Fostering partnership and cooperation with Mediterranean countries

**Activities:**

- Drafting a strategic document on cooperation with partner countries and regions
- Drafting Action Plan for Researchers’ Mobility
- Evaluating the existing bilateral cooperation and developing a better approach to third countries
- Establishing a long-term structured partnership in the field of research and innovation in the Mediterranean region according to the principles of mutual interest and common benefits and based on multiple bilateral and multilateral innovation activities in the region
3 MONITORING OF THE IMPLEMENTATION PLAN

Governance and evaluation

The time frame for the implementation of activities defined in the Implementation Plan is the period from 2016 to 2020, which is aligned with the programming periods of the major initiatives and documents of the EU, such as the Europe 2020 Strategy and the Innovation Union, as well as the Horizon 2020. This should result in convergence of ERA activities with funding programmes in order for the outcomes of the financed projects to ultimately be consistent with ERA principles.

Many relevant institutions in the science and technology system of the Republic of Croatia are involved in the implementation of activities defined by the Implementation Plan.

In order to monitor and control the entire system, it is necessary to make a series of IT solutions that will enable an integrated approach and performance measurement of the research, development and innovation system. In the period 2017 – 2020 MSES is planning to implement a strategic Science and Technology Foresight (Foresight) project, which will regulate the duties and responsibilities of stakeholders in the science and technology system (related to the handling of information on scientific activity), connect Croatian research organizations through a publicly accessible current research information system on Croatian scientific activity and ensure the visibility of their scientific activity. The aim of the Foresight project is to create a coherent and integrated system for setting priorities in RDI policy in the Croatian research and innovation area.

In order to avoid fragmentation of the RDI sector and achieve synergy with the business sector, the project will be implemented in cooperation with the Ministry of Economy (MoE). MoE is already carrying out a strategic project in support to the establishment of Innovation Networks for the Industry (INI) and Thematic Innovation Platform in the form of interconnection and data exchange, tools and methods of monitoring available through INI. The outcomes of both projects will allow mutual and complementary linking of public and private sectors and contribute to the creation of efficient Croatian research and innovation area, including the National Innovation System (NIS).

By the end of the implementation of the abovementioned strategic projects, monitoring and evaluation process will take place through the submission of annual reports submitted by public and private research organizations.

Financial framework of the Implementation Plan

As previously mentioned, the IP was made on the basis of the existing strategic documents. Therefore, the adoption of this Plan does not require the provision of additional funds from the state budget, since the fundamental funding for activities defined by the IP stems from already approved budgets of relevant government bodies and related agencies, as well as some private sources.

Quantitative and qualitative indicators of progress

Below is an overview of quantitative and qualitative indicators for monitoring progress on the priorities of the ERA in the future. Quantitative indicators of progress have been defined on the basis of the report Assessment of Progress in Achieving ERA in MS/AC (ICF International, 2015), and ERAC Opinion on the ERA Roadmap - Core high level indicators for monitoring progress from 2015.

It is important to note that the identified quantitative indicators (Appendix 1) for some of the priorities provide a broader picture of the progress made, but cannot fully encompass all the elements within each priority. In several cases, a comprehensive indicator of progress that

18
includes all the elements within a priority does not exist (because it is not possible to use one indicator to include all activities in priority or, more often, the core data for the calculation are currently not available or are not structured in a way that facilitates the development of such indicators). In other cases, there are several indicators focused on specific aspects of specific priorities identified in the ERA Roadmap. In these cases one indicator is selected that at this point provides the best approximation of the progress of implementation activities, and ultimately all selected indicators aim to provide a complete message on progress within individual ERA priorities.

Qualitative indicators (Appendix 2) are defined on the basis of the objectives, measures and activities in the Implementation Plan, and each indicator is accompanied by an institution responsible for each single activity and an identified deadline for their implementation.
Appendix 1: Chart of quantitative indicators with values

<table>
<thead>
<tr>
<th>Priority</th>
<th>Input Indicator</th>
<th>Output Indicator</th>
<th>Outcome/ Impact Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 - Effective national research systems</strong></td>
<td>Total GBAORD as per cent GDP (OECD)</td>
<td>Revised version of the Research Excellence Indicator</td>
<td>Composite indicator (Innovation Union Scoreboard)</td>
</tr>
<tr>
<td><strong>2(A) - Jointly addressing grand challenges</strong></td>
<td>Participation of MS in ERA-NET, joint programme initiatives etc (ERA-Learn)</td>
<td>National GBAORD allocated to Europe-wide, bilateral or multilateral transnational public R&amp;D programmes</td>
<td>Joint co-publications of ERA countries</td>
</tr>
<tr>
<td><strong>2(B) - Optimal use of public investments in research infrastructures</strong></td>
<td>Percentage of ESFRI projects the MS participates in</td>
<td>Availability of national roadmaps with data on national research infrastructures and corresponding investment needs along with identified ESFRI projects</td>
<td>Number of implementation phase ESFRI projects in which Croatia is a partner</td>
</tr>
<tr>
<td><strong>3 - An open labour market for researchers</strong></td>
<td>Proportion of doctoral candidates with a citizenship of another EU MS</td>
<td>Open recruitment: Researcher posts advertised through the EURAXESS Jobs portal per thousand researchers in the public sector per year</td>
<td>Proportion of researchers satisfied with employment procedures at their institution (openness, transparency, competence)</td>
</tr>
<tr>
<td>4 - Gender equality and gender mainstreaming in research</td>
<td>Proportion of female PhDs (Eurostat)</td>
<td>Proportion of papers with gender content</td>
<td>Proportion of women in grade A (professor) positions</td>
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<tr>
<td>5(A) - Optimal circulation and transfer of scientific knowledge - Knowledge transfer</td>
<td>Percentage product or process innovative firms collaborating with higher education institutions or with public research institutions for their innovation activities</td>
<td>R&amp;D in higher education institutions (HEIs) / public research organisations (PROs) funded by business</td>
<td>Public / private co-publication per million of the population</td>
</tr>
<tr>
<td>5(B) - Optimal circulation and transfer of scientific knowledge - Promoting Open access</td>
<td>Share of funders funding open access to publications / data</td>
<td>Proportion of Open Access papers (Gold and Green OA only)</td>
<td>Open access policies in national action plans</td>
</tr>
<tr>
<td>6 - International cooperation</td>
<td>International scientific co-publications per thousand researchers (FTE) in the public sector</td>
<td>Non-EU doctorate holders as a percent of total doctorate holders</td>
<td>Licence and patent revenues from abroad as a per cent of GDP</td>
</tr>
</tbody>
</table>