



**THE WORLD BANK**  
IBRD • IDA | WORLD BANK GROUP

**FOR OFFICIAL USE ONLY**

Report No: PAD5431

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT  
ON A  
PROPOSED LOAN

IN THE AMOUNT OF EUR 106 MILLION  
(US\$ 116.4 MILLION EQUIVALENT)

TO THE  
REPUBLIC OF CROATIA  
FOR A  
DIGITAL, INNOVATION, AND GREEN TECHNOLOGY PROJECT

May 26, 2023

Finance, Competitiveness and Innovation Global Practice  
Europe and Central Asia Region

This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.

## CURRENCY EQUIVALENTS

(Exchange Rate Effective Apr 30, 2023)

Currency Unit = Euro (EUR)

EUR 0.91 = US\$1

## FISCAL YEAR

January 1 - December 31

Regional Vice President: Antonella Bassani

Country Director: Gallina Andronova Vincelette

Regional Director: Lalita M. Moorty

Practice Manager: Ilias Skamnelos

Task Team Leader(s): Todor Milchevski, Francisco Moraes Leitao Campos

## ABBREVIATIONS AND ACRONYMS

AI	artificial intelligence
AM	Accountability Mechanism
ARMA	Association of Research Managers and Administrators
BERD	business enterprise expenditure on research and development
CEE	Central and Eastern Europe
CPF	Country Partnership Framework
DIGIT	Digital, Innovation, and Green Technology (project)
ECB	European Central Bank
ESF	Environment and Social Framework
ESIF	European Structural and Investment Fund
EU	European Union
EU27	Member States of the European Union
EUR	euro (currency)
FP7	Seventh Framework Programme (European Union)
FY	financial year
GCRF	Global Crisis Response Framework
GDP	gross domestic product
GERD	gross domestic expenditure on research and development
GRID	Green, Resilient and Inclusive Development
GRM	Grievance Redress Mechanism
GRS	Grievance Redress Service
HAMAG-BICRO	Croatian Agency for SMEs, Innovations and Investments
HICP	harmonized index of consumer prices
HVAC	heating, ventilation, and air conditioning
ICT	information and communication technologies
IoT	internet of things
LEED	Leadership in Energy and Environmental Design (certificate)
M&E	monitoring and evaluation
NPP	National Procurement Procedure
NRRP	National Recovery and Resilience Plan
OECD	Organization for Economic Cooperation and Development
PDO	project development objective
PIU	Project Implementation Unit
POM	project operational manual
PPP	purchasing power parity
PSC	Project Steering Committee
R&D	Research and development
RAS	reimbursable advisory services
RDI	research, development, and innovation
S3	smart specialization strategy

SME	small and medium enterprise
STEM	science, technology, engineering, math
STEP	Systematic Tracking of Exchanges in Procurement
STP II	Second Science and Technology Project
TRL	technology readiness level
VC	venture capital



TABLE OF CONTENTS

<b>DATASHEET.....</b>	<b>1</b>
<b>I. STRATEGIC CONTEXT .....</b>	<b>6</b>
A. Country Context.....	6
B. Sectoral and Institutional Context .....	8
C. Relevance to Higher Level Objectives.....	17
<b>II. PROJECT DESCRIPTION.....</b>	<b>19</b>
A. Project Development Objective .....	19
B. Project Components .....	20
C. Project Beneficiaries .....	27
D. Results Chain .....	28
E. Rationale for Bank Involvement and Role of Partners .....	30
F. Lessons Learned and Reflected in the Project Design .....	30
<b>III. IMPLEMENTATION ARRANGEMENTS .....</b>	<b>32</b>
A. Institutional and Implementation Arrangements .....	32
B. Results Monitoring and Evaluation Arrangements.....	33
C. Sustainability.....	33
<b>IV. PROJECT APPRAISAL SUMMARY.....</b>	<b>34</b>
A. Technical, Economic and Financial Analysis .....	34
B. Fiduciary.....	34
C. Legal Operational Policies.....	36
D. Environmental and Social.....	36
<b>V. GRIEVANCE REDRESS SERVICES .....</b>	<b>39</b>
<b>VI. KEY RISKS.....</b>	<b>40</b>
<b>VII. RESULTS FRAMEWORK AND MONITORING.....</b>	<b>42</b>
<b>ANNEX 1: Implementation Arrangements and Support Plan.....</b>	<b>54</b>
<b>ANNEX 2: EU funding complementarity .....</b>	<b>80</b>
<b>ANNEX 3: Institutional landscape for RDI policy in Croatia .....</b>	<b>85</b>
<b>ANNEX 4: Project contribution to climate change adaptation and mitigation.....</b>	<b>88</b>
<b>ANNEX 5: Economic and Financial Analysis .....</b>	<b>92</b>



DATASHEET

**BASIC INFORMATION**

Country(ies)	Project Name	
Croatia	Digital, Innovation, and Green Technology Project	
Project ID	Financing Instrument	Environmental and Social Risk Classification
P180755	Investment Project Financing	Moderate

**Financing & Implementation Modalities**

<input type="checkbox"/> Multiphase Programmatic Approach (MPA)	<input type="checkbox"/> Contingent Emergency Response Component (CERC)
<input type="checkbox"/> Series of Projects (SOP)	<input type="checkbox"/> Fragile State(s)
<input type="checkbox"/> Performance-Based Conditions (PBCs)	<input type="checkbox"/> Small State(s)
<input type="checkbox"/> Financial Intermediaries (FI)	<input type="checkbox"/> Fragile within a non-fragile Country
<input type="checkbox"/> Project-Based Guarantee	<input type="checkbox"/> Conflict
<input type="checkbox"/> Deferred Drawdown	<input type="checkbox"/> Responding to Natural or Man-made Disaster
<input type="checkbox"/> Alternate Procurement Arrangements (APA)	<input type="checkbox"/> Hands-on Enhanced Implementation Support (HEIS)

Expected Approval Date	Expected Closing Date
22-Jun-2023	29-Dec-2028

Bank/IFC Collaboration

No

**Proposed Development Objective(s)**

The project development objective is to advance research and innovation with a digital and green focus through enhancing institutional infrastructure and research performance of research organizations and firms.



**Components**

Component Name	Cost (US\$, millions)
Programs for digital and green research and innovation	43.90
Enabling institutional conditions for digital and green research and innovation	72.50

**Organizations**

Borrower:	Republic of Croatia
Implementing Agency:	Ministry of Science and Education

**PROJECT FINANCING DATA (US\$, Millions)**

**SUMMARY**

<b>Total Project Cost</b>	116.40
<b>Total Financing</b>	116.40
<b>of which IBRD/IDA</b>	116.40
<b>Financing Gap</b>	0.00

**DETAILS**

**World Bank Group Financing**

International Bank for Reconstruction and Development (IBRD)	116.40
--------------------------------------------------------------	--------

**Expected Disbursements (in US\$, Millions)**

WB Fiscal Year	2023	2024	2025	2026	2027	2028	2029
<b>Annual</b>	0.00	6.00	20.00	32.00	31.00	20.40	7.00
<b>Cumulative</b>	0.00	6.00	26.00	58.00	89.00	109.40	116.40

**INSTITUTIONAL DATA**

Practice Area (Lead)	Contributing Practice Areas
----------------------	-----------------------------



Finance, Competitiveness and Innovation

Environment, Natural Resources & the Blue Economy,  
Macroeconomics, Trade and Investment

**Climate Change and Disaster Screening**

This operation has been screened for short and long-term climate change and disaster risks

**SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)**

Risk Category	Rating
1. Political and Governance	● Moderate
2. Macroeconomic	● Low
3. Sector Strategies and Policies	● Moderate
4. Technical Design of Project or Program	● Moderate
5. Institutional Capacity for Implementation and Sustainability	● Moderate
6. Fiduciary	● Moderate
7. Environment and Social	● Moderate
8. Stakeholders	● Low
9. Other	
10. Overall	● Moderate

**COMPLIANCE**

**Policy**

Does the project depart from the CPF in content or in other significant respects?

Yes  No

Does the project require any waivers of Bank policies?

Yes  No





**Environmental and Social Standards Relevance Given its Context at the Time of Appraisal**

E & S Standards	Relevance
Assessment and Management of Environmental and Social Risks and Impacts	Relevant
Stakeholder Engagement and Information Disclosure	Relevant
Labor and Working Conditions	Relevant
Resource Efficiency and Pollution Prevention and Management	Relevant
Community Health and Safety	Relevant
Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Not Currently Relevant
Biodiversity Conservation and Sustainable Management of Living Natural Resources	Relevant
Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Not Currently Relevant
Cultural Heritage	Relevant
Financial Intermediaries	Not Currently Relevant

**NOTE:** For further information regarding the World Bank’s due diligence assessment of the Project’s potential environmental and social risks and impacts, please refer to the Project’s Appraisal Environmental and Social Review Summary (ESRS).

**Legal Covenants**

Sections and Description

No later than six (6) months after the Effective Date, the Borrower, through MSE, shall establish and thereafter maintain throughout Project implementation, a Project steering committee, with composition, qualifications, experience, and terms of reference satisfactory to the Bank.

**Conditions**

Type	Financing source	Description
Effectiveness	IBRD/IDA	the Borrower has established a PIU in a manner acceptable to the Bank



Type Effectiveness	Financing source IBRD/IDA	Description the Borrower has prepared and adopted the Project Operations Manual in form and substance satisfactory to the Bank
Type Disbursement	Financing source IBRD/IDA	Description the Borrower, through the MSE, shall prepare and adopt a Grants Operations Manual, in form and substance satisfactory to the Bank
Type Disbursement	Financing source IBRD/IDA	Description the Borrower, through MSE, shall enter into an implementation agreement with the Croatian Science Foundation under terms and conditions approved by the Bank

---



## I. STRATEGIC CONTEXT

### A. Country Context

**1. Croatia has made significant gains in living standards over the last two decades.** Croatia's gross domestic product (GDP) per capita in purchasing power parity (PPP) terms reached 70 percent of the average EU-27 level in 2021—up from about 50 percent in 2001 (Figure 1).<sup>1</sup> The income convergence process reflects advances in the business environment and institutional quality, liberalization of labor and product markets, and stable macroeconomic and financial environment. Croatia recently made several positive steps to integrate with the global economy. On January 1, 2023, Croatia adopted the euro as its national currency. Although Eurozone accession should provide access to more affordable liquidity in the long run, lingering geopolitical uncertainty may dampen the immediate effects of euro adoption. Simultaneously with Eurozone accession, Croatia joined the Schengen area, facilitating the free movement of people, goods, and services between Croatia and its most important trading partners. Finally, in 2022, Croatia officially started negotiations to join the Organization for Economic Co-operation and Development (OECD).

**2. Nevertheless, its income continues to lag the European Union (EU) average.** Structural headwinds—related mainly to limited improvements in productivity and an aging population—continue to weigh on Croatia's potential growth. Between 2015 and 2022, Croatia's potential output growth rate averaged only 2.0 percent yearly, half the average for the Central and Eastern European (CEE) region (Figure 2).<sup>2, 3</sup> The COVID-19 pandemic derailed Croatia's growth path and caused the deepest recession in the country's history, given its dependence on tourism. The country also suffered from two earthquakes in 2020, with significant damage to infrastructure in the capital, Zagreb, and Sisak-Moslavina county. The reopening of the economy and a large fiscal stimulus package in 2021 led to a rapid rebound with the growth rate reaching 6.3 percent in 2022 despite the negative impacts from Russia's invasion of Ukraine. Still, the near-term growth outlook remains challenging given a sharp tightening in financing conditions, high inflation, and subdued external demand from key trading partners in the euro area.

**3. Structurally enhancing Croatia's growth potential requires raising its productivity.** Although labor productivity has risen in the past twenty years, significant gaps persist between Croatia and its peers—and more advanced frontier economies. Over the last two decades, Croatian labor productivity has risen by 27 percent compared to an average of 73 percent for other CEE economies. Croatia's gap with other countries has partly reflected a sluggish improvement in key drivers of labor productivity, including research and development (R&D) spending, digital and technology adoption, business dynamism, competition, green transition, and management and organizational practices. Furthermore, although there has been some catch-up with Germany, which is considered the regional frontier economy, it takes on average almost three Croatian workers to produce the same value-added generated by a single German worker,<sup>4</sup> and regional peers that had started at similar values (such as Estonia, Slovakia, and Slovenia) have caught up faster. Available EU funding for public and private investments and programs as well as reforms could be instrumental for raising

<sup>1</sup> World Bank. 2023. *Croatia Country Economic Memorandum (CEM): Laying the Foundations: Boosting Productivity to Ensure Future Prosperity*.

<sup>2</sup> CEE countries include: Bulgaria, Croatia, Czechia, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia, and Slovakia.

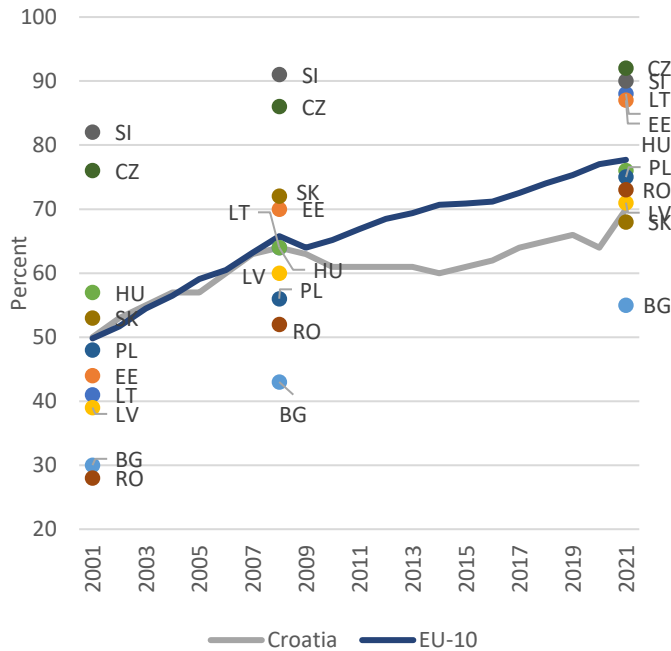
<sup>3</sup> World Bank. 2023. *Croatia CEM*. Potential output is output that fully utilizes available factors of production and is consistent with stable inflation. The output gap is the difference between current and potential output and helps distinguish cyclical and trend components of GDP growth.

<sup>4</sup> *Croatia CEM*.



productivity and boosting Croatia’s growth potential.<sup>5</sup> Croatia’s growth is projected to accelerate after a sharp slowdown in 2023, averaging about 3 percent over 2024–25 as external demand firms and as easing inflationary pressures lift private consumption.

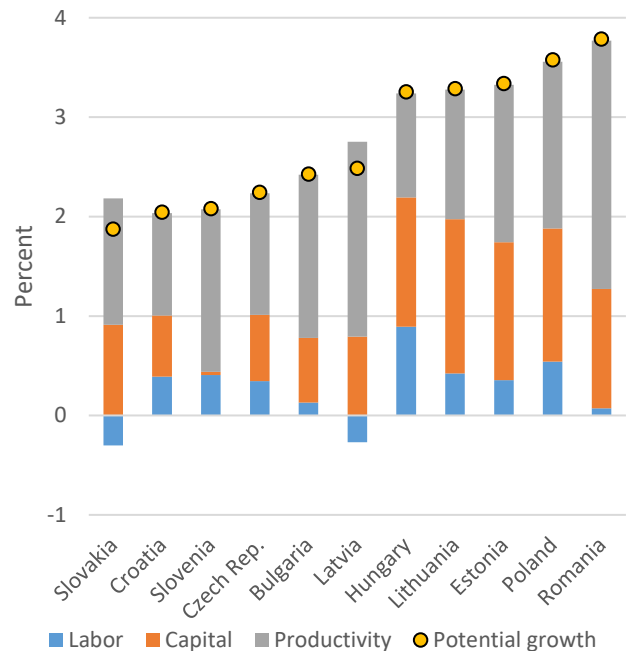
Figure 1 GDP per capita, in purchasing power standards, EU-27=100



Source: European Commission.

Note: EU-10 denotes the following EU member states: BG=Bulgaria, CZ=Czechia, EE=Estonia, HU=Hungary, LT=Lithuania, LV=Latvia, PL=Poland, RO=Romania, SI=Slovenia, and SK=Slovakia.

Figure 2 Contributions to potential growth, 2015–22 average, percentage points



Source: European Commission.

**4. Croatia is vulnerable to climate change risks.** Nearly a quarter of the Croatian economy is in sectors potentially vulnerable to climate change and extreme weather, including agriculture and tourism. These sectors alone account for over 20 percent of GDP.<sup>6</sup> Due to a combination of political, geographic, and social factors, Croatia is recognized as vulnerable to climate change impacts, ranked 55 out of 181 countries in the 2020 ND-GAIN Index.<sup>7</sup> Adaptation challenges still exist, but Croatia is well-positioned to adapt. Croatia is the 119<sup>th</sup> most vulnerable country and the 60<sup>th</sup> most ready country.<sup>8</sup> According to the Think Hazard tool,<sup>9</sup> risks of floods (river, coastal and urban), wildfires and landslides are

<sup>5</sup> The funds from the EU’s Recovery and Resilience Facility (RRF) totaling EUR 5.5 billion until 2026 are meant to tackle challenges related to education, productivity, and the business environment in a sustainable manner. A large part of the investment is focused in areas that advance digital infrastructure and the ambitions of the green transition, through investments that support energy efficiency, sustainable mobility, lower carbon energy and the green transition of businesses. Croatia is eligible for EUR 9.1 billion of cohesion policy funding from the EU’s new Multiannual Financial Framework (2021–27).

<sup>6</sup> World Bank. 2021. *Climate Risk Country Profile—Croatia*.

<sup>7</sup> Ibid.

<sup>8</sup> <https://gain-new.crc.nd.edu/country/croatia#:~:text=The%20low%20vulnerability%20score%20and,is%20well%20positioned%20to%20adapt.>

<sup>9</sup> <https://thinkhazard.org/en/report/62-croatia>



assessed as high, meaning that project planning decisions, project design, and construction methods must take into account the level of flood hazard in question. According to the same source, medium risks are assigned to earthquakes, extreme heat and water scarcity. Moreover, the country's reliance on hydropower (53 percent of annual production), which may be affected by rainfall reductions, and a predicted threefold increase in warm spell duration could further stress the country's energy capacities by 2040. With rising air pollution and the challenges mentioned above, climate change could negatively affect the economy, health, and, ultimately, the population in case risks and vulnerabilities to climate change are not addressed and considered properly.

**5. In the medium term, Croatia needs to jointly address productivity growth issues with climate change risks.** According to the European Investment Bank Investment Survey, nearly 60 percent of Croatian firms report climate change impacts their firms, with 15 percent saying it has a major impact. In this respect, the experience of Croatian firms is similar, albeit higher than the EU average (57 percent). Eighty five percent of respondents are taking action to reduce greenhouse gas emissions. Croatia submitted its Seventh National Communication (NC7) and Third Biennial Report of The Republic of Croatia under the UNFCCC in 2018. Croatia participated in the Updated Nationally Determined Contributions (NDC) submitted to the UNFCCC as an EU Member State in 2020. The country's adaptation priorities include availability and accessibility of water for drinking and irrigation uses, coast and coastal zones, forestry and land use change, agriculture, biodiversity, and human health.

## B. Sectoral and Institutional Context

### Addressing the productivity challenge in Croatia requires within-sector investments in R&D and innovation

**6. The low level of productivity in Croatia is associated with differences in within-sector productivity, helping to explain the bulk of the productivity gap compared to the regional frontier.** The Croatian economy is characterized by low diversification. Services exports amount to 25 percent of GDP, of which around 70 percent relate to tourism. High value-added service exports such as ICT, transport, and other business services are among the lowest in the CEE region.<sup>10</sup> Global innovator services—sectors with high potential for productivity growth—account for 23 percent.<sup>11</sup> However, the composition of the economy explains only a small part of the productivity gap compared to the regional frontier (Germany). Almost 90 percent of the productivity gap in Croatia is due to differences in within-sector productivity. Manufacturing and ICT are among the sectors with the largest within-sector gaps in labor productivity. Many knowledge-intensive service industries with high export potential, such as ICT, have been losing competitiveness relative to the productivity frontier. These service activities are critical for driving future productivity growth and play key roles as intermediate inputs for downstream sectors of the economy, including manufacturing.

**7. Digital and green research and technologies provide a strong growth opportunity for increased productivity and for Croatia's service-oriented economy.** These technologies are pushing markets toward less dependence on physical proximity, increased automation, and rising investments in intangible capital—all of which could raise productivity in Croatia's services sectors.<sup>12</sup> Technology adoption through technological upgrades in firms is one key source of productivity gains. In recent years, Croatia invested significant resources in upgrading production processes through

<sup>10</sup> Croatia CEM.

<sup>11</sup> These include professional, scientific, and technical services; ICT services; and financial and insurance services. These activities tend to be more technology and/or knowledge intensive and thus employ a large share of skilled workers. They are also highly tradable and, thanks to recent advances in digital technologies, they can be increasingly offshored, increasing the scope for scale effects.

<sup>12</sup> Nayyar, Gaurav et al. 2021. *At Your Service? The Promise of Services-Led Development*. Washington, D.C.: World Bank.



purchases of machinery, equipment—non-R&D innovation expenditures in Croatia in 2018 were 83 percent larger than the EU average. This trend is likely to continue as Croatia plans to invest substantial funds in digital and green technology adoption through the National Recovery and Resilience Plan (NRRP). Going forward, more targeted investment in digital and green innovation may propel service providers to pursue more lucrative segments and branch out of the domestic market, bringing increased trade and intra-sectoral diversification. This should be coupled with investment in capabilities in order to make innovation part of a sustained growth trajectory. These developments are also pertinent to Croatia's aspiration to reduce its reliance on tourism-related services.

*Box 1 Defining digital and green research and technologies*

**Digital research** refers to research activities to develop digital technologies and apply them to facilitate existing business processes efficiency, improve customer experience, develop new products and services, or create new business models. **Digital technologies** include *transactional technologies*, which better match supply and demand to facilitate market transactions by lowering information asymmetries (for example, digital ecommerce platforms and blockchain); *informational technologies*, which exploit the exponential growth of data and the reduced cost of computing (for example, business management software, cloud computing, big data analytics, and machine learning), and *operational technologies*, which combine data with physical automation to reduce production costs, including labor, materials and, in many cases, energy (for example, smart robots, 3D printing and the Internet of Things (IoT)).

**Green research** refers to research activities to develop technologies that achieve more resource-efficient, clean and resilient growth. **Green technologies** include technologies related to pollution reduction and greater resource efficiency (for example, thermal insulation and new materials, new uses of waste, energy efficient transport and agriculture), climate change mitigation (for example, cleaner energy supply and carbon capture storage), climate change adaptation (for example, climate-resistant products and tools to insure against climate-related risks), and environmental sustainability (for example, products and processes that protect biodiversity and reduce environmental impacts).

**The European Union has taken steps to define the scope of both digital and green technologies.** The EU's Taxonomy for Sustainable Activities sets out the conditions under which investments may be considered environmentally sustainable or green. In order to qualify investments must: (a) make a substantial contribution to at least one of six environmental objectives; (b) do no significant harm to any other environmental objective; (c) comply with minimum social safeguards; and, (d) comply with technical screening criteria. Environmental objectives, under the Taxonomy include climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and restoration of biodiversity and ecosystems. The broad definition of sustainable investments is met with a narrow scope of digital technologies. While acknowledging that the term *digital* applies more broadly, the EU defines five key digital technologies to be financed by RDI support: (1) High performance computing; (2) Artificial intelligence; (3) Cybersecurity and trust; (4) Advanced digital skills; and (5) Digital capacity and interoperability.

Source: Hallward-Driemeier, Mary, Gaurave Nayyar, Wolfgang Fengler, Anwar Aridi, and Indermit Gill. 2020. *Europe 4.0: Addressing the Digital Dilemma*. Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/34746>; Dutz, Mark, and Siddharth Sharma. 2012. *Green Growth, Technology and Innovation*. Washington, DC: World Bank.; European Commission. 2020. Regulation 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32020R0852>; European Commission. 2021. Regulation (EU) 2021/694 of the European Parliament and of the Council of 29 April 2021 establishing the Digital Europe Programme and repealing Decision (EU) 2015/2240 (Text with EEA relevance) <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32021R0694>.



**8. There is evidence of a positive relationship between investment in R&D and firm productivity in Croatia.** This relationship is especially strong among smaller and younger firms.<sup>13</sup> Business R&D investments are positively correlated with productivity among firms in Croatia. Croatian firms that invest in R&D have 2 percent higher productivity growth compared to firms that do not, and a 1 percent increase in business investment in R&D is associated with productivity growth of 0.6 percent.<sup>14</sup>

**9. However, Croatia has been falling short of its R&D spending targets.** Since EU accession, gross expenditures on R&D (GERD) increased from 0.8 percent of GDP in 2013 to 1.27 percent in 2021. This change is a marked improvement but is far below the EU's target of 3 percent by 2020. In contrast, business expenditures on R&D (BERD) moved from 0.4 to 0.59 percent of GDP in 2021, far below the EU average business R&D spending of 1.5 percent of GDP.

**10. Risk finance for innovation remains restricted.** Croatia's share of financially constrained firms (10.3 percent) remains above the EU average (6.2 percent). The most affected firms are those where R&D is the core of their business activities.<sup>15</sup> Croatia's bank-centric financial system caters primarily to incumbent firms, making access to finance for innovation difficult. Risk capital is severely limited; assets of private equity funds make up less than 0.3 percent of GDP, and angel investments are almost non-existent. Without tangible assets to use as collateral, many start-ups and SMEs struggle to acquire the risk finance needed to bring their innovations from concept to market.

**11. Croatia's participation in competitive international R&D funding is low.** The European Commission's Framework Programs (FP7, Horizon 2020, and Horizon Europe) are the most prestigious and competitive European programs for R&D funding. Horizon 2020 was worth EUR 80 billion in total, and its successor program, Horizon Europe, has a budget of EUR 95.5 billion until 2027. As in other new EU member states, Croatian research organizations and firms have struggled to access Horizon 2020 funds. Croatia ranked 22<sup>nd</sup> in the EU in terms of obtained funding per capita (and similarly low in funding per researcher and as a percent of GDP).<sup>16</sup>

**12. Investments in digital and green technology could boost Croatia's growth, but they have been low so far.** Firms that invest in digital R&D outperform other firms in turnover growth and are more likely to introduce product and process innovations. In Croatia, ICT sector R&D spending (as a proxy for digital R&D) was only 0.06 percent of GDP in 2019, behind regional peers such as Slovenia, Slovakia, Hungary, and Poland.<sup>17</sup> Similarly, spending on environmental and energy R&D is 50 percent of the EU average.<sup>18</sup> The current policy mix does not target creating green and digital technologies. Green objectives are supported only passively, through the obligation that supported projects do no significant environmental harm. Through the NRRP, Croatia has committed to an ambitious set of reforms focusing on resilient, inclusive, green, and digital recovery. If it implements its reform package, Croatia's potential growth could be 1.5 percentage points higher compared to the baseline (Figure 3)<sup>19</sup> and in line with the opportunity in regional comparators such as Poland and

<sup>13</sup> World Bank. 2019. *Croatia Public Expenditure Review in Science, Technology, and Innovation: Analysis of the Quality and Coherence of the Policy Mix*. Analytical report. Zagreb: World Bank.

<sup>14</sup> World Bank. 2019. *Croatia Public Expenditure Review in Science, Technology, and Innovation: Analysis of the Quality and Coherence of the Policy Mix*. Analytical report. Zagreb: World Bank.

<sup>15</sup> European Investment Bank. 2023. *European Investment Bank Investment Survey 2022*.

<sup>16</sup> European Court of Auditors. 2022. *Measures to Widen Participation in Horizon 2020 Were Well Designed but Sustainable Change Will Mostly Depend on Efforts by National Authorities*. Special report. 15/22.

<sup>17</sup> World Bank. Forthcoming. *Croatia Digital Diagnostic*.

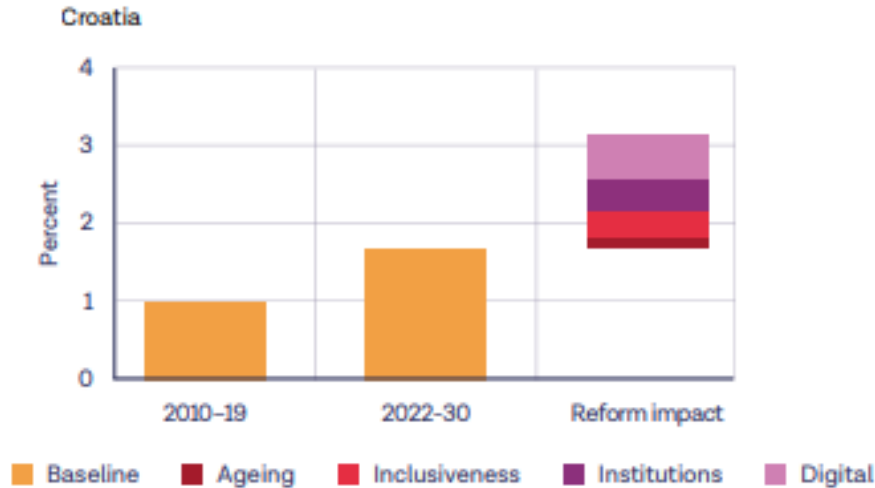
<sup>18</sup> *Ibid.*

<sup>19</sup> World Bank. 2022. *EU Regular Economic Report: Living Up to Potential in the Wake of Adverse Shocks: PART 2—Growth Over the Next Decade* (English). Washington, DC: World Bank.



Romania. The largest contributions to Croatia’s potential growth boost would come from reaching the 2 percent of GDP R&D spending target and realizing digital and green investments planned in the NRRP.

Figure 3 Estimated impact of investing in digital and green technologies on potential growth



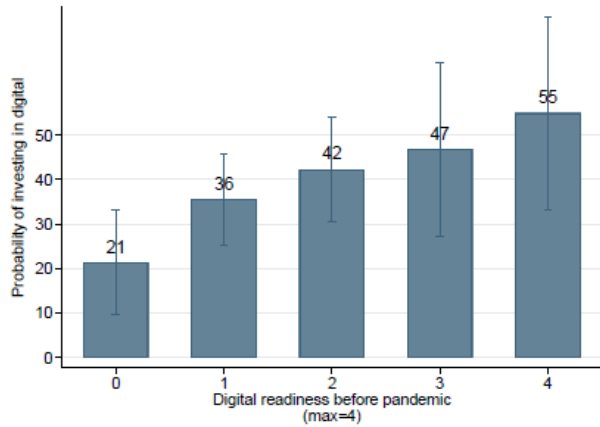
Note: The reform impact scenario includes the impacts of legislated changes to pension retirement ages (“Ageing”), closing the education gap with the EU (“Inclusiveness”), closing half of the institutional quality gap with the EU, and lifting absorption of EU funds to the best performer (“Institutions”), the boost from green investment from the NRRP (which is also incorporated in the baseline), and reaching nationally stated targets for R&D investment (“Digital”). Source: World Bank. *EU Regular Economic Report: Living Up to Potential in the Wake of Adverse Shocks: PART 2—Growth Over the Next Decade* (English). Washington, DC: World Bank.

**13. There is a growing digital and green divide for firms in Croatia.** Croatian firms with higher digital readiness are more likely to invest in digital technologies (Figure 4). Firms in Croatia also have higher rates of advanced technology adoption than their peers, but these remain low in absolute terms. The European Investment Bank Investment Survey 2021 finds that only 22 percent of firms invested in tackling climate risks (compared to 43 percent in the EU, Figure 5). Under the purview of the Ministry of Economy and Sustainable Development, support for in-firm digital and green technology adoption is increasing, with over EUR 210 million in funding from the NRRP and an additional EUR 200 million dedicated under ESIF.

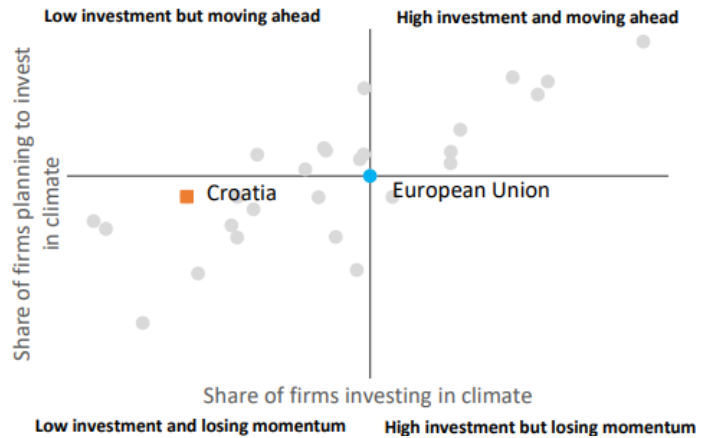




Figure 4 Probability of investing in digital solutions by digital readiness before the pandemic | Figure 5 Investment in climate risk mitigation



Source: 2022 Croatia Business Pulse Survey.



Source: European Investment Bank Investment Survey 2021.

### Modest R&D and innovation outcomes

**14. Fragmentation and governance deficiencies hold back the performance of the public research system.** As of 2019, there were 119 public research organizations in Croatia, which made the enactment of significant reforms very challenging.<sup>20</sup> Faculties, academies, and university centers act as independent legal entities with considerable autonomy in their work. The high fragmentation spills over into ineffectual governance and slows down the implementation of reforms. Past attempts to reform the financing of public research organizations did not trigger major changes in the system. Instead, the funding model stayed, in essence, input-based, while the share of budget allocated through performance-based mechanisms remained negligible. This model incentivized increasing the number of students enrolled and the number of study programs rather than research quality and innovation outcomes. A performance-based funding reform is currently underway to address these shortcomings. The new funding model entails negotiations between the Ministry of Science and Education and public research organizations on the expected outcomes. However, systemic fragmentation remains an obstacle to efficient negotiations and implementation.

**15. The research sector has struggled to produce high-quality research and establish effective linkages with the private sector.** The Croatian research system has long struggled with a lack of funding and dated infrastructure. Investments have increased since Croatia joined the EU, but several systemic issues persist. The current governance and institutional framework stifle the R&D activities of public research organizations and disincentivize collaboration between research organizations and with the private sector. A shortage of quality human capital also impedes research quality. Croatia has increased the share of human resources working on R&D from 0.65 percent of total employment in 2014 to 1 percent in 2021, but it continues to lag the EU27 average of 1.6 percent. At the same time, the quality of research has failed to keep up with expanding human resources. The country stands out for the overproduction of low-quality

<sup>20</sup> World Bank 2019. Croatia Public Expenditure Review in Science, Technology and Innovation: Analysis of Quality and Coherence of the Policy Mix. Analytical Report. Zagreb: World Bank.



publications, with Europe's highest average of uncited papers. However, co-authorship data indicates that research stemming from collaboration, especially international collaboration, tends to raise the quality of research outputs and helps national research actors integrate into global research networks.

**16. Innovation outcomes remain modest.** According to the European Innovation Scoreboard 2022, Croatia remains in the cohort of *emerging innovators*,<sup>21</sup> ranking 22<sup>nd</sup> in the EU. Croatia's score has increased to 66.5 percent of the EU average and has accelerated compared to the EU. Nevertheless, the innovation system struggles with developing R&D-based innovation, producing proprietary knowledge, developing technology transfer, and growing knowledge-intensive services and high-technology sectors. Intellectual property registration is scarce—Croatia produces very few patents, and international patent applications (normalized by GDP) are only 15 percent of the EU average and 53 percent of the CEE average.

**17. Digital research and development, while growing, is struggling to keep up with peers.** Between 1996 and 2021, Croatian computer science publications had an average of 5.9 citations per document and an h-index (a metric that measures both the productivity and citation impact of a body of publications) of 85, again behind all peers except Bulgaria.<sup>22</sup> This indicates that the Croatian research sector is both less productive in producing new knowledge in the field of computer science, but also that the knowledge that is produced has a relatively low impact on the international scientific community. Compared to regional peers, Croatia had the lowest share of participants and second lowest share of funds awarded in the Horizon 2020 Leadership in Enabling and Industrial Technologies program 2014-2020.<sup>23,24</sup> This would indicate that Croatian performers have lower competencies in these areas compared to peers. To this point, between 2015 and 2018, the Croatian research sector produced almost no patents related to Industry 4.0 technologies (i.e., advanced manufacturing, robotics, IoT, AI, and big data).<sup>25</sup>

**18. Outcomes in green research and innovation are especially sparse.** In the European Commission's Eco-Innovation Index, Croatia falls in the group of countries with catching-up eco-innovation, ranking 21<sup>st</sup> in the EU. Croatia ranked 58<sup>th</sup> globally in producing computer science publications and 60<sup>th</sup> in environmental science. Only 9.5 percent of patents are in environment-related technologies.

### **Institutional gaps remain challenges to effectiveness of research and innovation programs**

**19. The EU-wide pivot toward digital and green innovation is a challenge for public institutions in Croatia.** Institutional capacities in research and innovation are limited, and entry into the unfamiliar policy space of digital and green research and innovation is even more challenging. Unlike in the digital transformation of the public sector, where the Central State Office for the Development of Digital Society spearheads public-sector digitalization, there is no clear institutional ownership of the digital and green innovation agenda in research organizations and firms. The public administration lacks experience and expertise with digitalization and greening policy instruments. The infrastructure for green and digital R&D is lacking. Although financing for digital transformation and the green transition is envisaged through EU funds, most funding is earmarked to public institutions or technology adoption, and the institutional

<sup>21</sup> Emerging innovators are countries with performance below 70% of the EU average in 2022.

<sup>22</sup> World Bank. Forthcoming. Croatia Digital Diagnostic.

<sup>23</sup> Ibid.

<sup>24</sup> The Horizon 2020 Leadership in Enabling and Industrial Technologies program, which aims to develop new and breakthrough technologies with industrial applications, such as ICT, nanotechnology, advanced materials, biotechnology, advanced manufacturing, and processing.

<sup>25</sup> Ibid.



arrangements for effective implementation are lacking. Relevant experience, expertise, and implementation support in digital and green research and innovation are missing.

**20. The lack of a coordinated policy framework is a bottleneck for desired innovation outcomes.** The Ministry of Science and Education shares the research and innovation policy agenda with the Ministry of Economy and Sustainable Development. The Ministry of Regional Development and EU Funds and the Ministry of Finance play important roles as central bodies in the management and control of European Structural and Investment Funds (ESIF) and NRRP funds, respectively. In addition, the Croatian Science Foundation and the Croatian Agency for SMEs, Innovations and Investments (HAMAG-BICRO) are expected to be involved in the implementation of research and innovation policy. This complex research and innovation governance system creates significant coordination challenges both horizontally (between line ministries) and vertically (between ministries and implementing agencies). The updated Smart Specialization Strategy (S3) 2029 envisages an ambitious governance and coordination framework, with a new Policy Delivery and Monitoring Unit and a focus on policy co-creation with the research and private sector. Successfully establishing the new governance framework will require significant human resources.

**21. The ambitious new monitoring and evaluation (M&E) agenda outlined in the S3 2029 will require enhancing Croatia's M&E capacities.** Following the experience with EU funds in the 2014–20 period, the new strategy governing research and innovation policy—the S3 2029—strongly emphasizes evidence-based policy and increasing the effectiveness of funding for research and innovation. Maximizing the effectiveness of funding will require support for program design, implementation, and M&E. M&E is predominantly focused on monitoring and appears to be mostly compliance-driven rather than used as a learning and improvement tool. The M&E system did not foresee real-time corrections, and lack of harmonization and delayed reporting often impaired monitoring.<sup>26</sup> The Ministry of Science and Education, the Ministry of Economy and Sustainable Development, and other stakeholders should be able to exchange monitoring data more easily and adjust program implementation in real time. Capacity and institution building are required to ensure quality and consistent M&E.

**22. Maximizing the potential of EU funds requires complementary implementation support and pipeline development.** Implementation support entails strengthening the governance and capacities of critical public agencies on the supply side. Pipeline development requires developing a strong pipeline of high-potential projects on the demand side. In the 2016–20 period, over 90 percent of the total public innovation funding in Croatia originated from ESIF, and this trend is likely to continue in the future. However, there is a lack of implementation support to deliver programs effectively and a lack of soft support to applicants (such as guidance for preparing applications, project implementation aspects, and state aid). With the current and planned program mix, Croatia's use of EU funds is more about absorbing financing and less about building capacities to ensure effective spending of available funds.

**23. Resources are limited for the implementation of performance-based funding reform in public research.** A reform of performance-based funding in public research organizations is in preparation to incentivize and reward research excellence, collaboration with the private sector, and technology transfer. The new performance-based funding model requires research organizations to formulate a research and innovation plan that will form the basis of funding negotiations with the Ministry of Science and Education. The plan sets a commitment for research organizations to achieve specific targets related to research excellence and private-sector collaboration. Reform success hinges on

---

<sup>26</sup> World Bank. 2021. Croatia Public Expenditure Review in Science, Technology, and Innovation: Analysis of Design and Implementation of S3 governance. Analytical report. Zagreb: World Bank.



providing appropriate financial incentives and obtaining resources to establish a quality review of research and innovation plans, monitor the achievement of targets, and guide research organizations through the process. High research system fragmentation means the reform implementation process will be complex and labor-intensive. Although some funding is secured in the NRRP to incentivize voluntary onboarding to the new funding model, no resources are currently available to manage the reform process.

**24. Infrastructure for green and digital R&D is missing.** Outdated equipment, which is often too old and costly to maintain, physical constraints in laboratories, and a lack of modern IT infrastructure will likely continue to negatively impinge on digital and green research and innovation opportunities as well as on collaboration with other institutions and industry. Available EU funding for research and technology infrastructure<sup>27</sup> appears significant but is dedicated to a few projects, some of which remain incomplete from the previous financial perspective. Given the rapid developmental pace of digital and green research and innovation, it will be crucial to support infrastructure that deploys the latest technological facilities and addresses Croatia's strategic objectives across areas of comparative research advantage (for example, S3 thematic priority areas).<sup>28</sup>

**25. Existing research and technology infrastructure requires better management to optimize usage and attract more private-sector collaboration.** The responsibility for managing and maintaining the infrastructure falls to research teams, whose research duties do not leave much space for active infrastructure management. Information asymmetry and lack of business orientation discourage the private sector from using research infrastructure more intensively. Effective leadership and professional management are required to operationalize the core activities of research infrastructure, including the supervision of facilities and the facilitation of networking among entrepreneurs, researchers, investors, and others within and around the innovation ecosystem.

#### **The program mix for digital and green research and innovation is incomplete**

**26. Research and innovation support programs primarily supported low-risk projects and lacked thematic focus.** In the 2016–20 programming period, programs for the private sector supported mature firms and commercialization of R&D results, leaving a financing gap for higher risk pre-commercial R&D. Programs implemented in the past were also missing specific focus areas, such as addressing a particular stage of the innovation process or targeting digital or green innovation. This gap will likely continue in the future without changes in design, implementation, governance, and interinstitutional coordination.

**27. The current program mix does not address information gaps related to digital and green research and innovation.** The gaps include a lack of knowledge and awareness of firm needs, technological solutions, and returns on investment. In the European Investment Bank Investment Survey 2021, respondents cited technical support as among the most helpful support for investments in digitalization. Further, 54 percent of Croatian firms cited uncertainty about technology and climate change impacts as an obstacle to greening investments. Empirical research has shown that firms

---

<sup>27</sup> Research Infrastructures are facilities that provide resources and services for research communities to conduct research and foster innovation. Technology infrastructures are facilities, equipment, capabilities and support services where industrial players can find support to commercialize new products, processes and services.

<sup>28</sup> The new S3 2029 includes of seven thematic priority areas: Personalized Health; Smart and Clean Energy; Smart and Green Transport; Security and Dual Use – Awareness, Prevention, Response, Remediation; Sustainable and Circular Food; Customized and Integrated Wood Products; Digital Products and Platforms. The articulation of these areas through the S3 is a precondition for access to EU funds for RDI investments.



have a higher discount rate<sup>29</sup> for energy efficiency investments (around 40 percent) than for all other investments (10–15 percent).<sup>30</sup> The reasons for this *energy efficiency paradox* are unclear. However, they may include agency problems (managerial focus on short-term performance), information asymmetries, and perceptions of energy efficiency investments as cost centers.<sup>31</sup>

*Box 2 Findings of the Public Expenditure Review in Science, Technology and Innovation (PER in STI) on the quality and coherence of the policy mix*

The Public Expenditure Review in Science, Technology and Innovation conducted in Croatia provided an in-depth analysis of the composition and quality of research, development, and innovation (RDI) spending from 2016–20. The results show the following:

- **The bulk of institutional financing for RDI was spent on public research organizations, with a limited performance-based component.** This covers the salaries of academic staff and researchers, as well as other salaries and overheads. Performance-based funding arrangements are still optional and constitute a small portion of the financing of public research, which incentivized quantity (of staff and students) over quality (of research and innovation outputs).
- **Ninety (90) percent of RDI project funding was sourced from EU funds, and national funding has tapered since EU accession.** This substitution is not entirely equivalent because EU funding has a more complex governance framework and imposes a greater administrative burden on institutions and potential beneficiaries.
- **Eight-two (82) percent of EU RDI support funds awarded to private sector beneficiaries went to mature firms.** At the same time, firm-level analysis showed that R&D investments in small and young firms were associated with higher productivity gains compared to those in larger and more mature firms.
- **There was a gap in support for technology transfer in the research sector and early-stage R&D in the private sector.** Programs for the public sector focused mostly on basic research and somewhat on applied research, whereas programs for the private sector favored market commercialization. However, interventions to bridge the gap between research and commercialization through technology transfers were far and few.
- **Grants and matching grants were the predominant funding instrument, regardless of the level of risk and maturity of projects.** Other forms of financing, such as equity funding, loans, and loan guarantees, were underutilized in the policy mix.
- **Several programs experienced significant implementation delays, caused mainly by difficulty finding experts to conduct a good quality peer review process.** Implementation delays exacerbated the lack of predictability of financing and irregular call publication.
- **M&E practices focused on reporting and compliance** and lacked the depth necessary for learning, adjustments, and evidence-based policymaking.
- **The complex institutional landscape and governance framework created horizontal and vertical coordination frictions.** On a policymaking level, the Ministry of Science and Education and the Ministry of Economy, Entrepreneurship, and Crafts (today's Ministry of Economy and Sustainable Development) led the agenda. However, when the innovation policy was translated into innovation financing, the landscape

<sup>29</sup> The discount rate is the rate of return that an investor requires for a given investment. It is used in the calculation of the present value of future cash flows expected from an investment.

<sup>30</sup> Qiu, Yueming Qiu, Yi David Wang, and Jianfeng Wang. 2015. Implied Discount Rate and Payback Threshold of Energy Efficiency Investment in the Industrial Sector. *Applied Economics*. 47(21) 2218–33. DOI: 10.1080/00036846.2015.1005820.

<sup>31</sup> Ibid.



became much more complex. Many more institutions were involved; not all had experience or expertise in research and innovation policy.

Source: World Bank (2019). *Public Expenditure Review in Science, Technology and Innovation: Analysis of Quality and Coherence of the Policy Mix*.

**28. Some large-scale interventions in the new Smart Specialization Strategy (S3) have no funding secured.** The S3 envisages large “mission”-type projects that require significant and complex investments and the involvement of consortia made of private and public stakeholders. Such projects include, for example, designing and implementing microgrid pilot projects, developing a technology center for smart and green mobility, or creating a testbed pilot for developing remote healthcare. Such investments could propel Croatia’s green and digital research and innovation potential, benefiting private firms of all sizes as well as research organizations. However, EU funding for these types of interventions is not envisaged in ESIF nor NRRP financing because it is generally complex to implement such large, multi-stakeholder projects.

**29. High-quality research projects go unsupported due to financial constraints.** Between 2014 and 2020, 32 unique project proposals from Croatia received the Seal of Excellence in the Horizon 2020 program. Seal of Excellence projects meet the highest quality standards and are deemed worthy of financing but cannot be funded due to budgetary constraints. The European Commission awards the Seal of Excellence to help high-quality projects obtain financing from other sources. Only two secured subsequent funding from private or national public sources despite receiving positive scores in a highly competitive environment.<sup>32</sup>

### C. Relevance to Higher Level Objectives

**30. The project directly contributes to the objectives of the World Bank Group’s Country Partnership Framework (CPF) for Croatia for FY2019–2024.**<sup>33</sup> The CPF highlights the country’s need to strengthen market institutions to enable dynamic and innovative enterprises. This project will contribute to institutional capacity building (CPF Objective 1) for innovation policy, as well as to the low carbon and equitable growth agendas (Objective 3; Objective 4) by enhancing public sector performance and improving conditions to mobilize additional resources for domestic innovation in the context of greening and digitalization. The project also contributes to the achievement of CPF Objective 7 (*Promoting entrepreneurship, competition, and innovation*) by supporting the Government of Croatia in strengthening its innovation framework and providing complementary funding to EU R&D facilities. The project approach also aligns with the Green, Resilient, and Inclusive Development (GRID) framework promoted by the World Bank for post-pandemic economic recovery.

**31. The project is consistent with the country climate commitments.** Project activities will contribute to the NRRP’s general objective C3.2. in education, science and research, as well as three reforms under C3.2. related to raising research and innovation capacity. In addition, the project will finance research aligned with activities proposed in the Low-Carbon Strategy of Croatia for research, technological development, and innovation. The project Component 1 “Enabling institutional conditions for digital and green research and innovation” provides technical assistance and financing to strengthen institutional capacities and support the efficient use of EU funds. Component 2 of the project “Programs for digital and green research and innovation” provides sub-financing to cover the gaps in EU funding and improve the

<sup>32</sup> Horizon 2020 Dashboard.

<sup>33</sup> Report No. 130706, discussed by the Board of Executive Directors on May 2, 2019.



targeting of research and innovation support to digital and green technology. Furthermore, risks from climate hazards are not likely to have material impacts or adverse effects on the project and achievement of PDO, nor is it likely that there are risks of project having negative impact on country's low-GHG-emission development pathways.

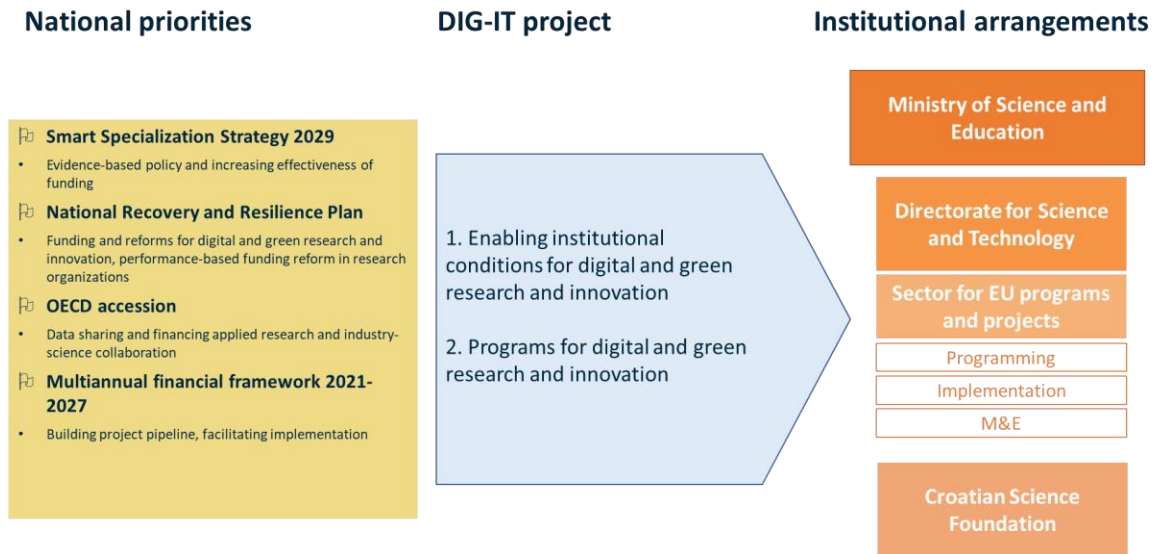
**32. The project is aligned with the Global Crisis Response Framework (GCRF).** All project activities contribute acutely to Pillar 4 – *Strengthening Policies, Institutions, and Investments for Rebuilding Better*. Technical assistance activities under Component 1 will help to strengthen the institutional capacities for research and innovation policy, with a focus on green and digital RDI. Additionally, the infrastructure funded under Component 1 will contribute to resilient reconstruction as well as digital development and may bring the latest research technology and equipment to lagging regions and/or scientific fields relevant to climate change adaptation and mitigation. Moreover, activities under Component 2 will provide funding for research and innovation that will contribute to green and sustainable growth and digital development by targeting environmentally conscious and digital R&D solutions. Together the components will support long-term policies and reforms to improve development outcomes related to sustainability, equitable growth, and digitalization.

**33. The project addresses institutional challenges in RDI policy and covers old and emerging funding gaps.** It does so by enhancing capacities for digital and green research and innovation, improving the effectiveness of funding, and increasing the RDI funding pipeline. Investing in RDI is essential for raising productivity and increasing resilience to shocks. The project supports the development of a knowledge and research base to eventually bring new products and services to the market and diversify the economy. The project will provide complementary support to maximize the impact of EU-financed interventions. It will also address longstanding gaps in the policy mix for complex interventions, such as supporting public-private collaboration, pre-commercial financing, and emerging digital and green technology creation gaps. Doing so will help unlock opportunities for scaling up through EU financing that supports bringing new products, processes, and services to market. The project enables private investments in R&D by mitigating financial risk, reducing information asymmetries with the research sector, and improving conditions for higher-quality research and innovation. Firms and researchers will benefit from better public services and more effective government support, whereas institutions will increase the impact of their policies.

**34. The project supports national strategic priorities and facilitates the implementation of several challenging reforms.** Figure 6 shows how the DIG-IT project supports the Ministry of Science and Education with implementing the national strategic priorities in its purview. First, the project aligns with S3 2029's strong emphasis on evidence-based policies, and increasing the effectiveness of funding requires developing substantial institutional capacities for policy design, implementation, and M&E. Also, the S3 2029 envisages an extensive program mix for which full financing is not secured. The project addresses some of the unfunded strategic priorities of Croatia's S3. Second, the NRRP envisages a challenging funding reform of public research organizations and focuses policy efforts on demand for RDI support. The project can help enhance the take-up of performance-based funding, thus helping the government reach its reform targets. Concomitantly, the project's assistance for the supply of RDI support will ensure policies are delivered more efficiently and effectively. Third, the project can support Croatia's bid to become a member of the OECD by developing policies and good practices in data sharing, supporting industry-science collaboration, and conducting applied research. Fourth, the project will directly support enhancing the effectiveness of funding for research and innovation that will be available through the Multiannual Financial Framework 2021–2027 by building up the project pipeline and facilitating the implementation of programs. Finally, the project addresses critical gaps in the current landscape of EU funding available for innovation. (See Annex 2 for details.)



Figure 6 Link between DIG-IT and national strategic priorities



## II. PROJECT DESCRIPTION

### A. Project Development Objective

The project development objective is to advance research and innovation with a digital and green focus through enhancing institutional infrastructure and research performance of research organizations and firms.

#### PDO-Level Indicators

The following key performance indicators will be used to measure the achievement of the PDO:

- Total value in euros of programs benefiting from measures to advance institutional capacity (of which: digital and green programs)\*
- Number of researchers using improved research or technology infrastructure facilities\*\*
- Total value in euros of research and innovation programs complemented\*\*\*
- Total value in euros of potential RDI projects from DIGIT beneficiaries (of which: digital and green projects)\*\*\*\*

\* The indicator measures the returns of capacity building and technical assistance support on the design, implementation, and M&E of research and innovation programs.

\*\* The indicator measures the use of research or technology infrastructure that is going to be built with the project's support.

\*\*\* The indicator captures the influence/impact of the project's complementarity activities (pre-screening applicants, professionalization of research centers, piloting new interventions, or supporting the peer review process) on the effectiveness of research and innovation programs.





\*\*\*\* The indicator reflects unlocking opportunities for further financing. The indicator measures the value of pre-commercial RDI subprojects which have advanced their research as a result of project's support under Component 2, and which might seek further funding to advance on the path towards commercialization.

## B. Project Components

35. Table 1 summarizes project components, subcomponents, and their indicative costs. Annex 1 describes the components in detail.

*Table 1 Summary of components and indicative costs*

	<b>Cost (EUR million)</b>
<b>Component 1 Enabling institutional conditions for digital and green research and innovation</b>	<b>66</b>
<b><i>Subcomponent 1.1 Strengthening the institutional infrastructure for research and innovation policy</i></b>	<b>56</b>
<ul style="list-style-type: none"> <li>• Capacity development for design, implementation, and M&amp;E of research and innovation programs</li> <li>• Institutional support for performance-based funding reform in public research organizations</li> <li>• Financing for selected research and technology infrastructure projects</li> </ul>	3 2 51
<b><i>Subcomponent 1.2 Strengthening the effectiveness of research and innovation financing</i></b>	<b>10</b>
<ul style="list-style-type: none"> <li>• Funding to enhance the effectiveness of the RDI program mix</li> <li>• Online diagnostic and technology scouting</li> <li>• Professionalization of research centers</li> </ul>	2.5 2.5 5
<b>Component 2 Programs for digital and green research and innovation</b>	<b>40</b>
<b><i>Subcomponent 2.1 Pre-commercial digital and green R&amp;D support</i></b>	<b>25</b>
<ul style="list-style-type: none"> <li>• Grants for pre-commercial digital and green R&amp;D</li> <li>• Challenge program</li> </ul>	10 15
<b><i>Subcomponent 2.2 Synergies program</i></b>	<b>15</b>
<ul style="list-style-type: none"> <li>• Synergies program</li> </ul>	15
<b>Total (Component 1+ Component 2)</b>	<b>106</b>



## Component 1 Enabling institutional conditions for digital and green research and innovation (EUR 66 million)

**36. Component 1 aims to foster enabling conditions for digital and green research and innovation by strengthening institutional capacities and bolstering the effectiveness of EU funds.** Institutional capacities are a critical bottleneck in the Croatian national innovation system.<sup>34</sup> The Ministry of Science and Education and complementary stakeholders require support to ensure that programs are designed and implemented to a high standard, applicants and beneficiaries receive high-quality services, research organizations have an appropriate incentive structure to strive for research excellence, and state-of-the-art facilities support research. The component also provides complementary investments to increase the quality of forthcoming and past funding, including by enhancing EU-funded operations, addressing information gaps and asymmetries for green and digital technology adoption and industry-science collaboration, and supporting the professionalization of research centers funded in the past. The Ministry of Science and Education will implement the component. The Component will contribute to Pillar 4 (Strengthening Policies, Institutions and Investments for Rebuilding Better) of the GCRF through institutional strengthening and capacity building, as well as entrenching climate smart policies in RDI and contributing to resilient reconstruction.

### **Subcomponent 1.1 Strengthening the institutional infrastructure for research and innovation policy (EUR 56 million)**

**37. Subcomponent 1.1 aims to improve the institutional capacities and infrastructure for RDI.** The activities under this sub-component will strengthen the Ministry of Science and Education's ability to deliver on the digital and green mandates while furthering other strategic agendas and improving research excellence. Funding for key research and technology infrastructure projects will address financing gaps for infrastructure, create incentives for public research organizations to implement reforms, improve general conditions for digital and green research, and help bridge the gap between research and the private sector. Specific activities to be supported under this subcomponent include:

- a. Capacity development for design, implementation, and M&E of research and innovation programs (EUR 3 million): This activity includes technical assistance, on-the-job training, and project management support to strengthen the Ministry of Science and Education and the Croatian Science Foundation's capacities to design, implement, monitor, and evaluate research and innovation programs. The activity will also support setting up and providing ongoing assistance to a dedicated help desk within the Ministry of Science and Education and a Horizon support unit within the Croatian Science Foundation to assist program applicants and beneficiaries. Finally, this activity will provide support to the existing M&E unit in the Ministry of Science and Education (the department for monitoring the implementation of programs and projects) to improve its capacity to collect, analyze and utilize data to improve RDI programs and support—with a view to expanding into a self-sustained M&E Policy Analysis Unit during the project's duration. Where possible, the activity will mainstream impact evaluation practices to provide evidence for return on investment of different reforms and pilot programs.
- b. Institutional support for performance-based funding reform in public research organizations (EUR 2 million): This activity includes establishing a team within the Project Implementation Unit dedicated to performance-based funding for research organizations. Under this reform, the project will provide technical assistance to set up a system to assess the quality of research and innovation plans, monitor their implementation, and guide research

<sup>34</sup> World Bank. 2021. Croatia Public Expenditure Review in Science, Technology, and Innovation: Analysis of Design and Implementation of S3 Governance. Analytical report. Zagreb: World Bank.



organizations through this process. The team will help to establish operational processes and practices that will continue to be used after project completion.

- c. Financing for selected research and technology infrastructure projects (EUR 51 million): This activity will finance grants to research organizations addressing gaps in the availability of quality equipment and access to research infrastructure. The selection of infrastructure projects will consider a set of non-exclusive criteria, including contribution to digital transformation and green transition, public-private collaboration, demand from the private sector, performance-based funding reform, lagging region development. Possible infrastructure includes a scientific center for electrical engineering and computing, a center for digitalization and greening in the maritime industry, and a STEM center. Annex 1 provides more details.

#### **Subcomponent 1.2 Strengthening the effectiveness of research and innovation financing (EUR 10 million)**

**38. Subcomponent 1.2 provides complementary investments to enhance the effectiveness of research and innovation financing.** Activities aim to support policies and aspects of program management necessary to boost the impact of EU funds for research and innovation. These include soft support services for applicants, piloting new interventions, and strengthening the peer review process. Additionally, the subcomponent will provide online diagnostic toolkits for digital and green technologies and technology scouting services to match business needs with technological possibilities at research organizations.<sup>35</sup> This subcomponent will complement and improve the effectiveness of EU-funded investments related to digital transformation and green transition. Finally, the subcomponent will support professionalizing research centers, many created through EU funds, to improve their business orientation and operational and management capacities. Specific activities include:

- a. Funding to enhance the effectiveness of the RDI program mix (EUR 2.5 million): This activity will support initiatives to complement and address gaps in the current EU-financed programs and interventions. This may include financing to improve the peer review process for RDI project selection, develop the innovation support ecosystem, and pilot new interventions (sub-grants).
- b. Online diagnostic and technology scouting (EUR 2.5 million): This activity includes developing two online and publicly available diagnostic toolkits (one for digital technologies and one for green technologies) to provide firms with actionable insights into their levels of technology adoption and areas for improvement. This diagnostic toolkit will help firms improve their awareness of their technology needs and raise their capabilities for technology upgrading. This activity also includes developing technology scouting services in Croatia, which help firms define specific research needs and connect them to capacities in research organizations. These connections will help build better industry-research linkages and associate the private sector with existing research capacities and infrastructure.
- c. Professionalization of research centers (EUR 5 million): This activity will focus on improving the quality and business orientation of research centers. Grants will be available to research organizations to professionalize the

---

<sup>35</sup> The diagnostic toolkits are envisaged for a broad audience of firms as the first step in understanding their level of digital and green technology adoption relative to their peers. The firm would fill out a questionnaire, and the toolkit would indicate general areas of strength and weakness relative to other similar firms. The technology scouting services include: (1) helping firms define the innovation needed to improve their business, (2) actively seeking out available research capabilities that may meet these needs, (3) linking researchers with firms to work on developing the innovation, and (4) providing technical and business validation for the innovation. Workshops and trainings for technology scouting service providers will develop the capacity of service providers prior to the publication of the first call for technology scouting.



management of research infrastructure by hiring professional management and/or technical staff (for example, lab technicians) to efficiently manage existing research infrastructure and potentially engage outstanding researchers.

## Component 2 Programs for digital and green research and innovation (EUR 40 million)

**39. This component provides financing to accelerate the economy's digital transformation and green transition through research and innovation.** The financing addresses critical gaps in the current program mix that inhibit digital and green research and innovation. (See Annex 2.) These gaps are reflected in the project types that can be financed and the design, implementation, and governance of the available instruments. The policy framework developed by Cirera et al. (2020) informs the choice of instruments and provides evidence-based recommendations for addressing market failures that hold back innovation.<sup>36</sup> As such, this component will also support the implementation of novel instruments that may receive continued EU funding beyond the life of the project. The Croatian Science Foundation will support the implementation of the component in specific areas as described in Section III (Implementation arrangements). The Component will contribute to Pillar 4 (Strengthening Policies, Institutions and Investments for Rebuilding Better) of the GCRF by supporting sub-projects that will boost Croatia's climate resilience and digital development.

### Subcomponent 2.1: Pre-commercial digital and green R&D support (EUR 25 million)

**40. This subcomponent will provide grants and matching grants for pre-commercial applied R&D related to green or digital innovation (EUR 10 million).** Grants of up to EUR 300,000 will be geared toward sub-projects conducted in cooperation between research organizations and firms. They will focus exclusively on R&D projects for green and digital solutions in early technology readiness level (TRL) stages.<sup>37</sup> The funding will target sub-projects demonstrating the potential for inter-sectoral synergies (for example, interdisciplinary consortia) and projects that address the green-digital intersect because they may yield heightened additionality.<sup>38</sup> Examples could include applied research in energy storage, carbon capture systems, smart grid technologies, artificial intelligence, and machine learning in transportation. This instrument will help by developing projects that may be further scaled through existing EU and national funds and available commercial financing sources.

**41. This subcomponent will also support establishing a Challenge program for innovative solutions related to digitalization and green transition challenges (EUR 15 million).** The program will provide grants and matching grants for R&D projects implemented by consortia comprising firms and research organizations to develop forward-looking solutions related to digitalization and green transition challenges, including to improve climate change mitigation and adaptation or resilience. Financing under the Challenge program will target the priority areas included in the S3 2029, prioritizing those areas which have not received NRRP or other financing. Box 3 provides an example of a pilot project to address energy security and volatility.

<sup>36</sup> Cirera, Xavier; Frias, Jaime; Hill, Justin; Li, Yanchao. 2020. *A Practitioner's Guide to Innovation Policy: Instruments to Build Firm Capabilities and Accelerate Technological Catch-Up in Developing Countries*. World Bank, Washington, DC.

<sup>37</sup> Technology readiness levels (TRLs) can be used to estimate the maturity of an innovation, going from the lowest (TRL1) to highest (TRL9). The TRL scale was initially introduced to track the development of space technologies, so the original definitions of TRL stages may not be applicable to all innovation projects.

<sup>38</sup> All green projects must demonstrate their contribution to climate mitigation and adaptation and comply with the EU taxonomy for sustainable activities. Funded digital technologies will at a minimum comply with the EU's 'do no significant harm' standard; European Commission. 2020. Regulation 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment and amending Regulation (EU) 2019/2088. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32020R0852>



*Box 3 Example of a pilot project that addresses the challenge of energy security and volatility*

**A microgrid is a small-scale, localized energy network connecting distributed energy sources that can operate independently of the main grid.** A microgrid can be configured as an energy system for a neighborhood, university campus, military installation, or residential condominium building. It can either be connected to the main grid or—as is typically the case in more remote locations—not have any link to the grid. If it is connected to the main grid, it can disconnect itself and operate in ‘island’ mode. The ability to island serves two functions. First, it enhances energy security (by allowing local networks to isolate from instability on the broader grid and simultaneously limiting the spread of energy or power disruptions). Second, it enables greater local control over energy assets, whether by a community or an individual user.

**Given the array of actors involved, developing and deploying a microgrid requires significant efforts in organizing a consortium of private and public entities, designing the system, and implementing the project.** Microgrids have three main components: distributed generation, energy storage, and control/switching technologies. As such, microgrids integrate various products and services of companies engaged in diverse activities across the energy sector, including HVAC, cleantech, and information and communication technology (ICT) firms.

**Due to geography, climate, and seasonal travel patterns, Croatian islands stand to benefit the most from energy microgrids.** Benefits include increasing energy resilience and reliability (especially in the summer when the grid comes under significant strain due to an influx of tourists) and accelerating the shift to renewable energy sources. Croatian islands have the potential to pioneer microgrid solutions through a collaboration of public and private stakeholders. A microgrid may provide Croatian firms with exportable know-how in an emerging market segment. Moreover, the Smart Islands initiative produced project documentation for photovoltaic microgrids on the islands of Unije and Korčula. One of these may be the nexus for a potential microgrid pilot project.

### **Subcomponent 2.2 Synergies program (EUR 15 million)**

**42. This subcomponent will provide funding to support high-quality projects that have received Horizon Seals of Excellence.** Grants and matching grants between EUR 50,000 and 3 million—with an expected average grant size of EUR 300,000—will be awarded to such projects to complement existing Horizon programs, expand the number of beneficiaries, improve the quality and commercial prospects for domestic research and innovation, and garner more interest in the Horizon program overall. This instrument fills a critical funding gap in the current program mix because obtaining Horizon funding is extremely challenging for research organizations and firms from new EU member states. High-quality Croatian projects risk falling through the cracks in the absence of Croatian Seal of Excellence funds; hence the Synergies program will address this financing gap and increase the potential eligibility of beneficiaries for future EU and other financing sources. Annex 1 provides further details on this program.

#### **Cross-cutting topics**

**43. Climate change adaptation and mitigation:** The project will address climate vulnerability by strengthening institutional capacities for the development of green R&D interventions along with direct support of research organizations and firms developing green R&D products and processes. The technical assistance provided under Component 1 will support adopting sustainable practices and compel research centers to engage in activities that improve climate adaptation and mitigation. The interventions under Component 1 will focus on strengthening the institutional framework and policies for promoting research, technological development, and innovation to take to market new products and processes that will focus on climate change adaptation or mitigation. Additionally, the infrastructure projects financed under Component 1 will contribute to green and digital objectives, supporting adaptation and mitigation. Depending on the selected infrastructure investments, their eventual research may likely yield results for



climate change adaptation or mitigation. The green technology pre-screening toolkit financed under Subcomponent 1.2 addresses information asymmetries that hinder green technology adoption, thus supporting mitigation. Beneficiaries under Component 2 may receive training provided by the PIU on green procurement, sustainability, environmental obligations, energy conservation techniques, carbon capture systems, and other relevant topics. Finally, some grants under Component 2 will target green R&D sub-projects for climate change adaptation and mitigation as well as digital sub-projects that may contribute to environmental sustainability.<sup>39</sup> The Results Framework includes indicators that set targets for actions aimed at investing in projects and institutional strengthening focusing on climate adaptation and mitigation impacts.

**44. Private Capital Mobilization/Enablement/Maximizing Finance for Development:** The project envisages *private capital mobilization* in the amount of EUR 10,000,000. This reflects private sector matching of funds for research and technology infrastructure investments, technology scouting, and possibly pilot interventions under Component 1 as well as for RDI support programs under Component 2. It is important to consider that a significant portion of project funds will support public research organizations. At the same time, attracting private investment in RDI is notoriously difficult due to high risk of failure, especially in early stages of research, therefore required matching rates are typically low. The project also supports *private capital enablement* through investments in Component 2, which may attract further private co-financing, as well as investments in research and technology infrastructure, which may be used on a commercial basis by the private sector. Indirectly, the project will also create better conditions for private investment in RDI by removing information barriers through the Online diagnostic and technology scouting intervention. The interventions under subcomponents 1.2, 2.1, and 2.2 provide missing soft support—which are major constraints to RDI in Croatia. If proven successful, the interventions are likely to be sustained beyond the project’s lifetime. The funding provided under component 2 will support the advancement of R&D sub-projects, which will unlock the possibility of further financing from other public and private sources, helping to support the sustainability of these sub-projects.

**45. Gender:** The project primarily targets the gender gap in research and innovation funding.

- a. **Gender gap:** Although there is overall gender parity among researchers in Croatia, women are underrepresented among applicants to research and innovation support programs focusing on applied research. Women comprise around 23 percent of applicants in research and innovation programs currently led by the Ministry of Science and Education.<sup>40</sup> Given that the percentage of women applicants corresponds roughly to the percentage of women grant recipients, the evidence would suggest a general shortage of female project applicants in RDI.
- b. **Reasons for the gap:** The gender gap in research and innovation funding can be attributed to several factors. First, women are underrepresented among researchers in STEM fields, which are the predominant recipients of applied research funding. Female doctoral graduates comprised 20 percent of ICT graduates and 31 percent of engineering, manufacturing, and construction graduates in 2019. Second, female applicants may use less

---

<sup>39</sup> Examples include applied research in energy storage, carbon capture systems, smart grid technologies, artificial intelligence, and machine learning in transportation, energy optimization through digitalization, big data in the management of agriculture and bioresources, blockchain in waste management, etc.

<sup>40</sup> Based on N=486 applicants to the Proof of Concept program launched in September 2022.



compelling language in their proposals<sup>41</sup> and are less likely to boast about their intellectual performance.<sup>42</sup> Finally, women receive less RDI funding because they are assessed less favorably as principal investigators, not because their proposals are of lesser quality.<sup>43</sup>

- c. **How the project addresses the gap:** The project addresses the gender gap in research and innovation funding through activities to attract more female applicants. For example, the project will target outreach for funding opportunities specifically to women (for instance, through dedicated presentations, application writing workshops, and best practice examples). These activities will be part of the work plan of the help desk unit envisaged under Component 1 and will be mainstreamed into the processes of the Ministry of Science and Education through institutional capacity-building activities.
- d. **Additional gender-oriented activities:**
- **Equitable selection processes.** Women face conscious and unconscious biases in selection processes for research funding. Grant funding under Component 2 will ensure a fair and rigorous selection process that emphasizes the quality of the research proposal, including through blind reviews.
  - **Gender-oriented M&E.** Collecting data and evidence on gender in research and innovation is critical for designing effective policies to address gender gaps. The project support to develop M&E capacities under Subcomponent 1.1 will include a module on monitoring and reporting on gender gaps in the national research and innovation system. This module will improve policymakers' awareness and understanding of barriers faced by female researchers in Croatia.
  - **Female-led businesses.** The purpose of this activity would be to encourage and prepare female-owned or managed businesses to adopt more sophisticated technology, thus closing the gender digital and firm productivity divide.<sup>44</sup> Several barriers prevent women-led businesses from adopting ICT tools and technologies.<sup>45</sup> The online diagnostic tools on green and digital technology adoption developed under Subcomponent 1.2 will help improve the knowledge and awareness of female-led businesses related to their technology needs and available solutions. The outreach for the online diagnostic tools will target female-owned or managed businesses, including through targeting female-dominated sectors and advertising the tool in women-focused platforms.
  - **Engagement.** The project will conduct a citizens engagement survey on the implementation of the project and aims to have the same satisfaction rate (at least 70 percent) for both women and men.
- e. **Measurement:** The project's contribution to reducing the gender gap in research and innovation will be measured through the share of woman-led projects among applicants to calls for proposals supported by the project's gender outreach activities. The target is 30 percent. As discussed, the proportion of woman-led project applications correlates to the proportion of woman-led project beneficiaries. Furthermore, the project cannot account for the quality of project applications. Therefore, the project will encourage and track the

<sup>41</sup> Kolev, J., Y. Fuentes-Medel, and F. Murray. 2019. Is blinded review enough? How gendered outcomes arise even under anonymous evaluation (No. w25759). National Bureau of Economic Research.

<sup>42</sup> Reuben, E., P. Sapienza, and L. Zingales. 2014. How stereotypes impair women's careers in science. *Proceedings of the National Academy of Sciences*, 111(12), pp.4403-4408.

<sup>43</sup> Witteman, H., M. Hendricks, S. Straus, and C. Tannenbaum. 2019. Are gender gaps due to evaluations of the applicant or the science? A natural experiment at a national funding agency. *The Lancet*. 393. 531-540. 10.1016/S0140-6736(18)32611-4.

<sup>44</sup> Cirera, X., Cruz, M., Martins-Neto, A., Kyung Min Lee, Nogueira, C. *Leveraging Technology for More Productive Women-Led Businesses* (Blog). Jobs & Development Partnerships. Published on March 15, 2023. URL: <https://www.jobsanddevelopment.org/2-leveraging-technology-for-more-productive-women-led-businesses/>

<sup>45</sup> OECD. 2018. Bridging the gender digital divide. Include, upskill, innovate.



share of woman-led projects among applicants, as opposed to woman-led project beneficiaries. Additionally, the project will measure the number of female-led firms supported with digital or green diagnostics, with a baseline of zero and target of 200.

**46. COVID response:** The project aligns well with the World Bank Group’s Crisis Response Approach Paper to address the COVID pandemic.<sup>46</sup> An enhanced RDI ecosystem will increase economic resilience by supporting productivity-led growth. Increasing economic resilience by supporting productivity-led growth directly aligns with the “economic response” pillar of the WBG crisis response as part of the third response stage: resilient recovery. The project supports Croatia in taking advantage of new opportunities for long-term economic growth as it emerges from the pandemic.

**47. Citizen engagement:** The project has developed a citizen engagement plan and feedback mechanism to foster citizen engagement and inclusion. This plan includes a range of citizen engagement mechanisms such as participatory planning and decision-making, consultive forums, the project Grievance Redress Mechanism (GRM), and beneficiary feedback surveys. The project-level GRM will provide a framework for complaints tracking, response, and resolution within the stipulated response times, thus closing the feedback loop. The project will put in place an engagement and communication strategy that will elaborate relevant and acceptable communications methodologies with citizens, including women, youth, and vulnerable groups, throughout the life of the project as well as information sharing and feedback techniques about all aspects of the project throughout implementation. The project will also measure and ensure citizen engagement through a survey across beneficiaries of programs under both components 1 and 2. Surveys will be conducted first in year 2, then annually until project close, with each type of beneficiary surveyed separately (although the results will be aggregated to report on the indicator). This survey will be used to measure the quality of services supported by the project but will also allow for suggestions on improving these services. As such, this indicator will both measure citizen engagement and act as an open and two-way feedback loop to inform project interventions in implementation. The project implementation unit will also hold consultations with beneficiaries and draft action plans to close potential implementation gaps up to 3 months after the completion of each survey. Additionally, beneficiaries of research and innovation programs will be engaged in a participatory planning process through focus groups, roundtables, and workshops. The help desk supported under component 1.1 will also incorporate a feedback and complaints system.

### C. Project Beneficiaries

**48. Direct project beneficiaries include public administration bodies, government agencies, research organizations, researchers, and firms.** Public administration bodies and government agencies will boost their capacities through technical assistance to serve the innovation system more effectively. Research organizations and researchers will benefit directly by receiving support for new research infrastructure; improving the management of existing infrastructure; establishing new collaborations with the private sector through technology scouting, digital, and green R&D projects; and implementing Seal of Excellence projects. Firms will also benefit directly by receiving support for defining their research needs, matching with research capabilities, establishing collaborations, conducting digital and green R&D projects, and implementing Seal of Excellence projects. Finally, the project will benefit the Croatian economy as a whole by improving the systemic outlook and conditions for research and development, digital and green innovation, business growth, productivity, and subsequent job creation.

---

<sup>46</sup> The World Bank. 2020. *COVID-19 Crisis Response Approach Paper*. Washington, DC: World Bank.



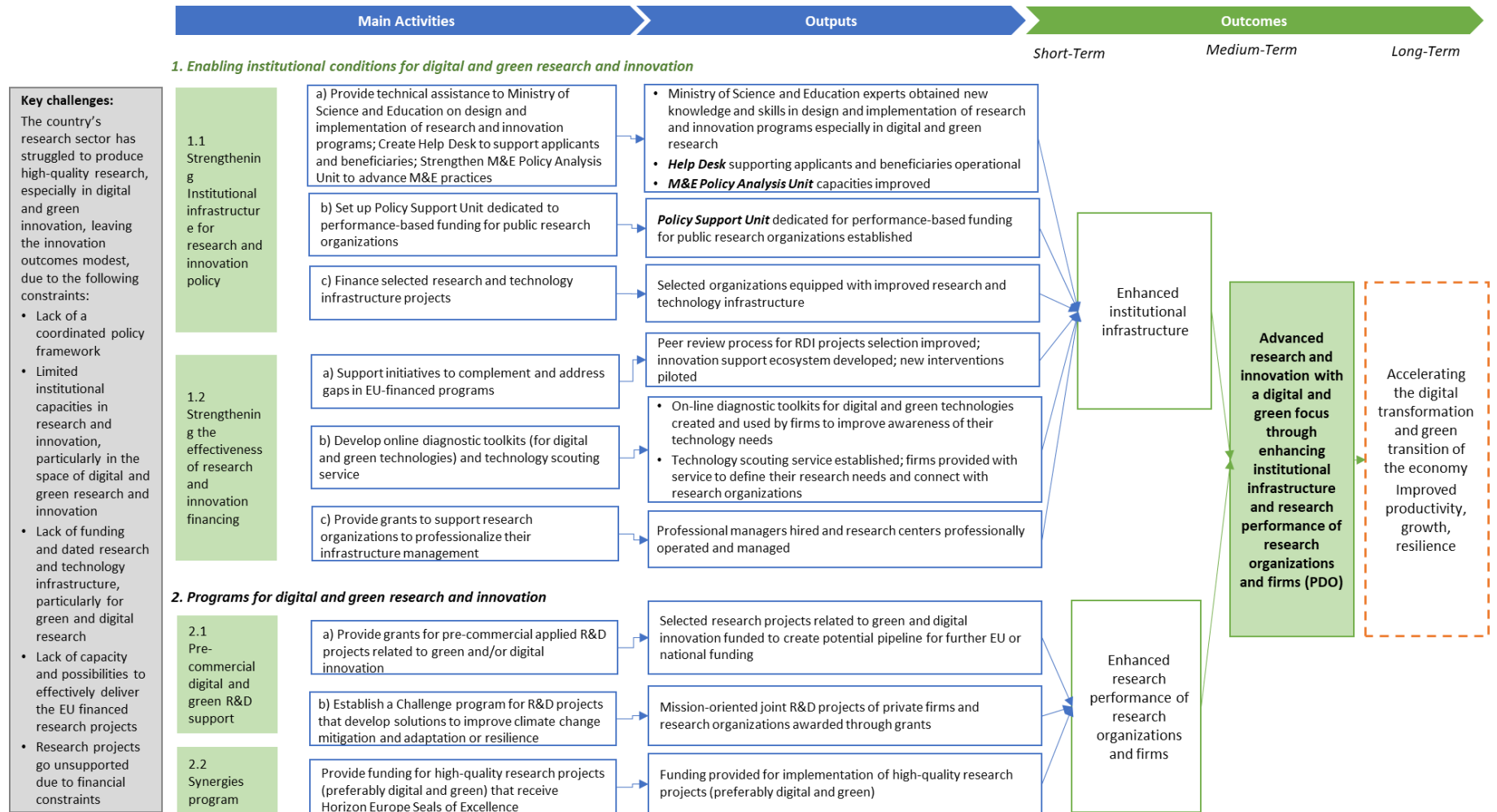


#### **D. Results Chain**

**49. The Project will support activities to address market and policy failures that hinder growth and investment in research and innovation in Croatia to help improve productivity and unleash private sector growth.** Project activities will support institutional capacity for digital research, green research, and innovation growth and provide direct financing to high-potential firms in these areas. The theory of change below provides further detail on the link between project activities and outcomes.



Figure 7 Theory of change for the DIG-IT project





## E. Rationale for Bank Involvement and Role of Partners

**50. The project addresses critical market failures limiting higher productivity R&D in Croatia that are binding constraints to unlocking broader financing and innovation opportunities.** Component 1 addresses market failures to improve the policy mix and institutional infrastructure for research and innovation. Further, the project targets areas not incorporated into other World Bank projects. For example, it addresses barriers to green and digital investments (which are within firms' control) rather than barriers in the business environment (which other interventions address). Component 2 provides critical financing to address the constraints preventing the use of risk capital in pre-commercial R&D and early-stage applied research. These programs also provide technical support to improve the capacity of beneficiary research organizations and firms, promoting their ability to invest in and reap benefits from innovation investments. As such, the project will contribute to developing a pipeline of projects for innovation and green growth. Growth-oriented businesses involved in these projects will benefit from improved access to financing from markets and private investors.

**51. The project prioritizes upgrading supply-side capacity and raising the effectiveness of available funding.** Increasing productivity through innovation requires interventions that foster both the supply of innovation (knowledge and technology creation) and the demand for innovation that brings products to the market (technology adoption). The Ministry of Science and Education is primarily responsible for supply-side innovation policies supporting activities early in the innovation cycle and associated with a higher level of uncertainty and positive knowledge spillovers. Further, the EU (whether under the NRRP or other funds) will not fund any of the activities financed by the project. (See Annex 2.) These activities include addressing both institutional capacity gaps as well as gaps in financing for specific and targeted policy instruments.

**52. The World Bank offers significant value to the proposed project activities by providing financing, technical assistance, and convening services.** The World Bank has considerable experience in developing and supporting the implementation of innovation and firm growth-oriented programs. Based on its expertise in research, development, and innovation (in existing and pipeline projects globally), the World Bank can incorporate lessons learned from these programs into the design of this project, including those explicitly drawn from other programs currently being implemented in Croatia. Recent operations supporting R&D investments, technological transformation, entrepreneurship, and innovation in Croatia, Cambodia, Argentina, and Serbia, among other countries, also provide important lessons and findings for implementing the proposed activities.

## F. Lessons Learned and Reflected in the Project Design

**53. The design of Component 1 is well-grounded in evidence demonstrating the link between public spending on RDI and aggregate productivity.** By engaging in research activities and achieving excellence, RDI support creates preconditions for the commercialization of research through spin-offs, patents, and licensing. Such commercialization activities may increase firms' productivity and thus influence aggregate productivity. Public investments through the research sector can also generate positive spillovers through research excellence and technology and knowledge transfer if the research is effective and designed with private sector demand in mind. The component is further underpinned by the findings of the Croatia Public Expenditure Review in Science, Technology and Innovation and outputs produced under the ongoing Reimbursable Advisory Services (RAS)—Strategic Partnership for Research, Innovation and Growth. Key findings from this work related to institutional capacities for RDI support indicate areas of improvement in beneficiary



support, M&E, research organization and research infrastructure funding, and instrument implementation. Component 1 will address these challenges through institutional support and investments in research infrastructure.

**54. Lessons learned from other World Bank engagements will inform the project.** Component 1 is informed by lessons from Armenia, Serbia, and Uzbekistan, especially regarding combining funding with technical assistance and capacity building. The combination will encourage sustainable lessons learned, lasting impacts on human capacity, and strategic fund deployment. The activities supported under Component 2 build on learnings from support provided under the previous entrepreneurship and innovation projects in Croatia, Argentina, India, Mexico, Morocco, Nigeria, Serbia, Tunisia, and Zambia. A set of randomized, controlled experiments and evaluations from these World Bank projects underscore the importance of hands-on and closely integrated business development services and management training to improve the effectiveness of financing provided to firm beneficiaries.<sup>47,48</sup> Moreover, the activities herein are informed by a World Bank study in Poland demonstrating how funding for R&D in public-private consortia can bolster industry-research collaboration and improve commercialization yields from early-stage research.<sup>49</sup> The support provided under this component also builds upon experience from other World Bank projects that have supported early-stage research, innovation financing, and institutional capacity building with the Ministry of Science and Education as a key counterpart. Learnings include improvements in targeted stakeholder engagement to build lasting public and private R&D capacities.

**55. Lessons learned from past interventions in Croatia will also inform the project.** The First and Second Science and Technology Project (STP I and STP II) provided valuable lessons for project implementation in Croatia. First, given the complexity of EU funding disbursement, implementation procedures should ensure speed, flexibility, and discretion in decision-making. Innovation is risky and requires swift decision-making, whereas EU funds are more tailored for stable interventions that are unaffected by lengthy procedures. Second, an efficient national innovation system is a prerequisite for improving RDI through public support. STP II highlighted the need for capacity building and policy reforms to strengthen the innovation system. Capacity building needs include building appropriate tools, including a robust system for data collection, to allow rigorous impact evaluation to inform policies and future investments. Finally, ad hoc institutional changes adversely affected the capacity gains and weakened the institutional and policy framework conducive to research and innovation. To mitigate the chances of such an occurrence, the PIU, the Ministry of Science and Education, and the Croatian Science Foundation will fill implementation roles previously held by three implementing bodies in STP II (HAMAG-BICRO, Croatian Science Foundation, and Unity through Knowledge Fund). In addition, implementation obligations will be explicit and predetermined in the Project Operational Manual.

**56. Lessons learned on stakeholder engagement.** Stakeholder engagement and community involvement are critical to increasing awareness of the benefits of project activities and the reform's political sustainability. Community buy-in will be particularly relevant in the context of reforms related to performance-based funding in research and research infrastructure investment projects. A factor that led the STPs in Croatia to bear fruit was high awareness of project activities among key stakeholders, expanding the pool of beneficiaries and resulting in private capital mobilization. Lessons from broad international experience suggest that stakeholder engagement increases ownership of reforms and investments, increasing the chance of success. Under Component 1, stakeholder feedback will be used to assess the

---

<sup>47</sup> McKenzie, D. 2015. *Identifying and Spurring High-Growth Entrepreneurship*. Washington, DC: World Bank.

<sup>48</sup> McKenzie, D. 2013. *Impact of Management Consulting on Firm Productivity in India*. Washington, DC: World Bank.

<sup>49</sup> Bruhn, M. and D. McKenzie. 2017. *Can Grants to Consortia Spur Innovation and Science-Industry Collaboration? Regression-Discontinuity Evidence from Poland*. Washington, DC: World Bank.



quality of support received through help desk and other services. Under Component 2, the project will use stakeholder feedback to inform program design.

### III. IMPLEMENTATION ARRANGEMENTS

#### A. Institutional and Implementation Arrangements

**57. The Ministry of Science and Education will be the implementing agency for the project.** A Project Implementation Unit (PIU) will be established prior to effectiveness in the Ministry, and once established, lead day-to-day project implementation, undertake fiduciary responsibility (such as financial management and procurement), monitor project progress, conduct monitoring and evaluation, ensure compliance with project social and environmental standards, prepare project reports, and coordinate and collect inputs from the relevant ministries and stakeholders. The PIU will be organized into several teams, as illustrated in Figure 8.

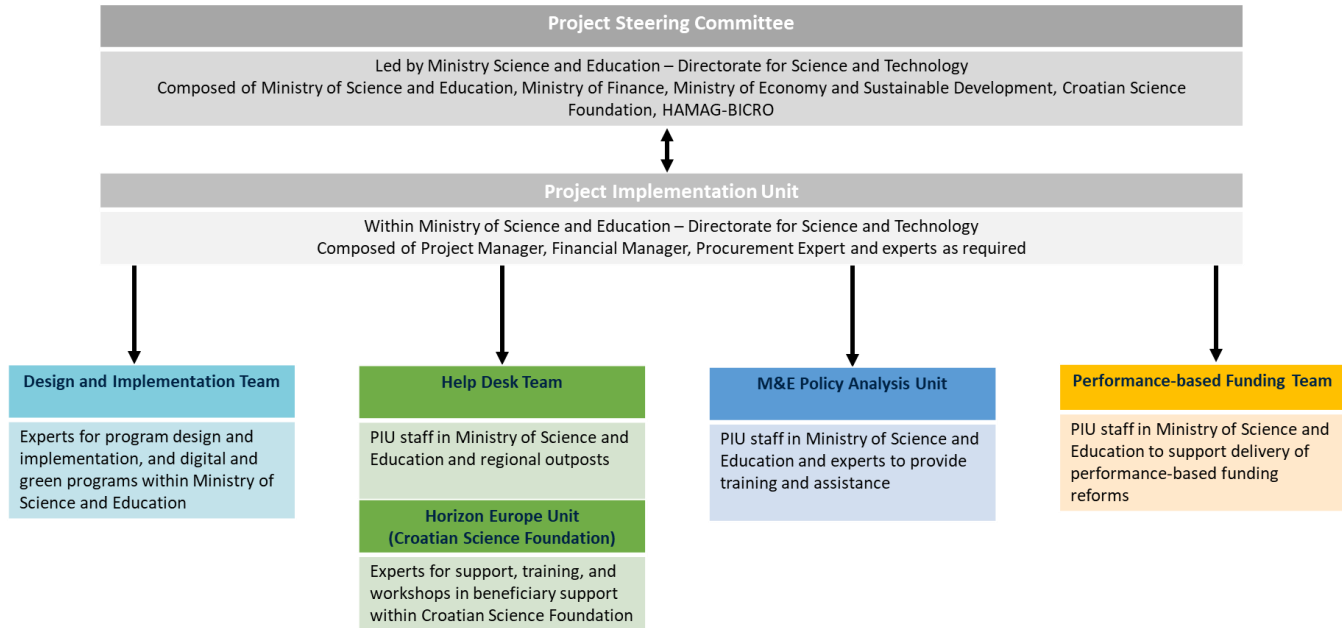
**58. The Croatian Science Foundation will support implementation in specific areas under Component 2 that do not involve financial management and procurement responsibilities.** The Ministry of Science and Education and the Croatian Science Foundation will sign an implementation agreement which define the responsibilities of the Croatian Science Foundation's scope of support, which shall be limited to implementation support under Component 2 and shall not involve any financial management and procurement responsibility. The Croatian Science Foundation's role may include publishing calls for proposals, conducting the selection process of subprojects, monitoring of subprojects implementation progress, and similar tasks.

**59. A Project Steering Committee (PSC) will provide strategic guidance and inter-ministerial coordination.** It will have representatives from the Ministry of Finance and the Ministry of Science and Education, as well as other ministries and agencies involved in the green and digital agenda, such as the Ministry of Economy and Sustainable Development, the Croatian Science Foundation, and the Croatian Agency for SMEs, Innovations and Investments (HAMAG-BICRO).

**60. As a critical policymaking and implementing body, the Ministry of Science and Education must have a reasonable capacity to deliver effectively.** The risk is relatively low, given the Ministry's experience implementing World Bank-financed projects (Science and Technology Project I and Science Technology Project II), including working with safeguards and the Environmental and Social Framework (ESF). A project manager will be appointed to the project implementation unit with core staff on procurement, financial management, and M&E. The PIU will be supported by teams of consultants in specific technical fields of interest and for specific component activities (for example, design and implementation, help desk, or Horizon Europe).



Figure 8 Institutional arrangements for implementation



## B. Results Monitoring and Evaluation Arrangements

**61. The project will build on existing M&E systems that the Ministry of Science and Education set up.** Results will be disaggregated by gender and climate financing as indicated in the results framework. The PIU, under the Ministry of Science and Education, will prepare semiannual reports with data for the results framework, to be reviewed and discussed with the World Bank Group. The World Bank team will periodically prepare Implementation Status and Results reports that capture the results framework data. Implementation support provided by the World Bank team will also enhance results’ M&E. Thus, progress against objectives will be assessed regularly. Component 1 will also support strengthening M&E systems to improve policy guidance and streamline underlying data systems across relevant ministries. Finally, the project M&E arrangements will also coordinate with existing initiatives within Croatia to support potential impact evaluations and expand evidence-based policymaking in the region.

## C. Sustainability

**62. Project interventions are expected to be sustained beyond the life of the project.** The support provided by the activities under Component 1 will address critical bottlenecks in the national innovation system, thus improving institutional capacity and bolstering the effectiveness of EU funds. Moreover, many of the established and supported capacities are either strategic priorities (applicant and beneficiary support as well as improved M&E) or legal obligations (performance-based funding of research institutions) that will carry on past the project’s implementation. The financing provided under Component 2 will also help support RDI pipeline development to enable downstream investment for sustainable investment in innovative beneficiaries. We expect other sources to continue financing the programs funded under Component 2 if proven effective.



## IV. PROJECT APPRAISAL SUMMARY

### A. Technical, Economic and Financial Analysis

**63. Support for improved R&D and resulting innovation can contribute to economic growth by expanding employment opportunities, increasing productivity, and improving economic and social livelihoods.**<sup>50</sup> This type of support is well grounded in the high potential returns of these types of investments. Lederman and Maloney (2003) estimated that the return on R&D investment ranges from 20 to 40 percent for OECD countries, with returns for medium-income countries of approximately 55 percent. A *Harvard Business Review* study by Anne Marie Knott estimated that a 10 percent increase in R&D investment could translate to a 10–20× multiple in firm revenues. Moreover, young, innovation-led, growth-oriented firms and SMEs account for most new jobs created worldwide, both in developed and developing countries. The analysis of firm dynamics has highlighted the importance of new firms that grow very rapidly, the so-called “gazelles” (Henrekson and Johansson 2010). These firms are engines of creative destruction, generating employment in large numbers, creating considerable value, and crowding out low-productivity competitors. Support in these areas will be critical in generating future jobs with good wages.

**64. The project has a net present value of EUR 62.9 million and an economic rate of return of 24 percent.** An economic and financial analysis (EFA) has been conducted across the project components to determine the value of the anticipated benefits relative to the costs associated with this project. The project net present value (NPV) is estimated at EUR 62.9 million at a 12 percent discount rate,<sup>51</sup> and the Economic Rate of Return (ERR) is 24 percent based on the total project investments.

**65. Component 1: Enabling institutional conditions for digital and green research and innovation**—The analysis for this component is based primarily on improved quality and reduced failure rate of research due to the research infrastructure investments financed under this component. The component NPV is estimated at EUR 24.9 million at a 12 percent discount rate and the ERR at 20 percent.

**66. Component 2: Programs for digital and green research and innovation**—The economic analysis of this component is based on increased revenues for companies and researchers receiving financial and technical support under Component 2. The component NPV is estimated at EUR 38.0 million at a 12 percent discount rate, with an ERR of 31 percent.

### B. Fiduciary

#### (i) Financial Management

**67. Financial Management.** The financial management arrangements rely on the borrower’s existing institutions and systems to the extent possible and with due consideration for their overall capacity. The project intends to use the existing financial management capacities within the Ministry of Science and Education.

<sup>50</sup> Nasr, S., and A. Rostom. 2013. “SME Contributions to Employment, Job Creation, and Growth in the Arab World.” World Bank Policy Research Working Paper WPS6682.

<sup>51</sup> We estimate a 12 percent discount rate as the risk-adjusted opportunity cost of capital. Additional NPV estimates at other discount rates have also been provided as a measure of the sensitivity of our analysis.



68. An initial assessment of the financial management capacity of the Ministry of Science and Education was conducted in March 2023. The existing financial management arrangements in the Ministry of Science and Education have been assessed to determine whether these arrangements (budgeting, accounting, reporting, internal control, staffing, funds flow, and audit) are satisfactory to the World Bank. The assessment concluded that the financial management arrangements need to be strengthened for the project implementation. Subject to the implementation of the agreed action plan (see below), the financial management arrangements are considered to meet the requirements of the World Bank. The overall financial management risk is moderate with the application of the mitigation measures. Some of the mitigation measures include the deployment of experienced staff, agreement on formats of interim financial reports (IFRs), acceptance of audit terms of reference (ToRs), and preparation of the Grants Operational Manual.

69. The Ministry of Science and Education will prepare semi-annual IFRs. The IFRs will include (a) a Statement of Sources and Uses of Funds, (b) Uses of funds by category, (c) Uses of funds by component; and (d) a Statement of Designated Account. The Ministry of Science and Education shall prepare and furnish IFRs to the World Bank—not later than 45 days after the end of each calendar semester—that cover the semester in form and substance satisfactory to the World Bank.

70. Project financial audits are to be carried out either by acceptable private sector auditors or by the country’s State Audit Office (SAO), which is also acceptable to the Bank, under terms of reference acceptable to the Bank. The Ministry of Science and Education expressed their interest in engaging the SAO to conduct the project financial audit. To realize this arrangement, the MSE needs to agree with the SAO to conduct the project financial audit. The MSE will provide the annual audited project financial statements and the audit reports to the World Bank within six months of the end of each fiscal year. Important requirements listed in Table 2 derive from the financial management assessment.

Table 2 Financial management assessment requirements

No.	Requirement	Responsibility
1	The Ministry of Science and Education will need to formally assign staff responsible for the Project’s financial management arrangements.	Ministry of Science and Education
2	The Financial Management sections of the operations manual will be drafted to describe all financial management arrangements.	Ministry of Science and Education
3	For the category of expenditure related to small grants, to be able to withdraw the funds, the Ministry of Science and Education will need to prepare a Grants Operations Manual (separate from the POM), which the Bank will review and approve such document.	Ministry of Science and Education

71. The project will have the flexibility of using retroactive financing. No withdrawal shall be made for payments made before the date of the Loan Agreement, except withdrawals for payments made prior to this date but on or after January 1, 2023, up to an aggregate amount not to exceed EUR 1 million, for eligible expenditures excluding expenditures for sub-grants.





(ii) Procurement

**72. The Bank’s procurement framework (PF), effective as of July 1, 2016, will govern procurement under the Project.**

Procurement of contracts for goods, works, and non-consulting and consulting services financed from the Project will be carried out in accordance with the World Bank Procurement Regulations for Investment Project Financing (IPF) Borrowers—Procurement in IPF of Goods, Works, Non-Consulting and Consulting Services, (Regulations), Fourth Edition of November 2020.<sup>52</sup> A Project Implementation Unit (PIU) will be established at the Ministry of Science and Education. The PIU will lead day-to-day project implementation, undertake fiduciary responsibilities such as financial management and procurement, monitor project progress, conduct monitoring and evaluation, ensure compliance with project social and environmental standards, prepare project reports, and coordinate and collect inputs from the relevant stakeholders. The project will be subject to using the World Bank’s electronic platform Systematic Tracking of Exchanges in Procurement (STEP). The PIU will use STEP initially to create and later to revise the ‘project’s Procurement Plan, monitor performance, and manage and store related documentation for all steps in procurement. As the applicable Procurement Regulations require, the Borrower is preparing a Project Procurement Strategy for Development (PPSD), and the World Bank expects to accept it during Project Appraisal. In addition to procurement arrangements for the project, the PPSD provides details on the risks for procurement and the proposed mitigation measures.

**73. The PIU is still not in place and will be established prior to the project’s effectiveness.** Based on the current limited capacity of the implementing agency for procurement, the risk rating for procurement is *Substantial*. This risk rating is subject to change based on a review of the Implementing Agency’s capacity for procurement and the status of addressing it through the proposed mitigation measures. The risk rating for procurement will be revisited after the first year of Project implementation.

**C. Legal Operational Policies**

	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Areas OP 7.60	No

**D. Environmental and Social**

**74. Both components under the project are E&S significant and trigger application of ESF, WB Environmental Health and Safety Guidelines (EHSF) and Good International Industry Practices (GIIP).** The proposed project will support infrastructure investment in participating scientific institutions and infrastructure/equipment (under Component 1) as well as various grant schemes to support R&D in the field of digital transformation and green transition (under Component 2). The selection process for funding R&D projects will consider a set of non-exclusive criteria, including contribution to digital transformation and green transition, public-private collaboration, demand from the private sector, performance-based funding reform, and lagging region development. Sub-component 1.1 will support institutional strengthening for research and innovation policy including measures to promote social inclusion outcomes. These

<sup>52</sup> <https://thedocs.worldbank.org/en/doc/178331533065871195-0290022020/original/ProcurementRegulations.pdf>



measures include the introduction of specific questions within sub-grant application templates and M&E guidelines that inform lagging region development and inclusion of vulnerable groups (elderly, at-risk youth, the disabled, the Roma ethnicity, migrants, among others). This component will also support research and innovation infrastructure with examples including: a scientific center for electrical engineering and computing, a center for digitalization and greening in the maritime industry, and a STEM center. Additional grant funding will be provided under sub-component 1.2. such as the technology scouting program, professionalization of research centers (including operating costs), and, possibly, new piloted interventions. Component 2 will support grant schemes related to precommercial digital and green technology, large-scale and complex digitalization and greening challenges, and recipients of Horizon Europe Seals of Excellence.

**75. Seven Environmental and Social Standards (ESS) are relevant to the project:** ESS1: Assessment and Management of Environmental and Social Risks and Impacts, ESS2: Labor and Working Conditions, ESS3: Resource Efficiency and Pollution Prevention and Management, ESS4: Community Health and Safety, ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, ESS8: Cultural Heritage, and ESS10: Stakeholder Engagement and Information Disclosure. The requirements of these standards are addressed through the ESF instruments, as described in the following paragraphs.

**76. Environmental risk rating is set at moderate due to environmental risks and potential impacts related to planned infrastructural investment in research institutions under Component 1, and support to R&D sub-projects that will be financed through different schemes under Component 2 (and potentially under sub-component 1.2).** The Project will not support any substantial risk activity. Though exact locations and scope of works are not determined at the Appraisal stage, construction/rehabilitation works at research institutions funded under Component 1 are expected to be small to medium-scale implemented in already urbanized areas. As a result, key environmental risks include those typical for civil works such as emission of dust and noise due to excavation and construction/reconstruction; management of construction and small amounts of hazardous wastes, traffic disturbance, noise, occupational health and safety (OHS) related risks, other community risks, etc. Further, as activities under Component 2 (and sub-component 1.2) will be digital and green in type (for example, may include applied research in energy storage, carbon capture systems, smart grid technologies, AI, and similar), the resulting potential impacts are expected to be small-scale, mostly limited to existing R&D laboratories and of limited scope such as pilot activities and laboratory work. Waste generation under Component 2 is likely to include small quantities of hazardous and municipal waste and management of small amounts of chemicals and hazardous materials (for example, some metals), small quantities of packaging. Limited purchase of equipment and installation works are also possible. Laboratories are expected to be mostly digital labs while no labs with biosafety risks will be financed. Sub-projects that entail collection or use of animal and human tissue, and animal testing as well as purchase of large amounts of chemicals and/or other types of hazardous materials will not be financed. The planned E&S Project and sub-project instruments will screen out all activities that meet substantial risk criteria as per ESF definition.

**77. The Social Risk rating is moderate as the project will support civil works and R&D sub-grants that could produce temporary impacts to surrounding communities.** Under the grant program for research and technology infrastructure (subcomponent 1.1), civil works will be supported for selected research institutions within land already under their ownership and use. Given this, no land acquisition or displacement should be caused by these works. The Environmental and Social Management Framework (ESMF) will include screening criteria to ensure that involuntary land taking, restrictions in access, and/or physical or economic displacement have not occurred to achieve the objective of the works supported by the Project. At the same time, R&D grants could entail data/sample collection, trials, and/or related works and activities that could introduce temporary impacts on communities or raise concerns for communities where these



take place. Other stakeholder risks around R&D grants could arise from disputes over intellectual property; or impacts on existing (and possibly less sustainable) commercial activities that could be adversely impacted or phased out with the introduction of the new technology. As the R&D subprojects will not be known by appraisal, the ESMF and SEP incorporate social screening criteria to identify, assess, and mitigate risks, based on the feedback of stakeholder engagement processes with relevant industry/user groups and communities where project activities take place. As Croatia follows EU labor standards and maintains practice aligned with ESS2 standards, labor and SEA/SH risk are low.

**78. The institution responsible for implementation of the new Project is the Ministry of Science and Education, which will lead and coordinate project activities as well as implement Components 1 and 2, while the Croatian Science Foundation will support the implementation of Component 2.** The Ministry of Science and Education will host the PIU and assume responsibility for an overall compliance with Banks Operational Policies (including ESF) for all activities supported by the project. E&S management will be organized within PIU, which will engage an environmental expert and a social expert to carry out E&S tasks under ESF for both components. In addition, E&S Focal Point will be appointed in the Croatian Science Foundation to support E&S experts in the PIU (with obtaining data, specific expertise and information, etc.) and facilitate communication on E&S issues between the Croatian Science Foundation and PIU. PIU E&S experts, other members of PIU, the Croatian Science Foundation E&S Focal Point and other project workers will receive a comprehensive ESF training from the World Bank within 30 days of their engagement. Capacity building will continue on an ongoing basis throughout the project implementation (by provision of comprehensive initial, and specific periodical focused E&S/ESF trainings). The Ministry of Science and Education will ensure that the Bank's environmental and social criteria for all activities, including Technical Assistance, are adequately applied throughout project implementation.

**79. Project environmental and social due diligence is based on a robust and comprehensive ESMF.** The ESMF was prepared to guide E&S management of project activities as sub-project locations and designs/activities under both components are not fully defined by Appraisal. ESMF is set out to address E&S risks and guide environmental due diligence of the sub-projects and other Project activities, including TA (under Component 1). E&S risks and potential impacts will be managed through screening procedures, assessment and resulting mitigation (aligned with requirements defined in WB EHSG and GIIP), as well as E&S review, monitoring, reporting and consultation procedures with clearly defined responsibilities, which are outlined in the Project's ESMF. The Project ESMF sets out clear guidelines and requirements on the preparation of activity-specific risk-proportional E&S instruments, such as simple E&S checklists and standard mitigation measures for low-risk subprojects and E&S Analysis and Management Plans (ESMPs) for infrastructure works. Other E&S instruments may be necessary such as Control list of Materials for small-scale R&S sub-projects, and Cultural Heritage Management Plans (CHMPs). Site/activity-specific instruments will be prepared during the Project implementation phase, and will be reviewed and approved by the WB, consulted and finalized in order to inform design (as relevant), and before bidding and contracting of works/activities. The ESMF includes an exclusion list that prohibits funding of non-eligible projects, including those on IFC exclusion list. Comprehensive screening procedures and instruments defined in the ESMF will further screen out substantial and high-risk activities, animal testing, purchase of large amounts of chemicals, collection and use of human and animal tissue, activities with significant risk to biodiversity and CH, the involuntary acquisition of land, restrictions in access or displacement, and other, as relevant.

**80. The Project is also informed and guided by a Stakeholder Engagement Plan (SEP).** The SEP includes a stakeholder mapping and strategies for engagement for stakeholders across all three types of project activities (institutional strengthening, infrastructure, and R&D grants) in order to build interest, uptake, capacity, and enhance outcomes, while ensuring that stakeholders are able to: (i) adequately inform planning, priority setting, and delivery mechanisms; and (ii)



raise risks and concerns in timely ways to influence design and interventions that affect them. Key stakeholders include: relevant government agencies; universities/research/academic institutions; communities where R&D or works are carried out; private entities that are represented in clusters, platforms or associations with particular interest in green and digital economies/solutions; and civil society organizations involved in environmental, green economy and digital technology policies and R&D or representing vulnerable groups who could benefit from or be affected by these technologies. The SEP builds from the existing engagement mechanisms already employed by the Ministry of Science and Education with the R&D community, complementing and tailoring these for the needs of the Project. The SEP includes procedures to ensure that vulnerable groups, populations or industries that could potentially be adversely impacted by the R&D projects supported, are identified and measures are taken, to the extent feasible and relevant, to ensure their inclusion within engagement strategies. The project's SEP also includes a GRM to register, respond and resolve complaints. The SEP will be implemented in coordination with other citizen engagement activities included within the project such as beneficiary feedback surveys and post-project assessments involving stakeholders in targeted locations.

**81. Prior to appraisal, the draft ESMF, including the LMPs, and the draft Stakeholder Engagement Plan (SEP) with a project-level Grievance Redress Mechanism (GRM) were prepared and disclosed on the Ministry of Science and Education website.** Appropriate stakeholder consultations, revisions and re-disclosure will take place prior to September 15, 2023, as set forth in the ESCP.

## V. GRIEVANCE REDRESS SERVICES

**82. Grievance Redress.** Communities and individuals who believe that they are adversely affected by a project supported by the World Bank may submit complaints to existing project-level grievance mechanisms or the Bank's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project-affected communities and individuals may submit complaints to the Bank's independent Accountability Mechanism (AM). The AM houses the Inspection Panel, which determines whether harm occurred, or could occur, as a result of Bank non-compliance with its policies and procedures, and the Dispute Resolution Service, which provides communities and borrowers with the opportunity to address complaints through dispute resolution. Complaints may be submitted to the AM at any time after concerns have been brought directly to the attention of Bank Management and after Management has been given an opportunity to respond. For information on how to submit complaints to the Bank's Grievance Redress Service (GRS), please visit <http://www.worldbank.org/GRS>. For information on how to submit complaints to the Bank's Accountability Mechanism, please visit <https://accountability.worldbank.org>.



## VI. KEY RISKS

**83. The overall risk to the project is moderate.** The overall risk rating is based on a balance between moderate risk related to sector strategies and policies, technical design, institutional capacity, political and governance, fiduciary, and environmental and social aspects low risk is identified related to macroeconomic and stakeholders.

**84. Sector strategies and policies, technical design, institutional capacity, and fiduciary risks are moderate.** The project supports relatively novel and challenging areas, including digital transformation, green transition, performance-based funding reform, linkages between private-sector and research institutions, selective research infrastructure projects requiring targeted identification, and M&E of research and innovation programs. The project also requires the delivery of financing solutions that aligned with broader programs in the country. The sectorial and technical design risks to achieving project objectives are mitigated by the increased global evidence about what works and the local experience through EU programs as well as the World Bank engagement, including through RAS and lending operations. The activities planned in the project were selected to be technically strong, strategically focused, and to be implemented with increased delivery capacity, mitigating the risks of achieving the objectives. An additional element of risk is that, in terms of institutional capacity, the Ministry of Science and Education shares the innovation policy agenda with the Ministry of Economy and Sustainable Development. Other institutions, such as the Ministry of Regional Development and EU Funds, Ministry of Finance, Croatian Science Foundation, and HAMAG-BICRO, actively participate in the governance structure. A lack of coordination between stakeholders may undermine the activities supported under the project and reduce their effectiveness. To mitigate this, the project will establish a Project Steering Committee involving relevant stakeholders responsible for innovation policy. The Committee will serve as a platform to encourage coordination and broader improvements in the research and innovation policy space. The project will also promote technical discussions across the institutions involved and with the private sector. The project's support to strengthen institutional capacity under component 1 will further mitigate the institutional capacity risk. Fiduciary risks are overall moderate as the Ministry of Science and Education has experience in implementing World Bank projects and understanding fiduciary risks. Financial management risk is moderate while procurement risk is substantial as the PIU has not been established yet and a procurement specialist has not been appointed. The PIU is reinforcing the technical team in the Ministry with capacity in coordination, procurement, financial management, M&E, and environmental and social aspects.

**85. Environmental and social risks are moderate.** Subcomponent 1.1 includes funding of grants for civil works of infrastructure improvement in selected research institutions. These centers may be equipped with upgraded research facilities, start-up incubators, co-working laboratories, research and development in the fields of information and communication technologies, artificial intelligence, and cyber security. The infrastructure to be financed under Component 1 will be selected to limit environmental and social impacts to mitigate this risk. The potential civil works in Component 2 include projects, through public and private sector grants, which may include individual microgrids, integrated transport, remote healthcare, or other innovative instruments or infrastructure. Consultants on environmental and social aspects will inform the PIU capacity to manage and limit these risks. The consultants will apply in each subproject a filter to assess for possible environmental and social impacts, exclusion lists, and as needed, request the design and implementation of appropriate instruments.

**86. Political and governance risks are moderate.** Although the 2024 general parliamentary, presidential, and EU parliament elections could impact the pace of project implementation, the current political environment in Croatia appears to be stable. With that in mind, the outstanding uncertainty related to elections warrants caution. The team will



coordinate closely with technical counterparts in the event of a change in leadership, but the commitment across the country on this agenda is perceived to be very strong.

**87. Macroeconomic and stakeholder risks are low.** Macroeconomic conditions are stable and Croatia has recently adhered to the euro and is working towards OECD accession. The project has support from key political actors and aligns with important reform priorities highlighted by the European Commission. Stakeholders across the country are deeply aligned on this work's importance in increasing productivity and competitiveness.



**VII. RESULTS FRAMEWORK AND MONITORING**

**Results Framework**

**COUNTRY: Croatia**

**Digital, Innovation, and Green Technology Project**

**Project Development Objectives(s)**

The project development objective is to advance research and innovation with a digital and green focus through enhancing institutional infrastructure and research performance of research organizations and firms.

**Project Development Objective Indicators**

<b>Indicator Name</b>	<b>PBC</b>	<b>Baseline</b>	<b>End Target</b>
<b>Enhance institutional infrastructure</b>			
Total value in Euros of programs benefiting from measures to advance institutional capacity (Number)		0.00	200,000,000.00
Total value in Euros of programs benefiting from measures to advance institutional capacity: digital (Number)		0.00	15,000,000.00
Total value in Euros of programs benefiting from measures to advance institutional capacity: green (Number)		0.00	15,000,000.00
Number of researchers using improved research infrastructure facilities (Number)		0.00	200.00
Total value in Euros of research and innovation programs complemented (Number)		0.00	10,000,000.00
<b>Enhance research performance of research organizations and firms</b>			
Total value in Euros of potential RDI projects from DIGIT beneficiaries (Number)		0.00	40,000,000.00



Indicator Name	PBC	Baseline	End Target
Total value in Euros of potential RDI projects from DIGIT beneficiaries (digital) (Number)		0.00	15,000,000.00
Total value in Euros of potential RDI projects from DIGIT beneficiaries (green) (Number)		0.00	15,000,000.00

**Intermediate Results Indicators by Components**

Indicator Name	PBC	Baseline	End Target
<b>Subcomponent 1.1 Strengthening the institutional infrastructure for research and innovation policy</b>			
Number of program applicants and beneficiaries supported (Number)		0.00	500.00
M&E unit within Ministry of Science and Education supported (Yes/No)		No	Yes
M&E Policy Analysis Unit workplan established (Yes/No)		No	Yes
Policy support unit within the Ministry of Science and Education dedicated to performance-based funding for research organizations established (Yes/No)		No	Yes
Number of research infrastructure projects completed with project support (Number)		0.00	2.00
<b>Subcomponent 1.2 Strengthening the effectiveness of research and innovation financing</b>			
Numbers of programs complemented (Number)		0.00	3.00
Number of firms supported with digital or green diagnostics (Number)		0.00	1,000.00
Number of female-led firms supported with digital or green diagnostics (Number)		0.00	200.00
Number of service providers trained for technology scouting		0.00	10.00





Indicator Name	PBC	Baseline	End Target
(Number)			
Number of firms supported by technology scouting (Number)		0.00	35.00
Number of research centers receiving grants for professionalization (Number)		0.00	15.00
<b>Subcomponent 2.1 Pre-commercial digital and green R&amp;D support</b>			
Number of beneficiaries of grants for pre-commercial R&D and Challenge Fund (Number)		0.00	70.00
Number of beneficiaries of grants for pre-commercial R&D and Challenge Fund, of which digital (Number)		0.00	50.00
Number of beneficiaries of grants for pre-commercial R&D and Challenge Fund, of which green (Number)		0.00	20.00
<b>Subcomponent 2.2 Synergies program</b>			
Number of beneficiaries of grants for Synergies program (Number)		0.00	15.00
Number of beneficiaries of grants for Synergies program with a focus on digital (Number)		0.00	4.00
Number of beneficiaries of grants for Synergies program with a focus on green (Number)		0.00	3.00
<b>Cross-cutting themes</b>			
Grievances addressed within the stipulated service standards (Percentage) (Percentage)		0.00	100.00
Total value in Euro of private capital mobilized for digital and green innovation financing (Number)		0.00	10,000,000.00
Number of consultations meetings organized (Number)		0.00	5.00
Share of beneficiaries who report satisfaction with the Project's engagement process (Percentage)		0.00	70.00
Percentage of female applicants for grants (Percentage)		23.00	30.00



**Monitoring & Evaluation Plan: PDO Indicators**

Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
Total value in Euros of programs benefiting from measures to advance institutional capacity	<p>The indicator measures the value of RDI funding in the portfolio of the Ministry of Science and Education that benefited from support for program design, M&amp;E, application support to strengthen the pipeline, and other forms of implementation support.</p> <p>The indicator represents the outcome of capacity building and technical assistance support for the design, implementation, and M&amp;E of research and innovation programs.</p>	Annual	Ministry of Science and Education collection of programs influenced by the institutional teams supported by project.	Reports	PIU
Total value in Euros of programs benefiting from measures to advance institutional capacity: digital	The indicator measures the amount of funding for programs supporting digital RDI, as described in calls for proposals, that benefited from support for program design, M&E, application support to strengthen the pipeline, and other forms of	Annual	Ministry of Science and Education collection of programs influenced by the institutional teams	Reports	PIU



	implementation support.		supported by project		
Total value in Euros of programs benefiting from measures to advance institutional capacity: green	The indicator measures the amount of funding for programs supporting green RDI, as described in calls for proposals, that benefited from support for program design, M&E , application support to strengthen the pipeline, and other forms of implementation support.	Annual	Ministry of Science and Education collection of programs influenced by the institutional teams supported by project	Reports	PIU
Number of researchers using improved research infrastructure facilities	The indicator measures the number of researchers using improved research infrastructure facilities funded through grants provided by the project.  The indicator refers to the use of research or technology infrastructure that is going to be built with the project’s support.	Annual	Ministry of Science and Education	Reports of research organizations supported with grants for infrastructure projects	PIU
Total value in Euros of research and innovation programs complemented	The indicator measures the value of research and innovation funding programs complemented. This refers to RDI support programs that have secured	Annual	Ministry of Science and Education amount of funding allocated	Reports	PIU



	<p>financing but are missing complementary elements that are key to enhancing their effectiveness, such as pre-screening applicants, professionalization of research centers, piloting new interventions, developing the innovation ecosystem, and supporting the peer review process.</p> <p>The indicator captures the influence/impact of the project’s complementarity activities on the effectiveness of research and innovation programs.</p>		<p>during the lifetime of project to programs complemented by applicable activities</p>		
<p>Total value in Euros of potential RDI projects from DIGIT beneficiaries</p>	<p>The indicator measures the value of of potential RDI projects from DIGIT beneficiaries.</p> <p>The indicator reflects unlocking opportunities for further financing. The indicator measures the value of pre-commercial RDI subprojects which have advanced their research as a result of project’s support under Component 2, and which might seek further</p>	<p>Annual</p>	<p>Ministry of Science and Education</p>	<p>Beneficiary surveys, questionnaires, or reports</p>	<p>PIU</p>



	funding to advance on the path towards commercialization.				
Total value in Euros of potential RDI projects from DIGIT beneficiaries (digital)	The indicator measures the value of potential RDI projects from DIGIT beneficiaries, tagged as digital.	Annual	Ministry of Science and Education	Beneficiary surveys, questionnaires or reports	PIU
Total value in Euros of potential RDI projects from DIGIT beneficiaries (green)	The indicator measures the value of potential RDI projects from DIGIT beneficiaries, tagged as green.	Annual	Ministry of Science and Education	Beneficiary surveys, questionnaires, or reports	PIU

**Monitoring & Evaluation Plan: Intermediate Results Indicators**

Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
Number of program applicants and beneficiaries supported	The indicator measures the number of applicants and beneficiaries receiving institutional support by project activities within the Ministry of Science and Education	Annual	Ministry of Science and Education	Reports	PIU
M&E unit within Ministry of Science and Education supported	The indicator measures whether the unit received expert inputs and trainings for capacity building in monitoring and evaluation of research and innovation	Annual	Ministry of Science and Education	Reports	PIU



	programs				
M&E Policy Analysis Unit workplan established	The indicator measures whether the M&E Policy Analysis Unit has established a workplan defining key processes and tasks of the Unit.	Annual	Ministry of Science and Education	Reports	PIU
Policy support unit within the Ministry of Science and Education dedicated to performance-based funding for research organizations established	The indicator measures whether the unit is operational and staffed with capacity to assess the quality of research and innovation plans, monitor their implementation and guide research organizations through this process	Annual	Ministry of Science and Education	Reports	PIU
Number of research infrastructure projects completed with project support	The indicator measures the number of research infrastructure projects completed during the project implementation period	Annual	Ministry of Science and Education	Reports	PIU
Numbers of programs complemented	The indicator measures the number of programs complemented through piloting new interventions, developing the innovation ecosystem, and supporting the peer review process.	Annual	Ministry of Science and Education	Reports	PIU
Number of firms supported with digital or green diagnostics	The indicator measures the number of unique users on diagnostic toolkits (one for	Annual	Ministry of Science and Education	Reports	PIU



	digital technologies and one for green technologies) to provide firms with immediate insights into their current technology adoption and areas for improvement.				
Number of female-led firms supported with digital or green diagnostics	The indicator measures the number of unique users on diagnostic toolkits (one for digital technologies and one for green technologies) that provide female-led firms with immediate insights into their current technology adoption and areas for improvement.	Annual	Ministry of Science and Education	Diagnostic tool usage demographics reports	PIU
Number of service providers trained for technology scouting	The indicator measures the number of service providers that completed training for technology scouting.	Annual	Ministry of Science and Education	Reports	PIU
Number of firms supported by technology scouting	The indicator measures the number of grants awarded for technology scouting services to firms to help define specific research needs and connect them to capacities in research organizations.	Annual	Ministry of Science and Education	Reports	PIU
Number of research centers receiving grants for professionalization	The indicator measures the number of research centers supported with grants to professionalize the	Annual	Ministry of Science and Education	Reports	PIU



	management of research infrastructure.				
Number of beneficiaries of grants for pre-commercial R&D and Challenge Fund	The indicator measures the number of entities awarded with pre-commercial applied R&D and of the Challenge program grants. This does not include only lead beneficiaries, but all the entities that are beneficiaries in the financed sub-project.	Annual	Ministry of Science and Education	Reports	PIU
Number of beneficiaries of grants for pre-commercial R&D and Challenge Fund, of which digital	The indicator measures the number of entities awarded with for pre-commercial applied R&D and of the Challenge program grants, tagged in applications to calls for proposals as digital.	Annual	Ministry of Science and Education	Reports	PIU
Number of beneficiaries of grants for pre-commercial R&D and Challenge Fund, of which green	The indicator measures the number of entities awarded with pre-commercial applied R&D and Challenge program grants, tagged in applications to calls for proposals as green.	Annual	Ministry of Science and Education	Reports	PIU
Number of beneficiaries of grants for Synergies program	The indicator measures the number entities awarded with grants from the Synergies program.	Annual	Ministry of Science and Education	Reports	PIU
Number of beneficiaries of grants for Synergies program with a focus on digital	The indicator measures the number of entities awarded with grants from the	Annual	Ministry of Science and Education	Reports	PIU





	Synergies program tagged as digital according to their application form.				
Number of beneficiaries of grants for Synergies program with a focus on green	The indicator measures the number of entities awarded with grants from the Synergies program tagged as green according to their application form.	Annual	Ministry of Science and Education	Reports	PIU
Grievances addressed within the stipulated service standards (Percentage)	The indicator measures the value of funding directly matched to (1) pre-commercial R&D, (2) Challenge program, and (3) Synergies program.	Annual	GRM reports	Reports	PIU
Total value in Euro of private capital mobilized for digital and green innovation financing	The indicator measures the value of funding directly matched to (1) pre-commercial R&D, (2) Challenge program, and (3) Synergies program.	Annual	Ministry of Science and Education	Reports	PIU
Number of consultations meetings organized	The indicator measures the number of stakeholder meetings organized to consult aspects of project implementation and provide feedback on actions how these have been improved based on feedback.	Annual	Ministry of Science and Education	Reports	PIU
Share of beneficiaries who report satisfaction with the Project's engagement process	The indicator measures the number of questionnaire or survey respondents (beneficiaries) that indicate	Annual	Reports	The project will conduct questionnaires and a citizens engagement survey on the	PIU



---

	they are satisfied or highly satisfied with the project's engagement process divided by the total number of respondents.			implementation of the project	
Percentage of female applicants for grants	The indicator measures the percentage of female applicants to research and innovation programs supported by the project's gender outreach activities.	Annual	Ministry of Science and Education	Reports	PIU

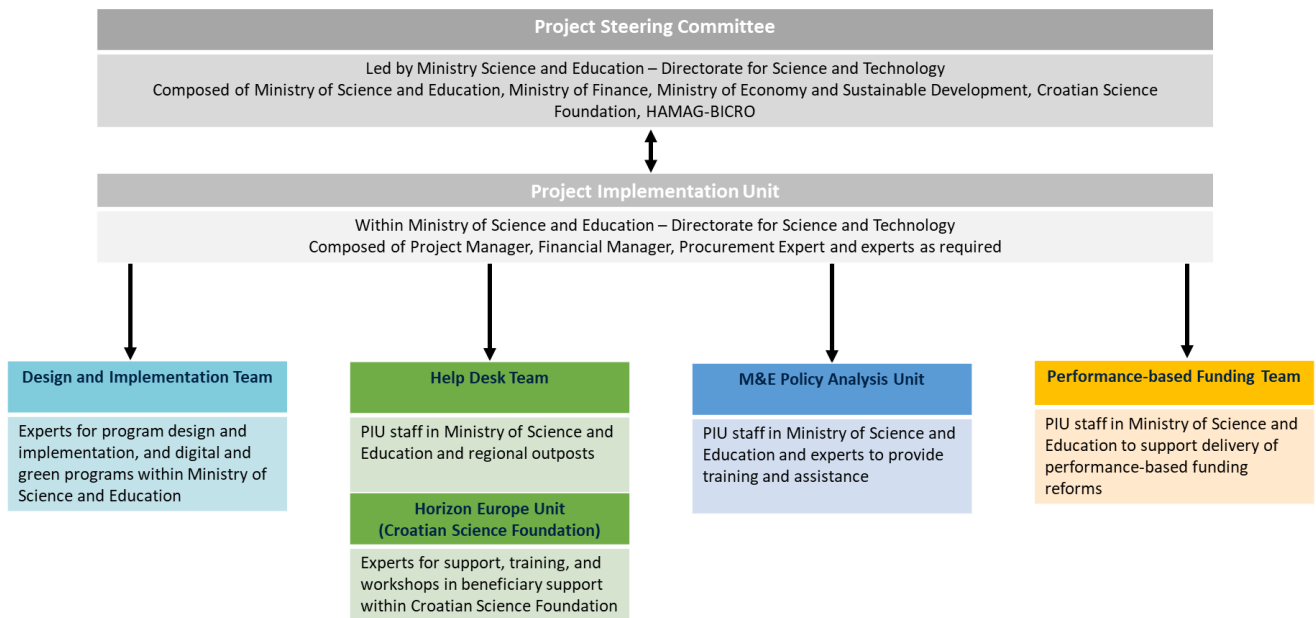


ANNEX 1: Implementation Arrangements and Support Plan

COUNTRY: Croatia
Digital, Innovation, and Green Technology Project

- 1. A Project Steering Committee (PSC) will be established to provide strategic guidance and inter-ministerial coordination. Figure 1-1 illustrates the structure of implementation arrangements. It will have representatives from the Ministry of Finance and Ministry of Science and Education, as well as other ministries and agencies involved in the green and digital agenda, such as the Ministry of Economy and Sustainable Development, the Croatian Science Foundation, the Croatian Agency for SMEs, Innovations and Investments (HAMAG-BICRO).
2. As a key policymaking and implementing body, the Ministry of Science and Education is expected to have a reasonable capacity to deliver effectively. The risk is relatively low, given the Ministry's experience implementing previous World Bank-financed projects (Science and Technology Project I and Science Technology Project II), including working with the Environmental and Social Framework (ESF).

Figure 1-1 Project implementation arrangements and PIU structure



- 3. A Project Implementation Unit (PIU) will be appointed in the Ministry of Science and Education to support project coordination and implementation. The PIU will be established prior to project's effectiveness and will consist of a project management team and five implementation support teams. The project management team will be located in the Ministry of Science and Education, in the Directorate for Science and Technology. The project management team will lead day-to-day project implementation, undertake fiduciary responsibility such as financial management and procurement, monitor project progress, conduct monitoring and evaluation, ensure compliance with project social and environmental standards, prepare project reports, and coordinate and collect inputs from the relevant ministries and stakeholders. The project management team will include a project



manager, procurement specialist, a financial management specialist, and may include additional experts for monitoring and evaluation, communication and citizen engagement, and environmental and social issues. Another five implementation support teams, comprising PIU staff and experts as required, will be responsible for the implementation of Component 1:

- *Design and Implementation team*, providing technical expertise to strengthen the capacity of the Ministry of Science and Education and the Croatian Science Foundation to design research and innovation programs through on-the-job training and capacity building,
- *Help Desk team*, providing technical expertise to deploy services to prospective applicants of RDI programs related to project pre-screening, application and implementation support, workshops and training, informing stakeholders of available funding opportunities, outreach, and consultations to inform program design,
- *Horizon Europe Unit team*, providing technical assistance to reorganize the Horizon Europe Support Unit within the Croatian Science Foundation as well as resources to enhance communication and outreach to potential applicants,
- *M&E Policy Analysis Unit team*, providing technical assistance to support the Ministry of Science and Education as well as to develop analytical and M&E capacities, and
- *Performance-based Funding team*, providing technical expertise to enable a high-quality review of research organizations' programs and implementation monitoring.

**4. The Croatian Science Foundation will support implementation in specific areas under Component 2 that do not involve financial management and procurement responsibility.** The Ministry of Science and Education and the Croatian Science Foundation will sign an implementation agreement which define the responsibilities of the Croatian Science Foundation's scope of support, which shall be limited to implementation support under Component 2 and shall not involve any financial management and procurement responsibility. The Croatian Science Foundation's role may include publishing calls for proposals, conducting the selection process of subprojects, monitoring of subproject implementation progress, and similar tasks.

**5. The following includes additional details on project components, including suggested selection filters, processes, and other implementation arrangements and considerations.** The components description is followed by Table 1-2, which summarizes the selection filters that will be applied to the different groups of beneficiaries within the project, and Table 1-3, which provides additional details on allocations and implementing teams across all project sub-components.

#### **Component 1 Enabling institutional conditions for digital and green research and innovation**

**6. Component 1 aims to foster enabling conditions for digital and green research and innovation by strengthening institutional capacities and bolstering the effectiveness of EU funds.** Institutional capacities are a critical bottleneck in the Croatian national innovation system. The Ministry of Science and Education and other relevant stakeholders require support to ensure that programs are designed and implemented to a high standard, applicants and beneficiaries receive high-quality services, research organizations have an appropriate incentive structure to strive for research excellence, and state-of-the-art facilities support research. At the same time, the



component provides complementary investments to increase the quality of RDI interventions and improve the overall conditions for research and innovation.

**Subcomponent 1.1 Strengthening the institutional infrastructure for research and innovation policy**

**7. Subcomponent 1.1 aims to improve the institutional capabilities and infrastructure for RDI.** The activities under this sub-component will upgrade and strengthen the Ministry of Science and Education’s ability to deliver on the green and digital mandates and other relevant strategic agendas and improve research excellence. This capacity support will include improving the Ministry of Science and Education’s and Croatian Science Foundation’s expertise in program design, M&E, thematic considerations, and other areas. Funding for critical research and technology infrastructure projects will address financing gaps, create incentives for public research organizations to implement reforms, improve general conditions for digital and green research, and help bridge the gap between research and the private sector. Financing under this subcomponent will build on the findings of the ongoing RAS Strategic Partnership for Research, Innovation and Growth. The RAS seeks to support institutional capacities for policy design and implementation and additional upgrades to Croatia’s RDI framework, such as a revamped technology transfer system, analyses of research infrastructure investments, and assistance in defining models for performance-based funding of public research. Where possible, the project will link and coordinate with other initiatives on expanding evidence-based policymaking, including World Bank work in the region on impact evaluations.

***Activity A. Capacity development for design, implementation, and M&E of research and innovation programs (EUR 3 million)***

**8. This activity addresses knowledge, coordination, and resource gaps by providing technical assistance for designing, implementing, monitoring, and evaluating research and innovation programs.** First, the activity will provide capacity building to deliver digital and green innovation support programs in full. Second, the activity addresses gaps in institutional support for applicants and beneficiaries to increase the quality and implementation of research proposals. Third, the activity will provide funding and technical assistance to the Ministry of Science and Education to improve M&E operational procedures and incorporate good data collection and analytics practices that the Ministry can use to monitor and adjust its support portfolio.

**i. Providing expertise for the design and implementation of digital and green programs**

**9. This activity will increase Croatia’s institutional capacity to deliver programs for the digital and green agendas.** Although the Ministry of Science and Education has considerable expertise within the R&D support framework, there is a need to further these capacities, especially as they relate to novel instruments and the digital and green agenda. This activity will provide technical expertise to strengthen the capacity of the Ministry of Science and Education and the Croatian Science Foundation to design research and innovation programs through on-the-job training and capacity building. The technical experts that form the program design and implementation team will be part of the PIU. This PIU composition will allow flexibility to engage experts of different profiles as needed. Specifically, the PIU will include experts in program design, implementation, financing of digital and green research and innovation, state aid, and similar areas.



ii. Setting up institutional support for applicants and beneficiaries of various research and innovation programs

**10. This activity addresses gaps in institutional support for applicants and beneficiaries to increase the quality of research proposals.** In the past, policymakers experienced high volumes of stakeholder inquiries related to applications, selection processes, and implementation conditions. The absence of a customer-facing team (help desk) dedicated to responding to these queries strained administrative resources and left stakeholders often unsatisfied. Furthermore, many applicants and beneficiaries were challenged in preparing and delivering their projects. It is worth noting that much of this difficulty arises from the administrative complexity of EU-funded support instruments, which follow external regulations outside the authority and control of the Ministry of Science and Education.

**11. This activity will improve the capacity of the Ministry of Science and Education to assist program applicants and beneficiaries.** As such, the activity addresses gaps in institutional support for applicants and beneficiaries, thus helping to improve the quality of research proposals. The activity consists of two elements:

- (a) Establishing and building the capacities (for examples, through trainings, workshops, knowledge transfers, and strategic guidance) of a help desk within the Ministry to support applicants and beneficiaries of national RDI support programs, and
- (b) strengthening the capacity of the Croatian Horizon Europe support unit.

**12. The project will provide technical assistance to establish and operate a new national RDI help desk to support prospective RDI funding applicants.**<sup>53</sup> The national RDI help desk team will consist of a help desk coordinator located centrally in the PIU and staff in regional RDI hubs throughout Croatia.<sup>54</sup> The help desk team will connect stakeholders with the Ministry to understand regional and local RDI capabilities and needs, actively support stakeholders to raise the quality of their project proposals, and steer them toward available funding opportunities. It is expected that the capacity built under this activity will contribute to strengthening the quality of the applications that will be submitted for financing under the Ministry of Science and Education program mix. The help desk team will provide services to prospective applicants of RDI programs, including:

- (a) project pre-screening, application and implementation support (for example, query and comment resolution, open days for one-on-one consultations, or project partner matchmaking),
- (b) workshops and training (for example, project proposal writing, updates on procedural requirements, project procurement, formulating project objectives and results frameworks, or finding project partners),
- (c) informing stakeholders of available funding opportunities and steering them toward available resources through direct consulting and information campaigns, and
- (d) stakeholder outreach and consultations related to program design, collecting feedback during and after implementation, roundtables, focus groups, and similar topics.

---

<sup>53</sup> Sustainability of the help desk will be ensured by the Ministry of Science and Education, who has expressed their dedication to long-term support for program applicants and beneficiaries, as initially noted in the PER in STI.

<sup>54</sup> The activity will finance the salaries of contractual staff within the PIU and consultant fees.



**13. The Croatian Science foundation will receive technical assistance to increase their capacity to support potential applicants and beneficiaries of the Horizon program.** The Croatian Science Foundation will establish a Horizon Europe support unit to attract more applicants and provide them with enhanced services. The activity will provide technical assistance through external consultants to establish the unit and resources to enhance communication and outreach to potential applicants. The activity will also support the development of additional tools to attract more applicants and increase the quality of their proposals. These may include guidance on choosing relevant topics and types of action, advice on administrative procedures and contractual issues, training and assistance on proposal writing, distribution of documentation (such as forms, guidelines, and manuals), and assistance in partner searching. Forms of support may include online platforms, proposal-writing clinics, telephone support, and helpdesks.

iii. Supporting a unit that advances M&E through data collection and analytics

**14. This activity will provide technical assistance to strengthen Croatia’s capacities to collect, analyze and use data to improve RDI support.** The support includes developing tools, practices, procedures, training, and workshops that enable a comprehensive and integrated monitoring and evaluation system for the NRRP, Multiannual Financial Framework 2021–2027, and national budget funding. The mechanisms supported by this activity will also enhance data management practices to assist Croatia in achieving compliance with OECD practices for data access and sharing related to public RDI support programs. The S3 2029, which should be formally adopted by June 2023, envisages providing analytical and technical support to the actors in the system responsible for smart specialization. However, capacity building and resources are needed to develop the capacities and operations. The Ministry of Science and Education will require its own capacity building to properly conduct S3 M&E functions. Moreover, the scale of the Ministry of Science and Education policy mix will necessitate ample resources to ensure program impacts are sufficiently tracked and evaluated in real time and after program implementation. As such, through the PIU this activity will support the existing M&E body in the Ministry of Science and Education to expand it into a self-sustained M&E Policy Analysis Unit during the project’s duration. The PIU will include a team with strong analytical and M&E expertise to support the M&E Policy Analysis Unit to:

- (a) expand their mandate, work program, and establish critical processes,
- (b) build a real-time analytical and monitoring mechanism at the level of individual calls for proposals, programs, and program portfolio to signal the need for improvements in program design and management (for example, analyzing the characteristics of applicants, applicant satisfaction, process monitoring, or organizing focus groups with beneficiaries on implementation issues),
- (c) define essential analytical products and functions, including building capacity for routine replication of PER in STI modules by line ministries, implementing and analyzing surveys,
- (d) raise its capacity for designing and supporting the implementation of counterfactual impact evaluations through trainings, workshops, and knowledge transfers.<sup>55</sup>

---

<sup>55</sup> Where possible, the project will seek to build synergies with advisory projects and other external financing to, for example, cover the implementation cost of surveys and impact evaluations.



***Activity B. Institutional support for performance-based funding reform in public research organizations (EUR 2 million)***

**15. This activity will facilitate the implementation of performance-based funding in research organizations.**<sup>56</sup> The successful implementation of the performance-based funding reform envisaged in the NRRP requires significant human and financial resources. Public research organizations will need guidance and support to formulate their research and innovation plans, which will form the basis for the funding agreement with the Ministry of Science and Education. The Ministry will, in turn, have to set up a system to assess the quality of research and innovation plans, monitor their implementation, and guide research organizations through the process. The Ministry's capacity to implement such funding is strong from a strategic perspective but lacking from an operational perspective; the support provided under this Component will help address these limitations.

**16. The activity will provide technical assistance to establish and operate a policy support unit for performance-based funding of research organizations.** The policy support unit will assist the Ministry of Science and Education with setting up a quality control system to assess research organizations' plans and strengthen the capacity of the Ministry to monitor their implementation successfully. The unit will also act as a contact point for research organizations for clarifications and guidance on preparing their research and innovation plans. The policy support unit will include full-time staff for day-to-day operations and external experts that may be engaged as needed for the review process, as such the activity will finance the unit's incremental operating costs and consultants' fees.

***Activity C. Financing selected research and technology infrastructure projects (EUR 51 million)***

**17. This activity seeks to improve the conditions for advanced digital and green research and support the ongoing reform of performance-based funding in public research organizations.** The grant financing will address gaps and challenges related to the availability of quality equipment and access to infrastructure necessary to propel research excellence, focusing on advancing digital transformation and the green transition of the economy. The investment will also support the ongoing reform of performance-based funding of research organizations by targeting public research organizations that sign performance-based funding agreements, with digital and green research acting as an additional filter. Targeting public research organizations in this way will incentivize them to move toward a performance-based funding model.

**18. This activity will finance sub-grants to research organizations for new research and technology infrastructure projects.** The Ministry has identified a long list of pipeline research and technology infrastructure projects. Some of them have already been supported to develop the necessary technical documentation. The selection process for funding infrastructure projects will consider a set of non-exclusive criteria, including contribution to digital transformation and the green transition, potential for public-private collaboration, performance-based funding reform, lagging region development, and similar factors. Project selection will also involve consultations with academia, civil society, and the private sector. All works financed under this component will meet Leadership in Energy and Environmental Design (LEED) sustainability standards and, as such, support both climate adaptation and mitigation, including high standards of energy efficiency. Selected projects will also

---

<sup>56</sup> The performance-based funding reform is a legal obligation of the Ministry of Science and Education as well as of public research organizations affected by the reform. As such, the sustainability of the activity will be ensured by the continuation of the regulation's application.





meet social sustainability standards. Some examples of potential sub-projects to be financed are discussed below; these include a scientific center for electrical engineering and computing, a center for digitalization and greening in the maritime industry, and a STEM center (Box 1-1).

*Box 1-1 Examples of possible research infrastructure projects supporting digitalization and greening*

**Infrastructure for digital research**

The center’s research mandate will be based on the needs of the private sector, focusing on energy and transport. Research areas include advanced power technologies and systems, industrial systems, robotics, and high-performance computing. The center would be equipped with upgraded research facilities, a start-up incubator, co-working laboratories, expanded skills development capabilities, and the ability to further popularize ICT through education workshops and training for the public.

**Infrastructure for digital and green research and innovation in the maritime industry**

The infrastructure can serve as an innovation hub for key enabling digital technologies and private-public research cooperation. The facility will enable research, innovation, and collaboration between research organizations and enterprises on developing advanced green and digital maritime solutions.

**Infrastructure for industry-science collaboration and science popularization**

The infrastructure is envisaged as a research infrastructure where research organizations and firms may interact with each other, test and prototype their inventions, and present their findings to the public through showcases, competitions, and interactive learning. Students and graduates will have the chance to interact with researchers from different fields, work on experimental development projects, cooperate with colleagues from other faculties, and possibly collaborate to start their own innovative firms. The infrastructure will also serve as a STEM popularization venue, where research organizations host workshops and demonstration exhibits for primary and secondary school pupils and educators to modernize science classes and encourage students to continue their education in STEM fields.

**Subcomponent 1.2 Strengthening the effectiveness of research and innovation financing**

**19. Subcomponent 1.2 provides complementary resources to enhance the effectiveness of research and innovation financing.** Activities aim to support policies and program management aspects necessary to boost the impact of EU funds for research and innovation, thus amplifying the effect of the current support. (See Annex 2 for details.). These include soft support services for applicants, piloting new interventions, and supporting the peer review process. Additionally, the subcomponent will provide pre-screening toolkits for digital and green diagnostics and technology scouting services to match business needs with technological possibilities at research organizations. These services will complement and improve the effectiveness of EU-funded investments in digital transformation and green transition. Finally, support will be provided to professionalize research centers, many of which were created through EU funds, to improve their business orientation and operational and management capacities.

**Activity A. Funding to enhance the effectiveness of the RDI program mix (EUR 2.5 million)**

**20. This activity provides complementary support to EU-financed programs and interventions.** Although EU funds are the largest source of research and innovation funding, their spending has certain limitations. These include complex application and selection procedures, a lack of soft support for developing RDI projects, and a lack of funding for pilot interventions. Together, they translate into a shortage of well-developed projects. The



activity will provide complementary financing for the effective implementation of research and innovation programs (Table 1-1). The funding may be used in one or more of the following ways:

- (a) *Supporting the peer review process (technical assistance)*—Access to high-quality peer reviewers has been a bottleneck in implementing the project selection process, leading to significant delays. The support would focus on improving the efficiency and speed of project selection procedures by providing funding to organize pools of experts in different research areas. The activity will provide advisory support for setting up an efficient peer review process and funding for experts to receive fair remuneration and be engaged on review tasks much faster. Additionally, this activity will provide a demonstration effect to show that a better peer review process aligns with better overall project selection; as such, this activity will help to showcase the usefulness of an improved peer review process.
- (b) *Developing the innovation support ecosystem (outcome-based payment)*—Business support organizations and technology transfer offices can provide essential services for the functioning of the innovation support ecosystem. They can, for example, provide innovation advisory services, assist with market validation, help with developing a business plan, or help with fundraising. Financing for such services in Croatia is scarce. This activity provides funding to motivate the innovation support ecosystem to provide more and better services to firms and researchers and simultaneously enhance the program mix's effectiveness. For example, business support organizations and technology transfer offices can provide advisory services to firms and research organizations in developing an RDI project proposal. This activity would provide financing for an outcome-based payment awarded to business support organizations and technology transfer offices if the project proposal they helped to develop is successful. This arrangement provides a strong monetary incentive for the innovation support ecosystem to provide high-quality services and, at the same time, raises the quality of RDI projects. This activity can also finance specific advisory services of technology transfer offices, such as business validation and intellectual property protection.
- (c) *Piloting new interventions (sub-grants)* —There is no room for experimentation with new funding mechanisms or modalities in the current funding framework. This activity would provide funding to pilot and evaluate novel interventions that could then be scaled up through EU funding. A pilot can be implemented on a small scale to test the effectiveness and efficiency of a new policy intervention and identify possible side effects. The focus in designing and implementing the pilot intervention is on collecting data and feedback from beneficiaries, primarily to gather more information on intervention aspects associated with some degree of uncertainty, such as demand, appropriate targeting of beneficiaries, administrative capacities, or achievement of intended outcomes. For example, a pilot intervention could be in the form of a program to provide sub-grants to research organizations to cover engagement of outstanding researchers.



Table 1-1 Eligible expenditures under Part 1.2.A

Activity	Beneficiary	Eligible expenditures
<i>Supporting the peer review process</i>	Ministry of Science and Education	Consulting services
<i>Developing the innovation support ecosystem</i>	Business support institutions and technology transfer offices	Outcome-based payment
<i>Piloting new interventions</i>	Research organizations, firms	Sub-grants for research and innovation projects, covering labor costs, materials, equipment, and external services

**Activity B. Online diagnostic and technology scouting (EUR 2.5 million)**

**21. By financing diagnostic pre-screening toolkits and technology scouting, this activity will address firms’ difficulties in correctly identifying technology needs and solutions.** This activity will finance (a) the development and distribution of two online diagnostic pre-screening toolkits (one for green technology and one for digital technology) and (b) technical assistance to develop technology scouting services and sub-grants for technology scouting and R&D activities to match business needs with technological capabilities at Croatian research organizations.

**22. The online diagnostics will address information asymmetries and knowledge gaps of firms related to digital and green technology.** The diagnostic pre-screening toolkits are envisaged for a broad audience of firms as the first step in understanding their level of digital and green technology adoption relative to their peers. The firm would fill out a questionnaire, and the toolkit would indicate general areas of strength and weakness relative to other similar firms. As such, the toolkit may reflect the beneficiaries’ technology readiness compared to peers, with a view to inducing behavioral changes toward digital and green technology adoption. It will also allow firms to be better prepared to seek financing to upgrade their technological, procedural, organizational, and human capacities. At the same time, the Government of Croatia will be able to use the combined data from users to improve the understanding of digital and green technology needs and provide targeted interventions to address common gaps. Box 1-2 reviews international experience in digital and green diagnostics, highlighting the importance of public support for such services.

*Box 1-2 International experience with green and digital diagnostic and advisory services*

**Public support for advisory services related to digital and green innovation in firms is available in developed economies, usually as vouchers and diagnostic toolkits.** An established approach to such instruments begins with an initial “diagnostic” stage in which an external expert or digital interface makes an assessment—often reliant on machine learning or artificial intelligence—of an issue that the firm has identified as being an impediment or of the whole firm and its performance. Then, an action plan is developed, and further advice can be provided to support the implementation of this plan. The advantage of this sequenced approach is that SMEs may misdiagnose their main problem, and an upfront assessment can promote the sensible prioritization of subsequent improvement activities. The following country examples are notable:



- **Singapore** has developed and deployed a comprehensive SME digitalization support framework.<sup>57</sup> More than 80,000 SMEs have adopted digital solutions, and 40 percent have reported increased revenue since receiving support. The process begins with digital diagnostic and advisory services—*CTO-as-a-service*. SMEs access an online platform to self-assess their digital readiness, identify their digitalization needs and gaps, and receive recommendations on digital solutions, including available institutional support. Firms can also access a shared pool of digital consultants for digital advisory and project management services. The digital advisory service covers digital needs analysis, digital solutions recommendations, basic cybersecurity risk advisory, and project management/implementation. First-time usage of the services is available at no cost to eligible SMEs.
- **New Zealand's Digital Boost** platform offers users accessible, straightforward, and comprehensive digital diagnostics and advisory services.<sup>58</sup> Firms can access an initial machine-learning-driven diagnostic tool that subsequently guides them through available public support services, directs them toward educational resources, and suggests a set of publicly funded applications and digital tools that can be integrated to improve productivity, collaboration, communication, and project management.
- **Spain's Aceler Pyme** operates a self-diagnosis tool.<sup>59</sup> The platform helps firms assess their digital maturity and identify areas of focus for transformation. This initial assessment is followed by articulating a digital transformation roadmap, monitored and evaluated by the digital self-diagnosis tool and supported by easier access to other public support instruments. In addition to digital diagnostic and digital transformation self-assessment modules, the platform also offers a cybersecurity self-assessment.
- The **Australian state of Tasmania** operates a one-stop online digital diagnostic toolkit.<sup>60</sup> The platform allows firms to enter their websites and other digital parameters and analyzes them using a machine-learning engine. Subsequently, a set of business advisory support options and pre-determined transition plans are available for firms to elect.

**23. The development of the toolkits will leverage existing World Bank work in this area.** The activity provides funding for developing and deploying one digital diagnostic toolkit and one green diagnostic toolkit (including vendors and consultants). The World Bank has already developed similar diagnostic benchmarking tools in other countries, using global data on technology adoption. The toolkits' development will consider experiences from the Firm-level Adoption of Technology (FAT) survey conducted in Croatia in 2023. Upon deployment, the activity will finance the promotion of the usage of the toolkits through outreach campaigns and advocacy through business support organizations. The Ministry of Science and Education would maintain and upgrade the toolkits beyond the project.<sup>61</sup> Both toolkits are expected to reach 1,000 firms over the project's lifetime. Outreach efforts will target female-owned businesses, for which research shows that technology upgrading effect is higher.

**24. The activity will also fund technology scouting to help foster industry-research linkages by matching innovation needs in the business sector with research capabilities and resources.** In contrast to the online diagnostic toolkits, which attempt to provide a general understanding of the level of technology adoption, the technology scouting activity provides a more targeted and tailored approach to firms that are developing technology solutions and may need external support to solve a specific problem. This activity will be an

<sup>57</sup> Infocomm Media Development Authority. 2022. Helping SMEs Go Digital.

<sup>58</sup> Government of New Zealand. 2022. Digital Boost. [https://digitalboost.business.govt.nz/s/?language=en\\_NZ](https://digitalboost.business.govt.nz/s/?language=en_NZ)

<sup>59</sup> Government of Spain. 2022. Aceler Pyme. <https://www.acelerapyme.gob.es/en/do-you-want-know-degree-digitization-your-sme>

<sup>60</sup> Tasmanian Government. 2022. Digital Ready – Digital Check-up. <https://checkup.digitalready.tas.gov.au/>

<sup>61</sup> This task may also be delegated to an implementation agency at a later stage.



opportunity to establish lasting channels of collaboration between research organizations and the private sector, increasing private sector use of existing research infrastructure.

**25. The activity will provide technical assistance to develop capacities for technology scouting on the Croatian market.** This includes training local consultants to provide technology scouting services. A communications campaign and call for expression of interest in training will garner a supply of consultants. Consultants selected for technology scouting will have previous experience working with firms on managing innovation projects and demonstrated familiarity with the capabilities of research organizations. Most of the trained consultants will be from the private sector. This will be the first phase in deploying the technology scouting service for beneficiaries.

**26. Following the establishment of domestic capacities for technology scouting, the activity will provide sub-grants to firms to receive technology scouting services and implement a small collaborative research activity.** The technology scouting services include: (1) helping firms define the innovation needed to improve their business, (2) actively seeking out available research capabilities that may meet these needs, (3) linking researchers with firms to work on developing the innovation, and (4) providing technical and business validation for the innovation in question. If the technology scouting is successful at providing the firm with a suitable research partner, the firm will be able to access additional funding to conduct a small-scale collaborative research project, such as proof of concept. Target beneficiaries are SMEs and midcaps developing new products, services, or processes.<sup>62</sup> The activity will generate evidence on the effectiveness of the intervention to inform a possible scale up from other funding sources.

**27. The activity covers gaps in EU funding related to diagnostic and technology scouting services necessary for the digitalization and green transition of firms.** Current EU funding does not envisage diagnostic pre-screening tools for either digital or green technology adoption. The digitalization voucher under the NRRP will support 110 SMEs with EUR 10,000 vouchers to prepare digitalization strategies or conduct other digitalization activities.<sup>63</sup> The absence of pre-screening diagnostics may impede firms from efficiently deploying digitalization and greening—a gap this activity will address. Additionally, spillovers from technology scouting services, such as early prototypes, may expand the pipeline of available projects and feed into programs fostering collaborative R&D projects between research organizations and enterprises and technology transfer.

***Activity C. Professionalization of research centers (EUR 5 million)***

**28. This activity will provide funding for sub-grants to public research organizations to engage individual consultants and outstanding researchers to improve public research centers' quality and business orientation.** The funding encourages more efficient usage of existing research infrastructure investments and collaboration with the private sector—private sector orientation of public research organizations is critical to professionalization. The funding will enable public research organizations to set up stronger research capacities and more professional management mechanisms, encouraging efforts to design and deliver services according to the specific needs of different stakeholders. The support provided under this activity is complementary to the

---

<sup>62</sup> Following the European Commission nomenclature, 'midcap' firms are those that employ between 250 and 3,000 employees.

<sup>63</sup> The instrument is expected to continue under ESIF financing, but besides digitalization strategies, it may also be used to develop e-commerce solutions.



technology scouting activity discussed above. It will help address non-financial and non-technological constraints to infrastructure usage, particularly by the private sector.

**29. Public research organizations will apply for financing based on submitted development plans.** Research organizations will prepare development plans for the research infrastructure that outline their objectives in responding to market demand in research, improving access to infrastructure by researchers and businesses, enhancing internal operational and management capacities, and improving climate adaptation and mitigation standards for the organization. Selected public research organizations will receive funding to hire eligible professional managers<sup>64</sup> and lab technicians (as individual consultants), as well as for external services to support the implementation of development plans (such as outreach activities, training, consulting services, and similar) and potentially to engage outstanding researchers. Certain material costs related to the beneficiary development plans may also be financed. The professional manager will operationalize the development plans of public research organizations and set demonstrable and measurable targets. Selection criteria will be defined in detail as part of the Project Operational Manual (POM). However, the criteria will include the quality of the development plan proposal (including how the organization will use the financing to improve quality, market orientation, and climate standards), the public research organization's track record, and their justification for hiring additional staff. The support is expected to reach 15–20 research centers.<sup>65</sup>

#### **Component 2 Programs for digital and green research and innovation (EUR 40 million)**

**30. This component provides sub-grants to accelerate the economy's digital transformation and green transition through research and innovation.** The financing addresses critical gaps in the current program mix that inhibit digital and green research and innovation. These gaps are reflected in the types of projects that can be financed and the design, implementation, and governance of the available instruments. The policy framework developed by Cirera et al. (2020), which provides evidence-based recommendations for addressing market and system failures that hold back innovation, informs the choice of instruments.<sup>66</sup>

**31. This financing will support the implementation of novel instruments through competitive grant programs.**<sup>67</sup> The instruments under this component will target more sophisticated beneficiaries engaged in innovation in digitalization and greening through innovative financing mechanisms such as competitive grants for pre-commercial R&D, challenge-based grants, and financing for Horizon Seal of Excellence recipients. The project will test novel instruments that can crowd in private capital and enhance the effectiveness of EU funding.<sup>68</sup> The

---

<sup>64</sup> Professional managers are persons with relevant education and appropriate experience for the management of research and technology infrastructure, including in strategic management, business development, and resource management.

<sup>65</sup> Internationally, research infrastructure management is becoming more prominent. For example, the Research Infrastructure Training Programme based in Austria is an EU-funded project aimed at improving and professionalizing the training of managerial and leadership staff in research infrastructure. The Research Infrastructure Training Programme offers executive education for research infrastructure management in recognition of the skills needed to respond to the specific management needs of scientific service providers. In Australia, the University of Queensland uses a Research Infrastructure Management System to help researchers access facilities and facilitate external and industry collaboration.

<sup>66</sup> *Practitioner's Guide to Innovation Policy*.

<sup>67</sup> Competitive grant means a grant for which the division solicits a call for proposals from eligible applicants, reviews the applications for eligibility and other criteria, and then convenes a grant review committee to recommend grant awards.

<sup>68</sup> One example of this is the Proof-of-Concept program, which was introduced as part of the World Bank's STP II. The program finances prototyping, testing, and technology validation and was the first of its kind in Croatia. After STP II was closed, the program continued to be



Croatian Science Foundation will provide implementation support for the component as described under Section III of the Project Appraisal Document.

### **Subcomponent 2.1. Pre-commercial digital and green R&D support**

#### ***Activity A. Grants for pre-commercial digital and green R&D (EUR 10 million)***

**32. The instrument will exclusively target research and innovation of green and digital solutions for which public funding would otherwise be unavailable.** Croatian strategic documents, particularly the S3 2029, emphasize the importance of innovations in enabling economic performance and their potential to tackle ongoing issues such as subpar productivity performance. The strategic framework also recognizes national and supranational societal challenges and the current global outlook, especially concerning pollution and climate change mitigation. To a large extent, the current program mix that targets the private sector is geared toward commercializing R&D results. Some instruments providing grants for pre-commercial research stages are in place (for example, Proof-of-Concept grants), but they do not specifically target digital and green R&D innovation. The ambition regarding digital transition and green transformation introduced in the strategic framework needs to be backed by an appropriate funding allocation to mitigate the risk that promising green and digital innovation projects remain unfunded.

**33. Grants or matching grants will directly support pre-commercial applied R&D related to green or digital innovation.** Grants of up to EUR 300,000 will target sub-projects conducted in cooperation between research organizations and firms for pre-commercial applied R&D.<sup>69</sup> The grants will focus exclusively on R&D projects for green and digital solutions in early technology readiness level (TRL) stages.<sup>70</sup> Given the high risk of failure of these stages, risk capital is limited; as such, public intervention is even more needed. The funding will target sub-projects that demonstrate the potential for inter-sectoral synergies (for example, interdisciplinary consortia) and those that address the green-digital intersect, potentially yielding heightened additionality. Examples could include applied research in energy storage, carbon capture systems, smart grid technologies, artificial intelligence, and machine learning in transportation, energy optimization through digitalization, big data in the management of agriculture and bioresources, blockchain in waste management, etc.

**34. The instrument will support early-stage applied research in digital or green technologies, products, and processes.** The main objective of these grants will be to develop transformative innovation and help unlock opportunities for early-stage, innovation-driven businesses that are still developing their products and defining their market niches. In this manner, beneficiaries will receive funding to minimize risks associated with pre-commercial R&D and strengthen their operations, facilitating their access to private financing for further growth. The instrument will support 30–35 subprojects, with roughly equal numbers of digital and green subprojects. Digital beneficiaries will need to demonstrate their capabilities and contribution to developing innovative digital technologies, products, and processes. Green beneficiaries will be required to demonstrate how their research

---

financed from national and EU funds. The implementation of the program through STP II provided valuable insight to policymakers on the demand for such a program, as well as implementation experience to continue the program in a demanding EU regulatory environment.

<sup>69</sup> Where firms are a partner beneficiary, successful projects will receive matching grants in proportions relative to those determined by state-aid regulations.

<sup>70</sup> Technology readiness levels (TRLs) can be used to estimate the maturity of an innovation, going from the lowest (TRL1) to highest (TRL9). The TRL scale was initially introduced to track the development of space technologies, so the original definitions of TRL stages may not be applicable to all innovation projects.



addresses a sustainability challenge (for example, energy efficiency or the circular economy) as part of the selection process. Ultimately, grant recipients for green projects will have to indicate how their research will contribute toward climate adaptation or mitigation.<sup>71</sup> Moreover, exclusion lists will be articulated in the Grant Operations Manual to ensure that funded research projects do not yield adverse impacts on the environment.

**35. By targeting digital and green R&D in low-TRL stages and raising their maturity, this instrument aims to unlock opportunities for scaling up projects through alternative financing sources.** Previous experience with STP II demonstrates that targeting low-TRL projects significantly increases the project pipeline. Overall, projects worth EUR 301 million were developed, of which over EUR 212 million were awarded financing from various EU programs.<sup>72</sup> The results from STP II are a solid pipeline for ongoing and future EU funds calls and constitute evidence that the project helped bridge the gap in financing R&D. If supported projects successfully generate their envisaged outcomes, they may achieve the appropriate development stage to receive further funding closer to the market and commercialization of the solutions developed. In addition, STP II concluded that research and innovation financing is sensitive to speed, flexibility, and competence of administrators to manage RDI support programs, whereas EU financing is more tailored for interventions that are stable and not affected by lengthy procedures.

**Activity B. Challenge program (EUR 15 million)**

**36. A grant program will be established to support creating solutions related to digitalization and green transition challenges.** The purpose of the grant Challenge program is to support the development of solutions to large-scale and complex challenges that require a mission-driven approach. The mission-driven approach entails setting an ambitious and inspirational target with wide societal relevance that catalyzes innovation across sectors and economic actors.<sup>73</sup> A mission-oriented project includes any new or improved technological, social, and organizational solution (product, process, or service) contributing to achieving the mission.

**37. The program will support innovative proposals from consortia of firms and research organizations that address specific digitalization and greening challenges.** The Ministry of Science and Education will set a specific challenge based on stakeholder consultations. The Challenge program is envisioned as technology and sector agnostic. However, it will seek complementarity with EU Missions under Horizon Europe, namely *Adaption to Climate Change, Restore our Ocean and Waters by 2030, 100 Climate Neutral and Smart Cities by 2030, and A Soil Deal for Europe*. The proposed challenge could be developing transformative, forward-looking solutions that will contribute to Croatia becoming climate neutral and resilient by 2050, or facilitating the digital transition of the economy (e.g., developing remote healthcare services).<sup>74</sup> Solutions may be proposed in any sector and must demonstrate their potential for transformative impact in achieving Croatia's digital transformation or transition to a climate-resilient, biodiversity-rich, environmentally sustainable, and climate-neutral economy.

**38. The Challenge program will provide grants or matching grants to support competitively selected consortia.** These consortia will be selected through a call for proposals over the project's lifetime. These consortia

---

<sup>71</sup> Digital sub-projects will be required to be at least climate-change or environmentally neutral and comply with the 'do no significant harm' standard; green sub-projects will comply with the EU's taxonomy for sustainable activities.

<sup>72</sup> World Bank. 2020. *Second Science and Technology Project. Implementation Completion and Results Report*.

<sup>73</sup> Mazzucato, Mariana. 2021. *Mission Economy: A Moonshot Guide to Changing Capitalism*. London: Allen Lane.

<sup>74</sup> The challenge is in line with the principles and objectives of the *Low Carbon Development Strategy of the Republic of Croatia Until 2030 with a View to 2050*.





will include firms and research organizations across different disciplines and sectors, and the private sector will contribute with matching funds and strong participation in governance. At least one private firm (or multiple firms) should be part of the consortia to reduce moral hazard and adverse selection risks and improve the chances of market access by the beneficiaries.<sup>75</sup> Consortia will provide a portion of the financing provided by this component. The selection filters will reward the amount invested by the private sector firm(s) that are co-sponsoring. The program will also encourage linkages to established international centers and a clear emphasis on creating public value and the potential commercial application of results through both member companies and the wider sector, including new technology-based businesses and other innovative firms.

**39. The instrument will cover the gap in funding for large-scale, multi-stakeholder projects.** The S3 2029 aligns with Croatia's and the EU's strategic frameworks, including those under Horizon Europe. It identifies seven priority areas in which Croatia plans to concentrate its innovation capacities and resources: (i) personalized health, (ii) smart and clean energy, (iii) smart and green transport, (iv) sustainable and circular food, (v) customized and integrated wood products, (vi) security and dual use, and (vii) digital products and processes. Each priority area identifies a transformational objective supported by a tailored policy mix. Some areas envisage using multi-stakeholder testbed pilots to develop various solutions (for example, remote healthcare, personalized medicine, or integrated transport solutions). Although some large-scale projects have received NRRP financing, most innovation pilot projects outlined in the S3 2029 priority areas remain unfunded.

### Subcomponent 2.2 Synergies program

#### *Activity: Synergies program (EUR 15 million)*

**40. This instrument will provide funding to support high-quality projects that have received Horizon Seals of Excellence.** A program will be established with grants and matching grants up to EUR 3 million for projects that received a Horizon 2020 or Horizon Europe Seal of Excellence.<sup>76,77</sup> The Seal of Excellence is a quality label awarded under the Horizon framework to projects that exceed all the evaluation thresholds but cannot be funded due to budgetary constraints.<sup>78</sup> Because the projects awarded the Seal already passed a rigorous selection process, the selection process can be simplified and expedited. The program will act as a pilot to demonstrate the potential impact of expanding financing opportunities for projects that receive the Horizon Seal of Excellence. By extending financing to R&D projects with the Seal, the program will complement existing Horizon programs, expand the net of beneficiaries, amplify the chances of funding cutting-edge domestic research and innovation, and create more

<sup>75</sup> Moral hazard is a situation where an economic actor has an incentive to increase its exposure to risk because it does not bear the full costs. Adverse selection occurs when one party in a negotiation has relevant information the other party lacks. The asymmetry of information often leads to making bad decisions, such as doing more business with less profitable or riskier market segments.

<sup>76</sup> The Seal of Excellence is awarded to proposals that apply under the following Horizon Europe programs: EIC Accelerator, EIC Transition (only individual SME applicants are eligible for Seal of Excellence), Marie Skłodowska-Curie actions (MSCA) postdoctoral fellowships, MSCA COFUND, Teaming, Horizon Europe Mission on Adaptation to Climate Change, and ERC Proof of Concept.

<sup>77</sup> Where a firm is a partner beneficiary, successful projects will receive matching grants in proportions relative to those determined by state-aid regulations.

<sup>78</sup> Proposals are evaluated and scored against award criteria set out in the call conditions for each Horizon program. The award criteria, scores, thresholds and weightings depend on each program and type of action. For example, the EIC acceleration program awards a Seal of Excellence to proposals that receive 13 out of 15 points. Generally, most programs evaluate the following quality parameters: project relevance, quality/implementation, and impact.



interest in this highly competitive program. The financing may also assist Croatia in achieving strategic outcomes relevant to the green transition (see Box 1-3).

*Box 1-3 Green research and innovation in Horizon 2020*

**Under the previous Horizon financial framework, significant funding was dedicated to projects that contribute towards climate mitigation and adaptation.** Between 2014 and 2020 roughly EUR 17.4 billion or 26% of all Horizon 2020 funds went to finance research in topics related to sustainable growth and development.<sup>79</sup> When other sustainability linked projects are included the overall share of ‘green’ research and innovation likely surpasses 50% of the EUR 68 billion envelope. Examples of Horizon funded projects across the EU, the likes of which may be funded under the Synergies program, include:

#### **Grow Green Project**

Grow Green Project aims to create climate and water resilient, healthy and livable cities by investing in nature-based solutions. Making nature part of the urban living environment improves quality of life for all citizens and will help business to prosper. High quality green spaces and waterways provide innovative and inspiring solutions to major urban challenges, such as flooding, heat stress, drought, poor air quality and unemployment and will help biodiversity to flourish. By embedding nature-based solutions in long term city planning, development and management, accessible green and blue spaces are a permanent feature of all urban areas around the world, creating harmony between people, economy and the environment, for the benefit of all.

#### **Data-driven sustainable agri-food value chains**

Agri-food value chains include many interlinked challenges which jeopardize their sustainability, including productivity pressures, environmental and social pressures, and skewed chain power. Data-driven technological advances have contributed to the growth of agricultural production, but can also have negative effects. The EU-funded Ploutos project brings together farmers, food industry companies, scientists, ICT specialists and policymakers to ensure that the value chain meets societal and environmental demands. The project developed a Sustainable Innovation Framework based on behavioral innovation, sustainable collaborative business model innovation and data-driven technology innovation. Innovations were validated in Sustainable Innovation Pilots across 13 countries, covering a range of agri-food ecosystems. The Ploutos Innovation Academy was established to support co-design and implementation, as well as to disseminate know-how and best practices.

#### **Landsupport**

The project aims at developing a web-based completely free, open-access GeoSpatial Decision Support System devoted to support sustainable agriculture and forestry; evaluate trade-off between land uses; contribute to the development and implementation of land use policies in Europe. To achieve this, Landsupport is developing 100 operational, trans-disciplinary GeoSpatial Decision Support System tools, based on a smart Geospatial CyberInfrastructure, to achieve a set of innovative scientific, technical and land policy-oriented specific objectives.

**Moreover, the current Horizon financial framework Horizon Europe 2021-2027 includes an expanded focus on sustainable and environmentally friendly research and innovation.** The reinforcement of green topics is propelled by Horizon’s emphasis on mission-oriented transformations through research and innovation. Of the five articulated missions, four relate directly to climate change adaptation and mitigation. Namely, the *Adaptation to Climate Change; Restore our Ocean and Waters by 2030; 100 Climate-Neutral and Smart Cities by 2030;* and, *A Soil Deal for Europe* will direct EU RDI funding for the coming several years. As a result it is reasonably foreseeable that the pool of Croatian Seals of Excellence recipients will have an increasingly green focus. Thus, the aspiration of the Synergies program is to ensure such reputable research and innovation projects do not go unfunded.

<sup>79</sup> European Commission. Horizon Dashboard.



**41. The instrument will fill a critical funding gap and benefit from merit-based selection procedures.** Horizon funding is notoriously challenging to obtain for research organizations and firms from new EU member states.<sup>80</sup> High-quality Croatian projects risk falling through the cracks without European or Croatian Seal of Excellence funds. The existence of a national Seal of Excellence scheme encourages applications to Horizon schemes because it signals to applicants that projects that meet Horizon quality standards will get another opportunity to be financed. Croatia has earmarked limited ESIF funding (EUR 22 million) to co-financing Horizon and Digital Europe beneficiaries. Because this funding will likely be only sufficient to cover Teaming schemes, the gap for Seal of Excellence projects is likely to remain unfilled. European peers such as Cyprus, Poland, and Slovenia have enacted nationally funded or created derivative EU-funded programs to support Seal of Excellence holders. Modalities of support often vary from funding commercialization to investing in managerial capacities. (See Box 1-4.) However, all programs benefit from simplified disbursement because the Seal of Excellence obviates the need for project evaluation. As a novel instrument with eased administrative procedures, the program may serve as a model for future domestic Seal of Excellence support programs.

*Box 1-4 Funding modalities for Seal of Excellence recipients*

**The Horizon 2020 SME Instrument offered funding for SMEs with ground-breaking concepts that could shape new markets or disrupt existing ones.** The funding included EUR 50,000 in Phase 1 to conduct R&D, assess the technical feasibility and commercial potential of an innovative idea, and develop it into a credible business plan for scaling it up. Phase 2 offered up to EUR 2.5 million in grants and EUR 15 million in equity to scale up the business. To fill gaps in Horizon 2020 funding and assure first-rate research and development are supported, several European countries have developed complementary instruments for Seal of Excellence project proposals. Because Seal of Excellence funding is optional, it is up to each country or region to establish schemes that are specifically dedicated to Seal of Excellence proposals and provide alternative funding, in compliance with national and European rules.

In **Cyprus** a Seal of Excellence fund was established to fund projects on a first-come, first-served basis. The maximum funding per project is EUR 50,000 for SME Instrument Phase 1 (concept and feasibility assessment) and EUR 700,000 for SME Instrument Phase 2 (innovation project). Overall, the various Seal support schemes implemented by the RIF approved 4 projects under SME Instrument Phase 1 and 6 projects under SME Instrument Phase 2.

The **Polish** Agency for Enterprise Development organized a series of workshops in November and December 2016 for Polish Seal of Excellence holders who submitted to Phase 1 of the SME Instrument. This scheme was developed under the innoLAB business advisory project, launched in partnership with the Polish Ministry of Economic Development.

Seal of Excellence holders for the Horizon SME 2020 Instrument in **Slovenia** were offered co-financing by the executive agency Spirit. Phase 1 Seal of Excellence holders were eligible for lump sum financing of EUR 35,000 to conduct feasibility studies for their projects. A total of 19 projects were supported with EUR 665,000 through four calls for proposals. Phase 2 Seal of Excellence holders were eligible for co-financing of the same eligible cost as in the Horizon 2020 scheme. A total of 13 projects were supported with EUR 14.2 million through three calls for proposals. A key feature of both programs was that there was not additional assessment of projects because the assessment already received under the Horizon 2020 scheme was deemed to be valid and appropriate.

Source: European Commission.

<sup>80</sup> European Commission. 2017. "In-depth Interim Evaluation of Horizon 2020." Brussels



Table 1-2: Indicative selection filters for support programs funded under DIGIT<sup>81</sup>

Activity	Tentative funding per project (EUR)	Indicative number of beneficiaries	Indicative Filters for Beneficiaries (to be further elaborated upon in the POM)
<b>Subcomponent 1.1: Strengthening the institutional infrastructure for research and innovation policy</b>			
Financing selected Research Infrastructure and Technology Projects	10–45 million	Up to 3 infrastructure projects	<p>The activity may seek to support projects pursuant to:</p> <ul style="list-style-type: none"> <li>• Evaluation of technical capabilities and needs</li> <li>• Scientific basis and contribution to development objectives</li> <li>• Contribution to digital transformation or green transition</li> <li>• Likely economic rate of return</li> <li>• Financial/technical feasibility, private sector participation, and stakeholder commitment</li> <li>• Alignment with performance-based agreement obligations (where relevant)</li> <li>• Contribution to the development of a lagging region</li> <li>• Potential social sustainability and impact on the population</li> <li>• Compliance with LEED sustainability standards and contributions to climate change adaptation or mitigation impacts</li> <li>• Impact on research job creation</li> <li>• Predicted or agreed-upon cooperation between research infrastructure and industry</li> </ul>
<b>Subcomponent 1.2: Strengthening the effectiveness of research and innovation financing</b>			
Funding to enhance the effectiveness of the RDI program mix (Possible interventions: <i>Supporting the peer review process; Developing the innovation support ecosystem; Piloting new interventions</i> )	Up to 200,000	10-200 projects	The funding under this activity may be used for technical assistance ( <i>Supporting the peer review process</i> ), outcome-based payments ( <i>Developing the innovation support ecosystem</i> ), or grants ( <i>Piloting new interventions</i> ). In case it is used for grants, the selection criteria will be determined based on the design of the pilot intervention.
Online digital and green diagnostic	N/A	1,000 firms	The tools will be online and free to the general public.

<sup>81</sup> Final selection criteria will be set out in the POM and determined by the PIU during project implementation.



Activity	Tentative funding per project (EUR)	Indicative number of beneficiaries	Indicative Filters for Beneficiaries (to be further elaborated upon in the POM)
tools			
Technology scouting grant	30,000-70,000	25–50 firms	<p>Grants will be distributed to firms to use for technology scouting services provided by pre-approved service providers, as well as to implement a small research project with a research organization. Grant approval may consider the following criteria:</p> <ul style="list-style-type: none"> <li>• The applicant has articulated a technology-scouting need</li> <li>• The applicant has identified an appropriate service provider</li> <li>• The proposed project is leading to product or process innovation, utilizing the expertise of research experts</li> <li>• The applicants have demonstrated the required co-financing of the project</li> </ul>
Professionalization of research centers	60,000-350,000	15–20 research centers	<p>Beneficiaries should present action plans that show how the support (hiring, training, or services) will improve productivity, performance, and market demand in research, access to infrastructure by researchers and by businesses, internal operational and management capacities, and climate adaptation and mitigation standards for the organization. The action plans may, at a minimum, cover:</p> <ul style="list-style-type: none"> <li>• The organization’s experience and qualifications</li> <li>• How the organization will use the support to address a key set of challenges</li> <li>• How addressing these challenges will improve productivity, performance, market demand in research, access to infrastructure by researchers and by businesses, internal operational and management capacities, and climate adaptation and mitigation standards</li> <li>• How these improvements will be measured (indicators)</li> <li>• Justification for hiring or training their staff</li> <li>• How the support’s impact will be sustained past the project activities</li> </ul>



Activity	Tentative funding per project (EUR)	Indicative number of beneficiaries	Indicative Filters for Beneficiaries (to be further elaborated upon in the POM)
<b>Subcomponent 2.1 Pre-commercial digital and green R&amp;D support</b>			
Grants for pre-commercial digital and green R&D	Up to 300,000	30–35 firms and research organizations	<ul style="list-style-type: none"> <li>Administrative compliance (including justification of research belonging in TRLs 1-5, legal compliance of beneficiary, etc.)</li> <li>Quality of research proposals (including potential for digital transformation and green transition, complementarity with strategic framework, linkages to other actors in the RDI ecosystem)</li> <li>Compliance with the exclusion criteria, namely that the project will not have a negative impact on the environment</li> </ul>
Challenge program	2–6 million	2–3 consortia	<ul style="list-style-type: none"> <li>Consortia should include at least two members and at least one research organization; participation of international consortia members is encouraged</li> <li>Quality of the proposed solution to the challenge (scientific basis and contribution to development objectives, impact on and compliance with mission/challenge, social sustainability and impact on population, etc.)</li> <li>Technical capabilities of consortia members</li> <li>Research and innovation performance of consortia members to date.</li> </ul>
<b>Subcomponent 2.2 Synergies program</b>			
Synergies program	50,000-3,000,000	15–20 projects	<ul style="list-style-type: none"> <li>Applicants must demonstrate that their project received the Horizon Seal of Excellence</li> <li>Seal of Excellence project preferably in a topic that is relevant to digital transformation or green transition</li> </ul>

Table 1-3: Additional Implementation Details – Expected allocation of resources/Implementing teams

Activity	Allocation (EUR million)	Beneficiaries	Type of support	Responsible
<b>Subcomponent 1.1: Strengthening the institutional infrastructure for research and innovation policy</b>				
Capacity development for design, implementation, and M&E of research and innovation programs	3	Ministry of Science and Education Croatian Science Foundation M&E Policy Analysis	Technical assistance	PIU Design and Implementation Team PIU Help Desk Team PIU Horizon Europe Unit



Activity	Allocation (EUR million)	Beneficiaries	Type of support	Responsible
		Unit RDI support applicants and beneficiaries		Support PIU M&E Policy Analysis Unit Team
<b>Institutional support for performance-based funding reform in public research organizations</b>	2	Ministry of Science and Education Public research organizations	Technical assistance	PIU performance-based funding team
<b>Financing selected research and technology infrastructure projects</b>	51	Research organizations and/or firms	Technical assistance and grants	Ministry of Science and Education
<b>Subcomponent 1.2: Strengthening the effectiveness of research and innovation financing</b>				
<b>Funding to enhance the effectiveness of the RDI program mix</b>	2.5	Ministry of Science and Education Business support organizations	Technical assistance and/or grants	Ministry of Science and Education
<b>Online diagnostic and technology scouting</b>	2.5	Firms (Research organizations via research contracting)	Technical assistance and matching grants	Ministry of Science and Education
<b>Professionalization of research centers</b>	5	Public research organizations	Grants	Ministry of Science and Education
<b>Subcomponent 2.1: Pre-commercial digital and green R&amp;D support</b>				
<b>Grants for pre-commercial digital and green R&amp;D</b>	10	Firms Research organizations	Matching grants and grants	Ministry of Science and Education
<b>Challenge program</b>	15	Public-private research consortia	Matching grants and grants	Ministry of Science and Education
<b>Subcomponent 2.1: Synergies program</b>				
<b>Synergies program</b>	15	Firms Research organizations	Matching grants and grants	Ministry of Science and Education



## Financial Management

**42. Financial Management Implementation Arrangements.** The project will use existing financial management systems available in the Ministry of Science and Education for project fiduciary purposes. Several strengths provide a basis for relying on this arrangement. They include (a) use of existing civil servants with adequate background and experience in financial management, (b) familiarity with World Bank–financed projects in the past, (c) familiarity with implementing projects financed by other donors, (d) ownership over the project by the Ministry of Science and Education.

**43. Planning and budgeting.** The project will finance items in the project procurement plan. There will be regular project budgeting and planning activities and monitoring of the execution of the plans and budgets. Counterpart funding is envisaged for the category of grants; hence, the financing percentages from the loan for that category will be lower than 100 percent.

**44. Accounting system.** The Ministry of Science and Education has used SAP as its accounting system since 2005. The system incorporates two main modules: a finance and accounting module and an inventory management module. The system also contains several integrated modules: general ledger, budget, fixed assets, and reporting. The project accounting records are organized by activity. Activities can fall under various expenditure categories, so each invoice shows the source of financing. The recording is done in EUR currency starting from January 1, 2023, using the Croatian state budget classifications (economic, functional, program, organizational, and locational). Payments are made using the Treasury SAP system. Regular backups in the cloud and on external disks are taken once a month and kept in a bank vault.

**45. Financial Reporting.** The Ministry of Science and Education will furnish to the World Bank the semi-annual IFRs not later than 45 days after the end of the reporting semester. The Ministry of Science and Education will prepare separate annual financial statements that include all project costs. The IFRs will be prepared on a cash basis. The IFRs, as well as the annual project financial statements, will include the following reports stated in the currency of the loan: (a) statement of sources and uses of funds, (b) uses of funds by category, (c) uses of funds by component, (d) statement of designated account (DA), and (e) explanatory notes and accounting policies (only annual audited project reports).

**46. Internal Controls and Internal Audit.** The Ministry of Science and Education has adequate internal controls for the project, including regular reconciliation of DA, adequate segregation of duties, and proper accounting policies and procedures.

- There will be regular reconciliations: SOE will be reconciled with the accounting data for every withdrawal application, monthly reconciliations of DA, and accounting data. Client connection disbursements will be performed. The Ministry of Science and Education will regularly reconcile project accounting records with beneficiaries' trial balances.
- The contracts are verified and approved by the Project Manager. The Financial Management Specialist and the Procurement Specialist will verify the financial provisions of complex contracts. Only the Procurement Specialist will verify standard contracts.
- The invoices will be verified for each Contractor who fills in on every invoice the reference number of the





related contract and the disbursement percentages applied for payments according to the loan agreement. The Financial Management Specialist will also sign every invoice to certify that they checked the accuracy of the financial data.

- Applications for withdrawal are authorized by persons determined by the Ministry of Finance, considering adequate segregation of duties.
- The Ministry of Science and Education will maintain a fixed asset register for project assets. The Ministry of Science and Education will keep records of the invoices related to purchases of assets paid from project funds and of the transfer protocol, if any.
- The Ministry of Science and Education established an internal audit department in early 2004. It comprises a few staff who received training under the EU CARDS project, “Development of PIFC and Internal Audit.” To the extent possible, the project will rely on the work done by internal audit.

**47. External Audit.** Project financial audits are to be carried out either by acceptable private sector auditors or by the country’s State Audit Office (SAO), which is also acceptable to the World Bank, under terms of reference acceptable to the Bank. The Ministry of Science and Education expressed their interest in engaging the SAO for conducting the project financial audit. To realize this, the Ministry of Science and Education needs to agree with the SAO. The annual audited project financial statements and the audit reports will be provided to the World Bank within six months of the end of each fiscal year.

**48. Disbursements and flow of funds.** Disbursements will use traditional disbursement methods such as advances, special commitments, direct payments, and reimbursements. For such category of expenses, the Ministry of Finance will open an analytical account in the State Treasury that will be used as a DA in line with the existing treasury procedures. The loan funds will flow from the World Bank through the Croatian National Bank to the DA and via the Treasury system and the Ministry of Science and Education to contractors based on approved invoices. The World Bank has assessed this approach and found it acceptable. The DA will be denominated in EUR currency. Expenses related to the disbursement of works, goods, consultancy, non-consultancy services, and incremental operating expenses will be documented using statements of expenditure. The funds for the small grants category will flow from the DA to the final beneficiaries based on the procedure described in the grants operations manual (GOM). The disbursements from the small grants category will be conditioned upon acceptance of the GOM by the World Bank’s team. The project Disbursement and Financial Information Letter will detail the ceiling, authorized allocation, and supporting documentation for disbursements.

**49. Retroactive financing.** No withdrawal shall be made for payments made before the date of the Loan Agreement, except withdrawals for payments made prior to this date but on or after January 1, 2023, up to an aggregate amount not to exceed EUR 1 million, for eligible expenditures excluding expenditures for sub-grants.

**50. Financial Management Conditions and Covenants.** The PIU will maintain a project financial management system acceptable to the World Bank. The project financial statements will be audited by independent auditors acceptable to the World Bank and on terms of reference acceptable to the World Bank. The PIU will provide annual audited statements and an audit report to the World Bank within six months of the end of each fiscal year. Semi-annual IFRs will be forwarded to the World Bank no later than 45 days after the end of each semester. There are no conditions for negotiations. The establishment of the PIU and POM are effectiveness conditions. The only disbursement condition for sub-grants relates to the adoption of the GOM by the Borrower, through the Ministry



of Science and Education, and the execution of the implementation agreement between the Ministry of Science and Education and the Croatian Science Foundation.

**51. *Implementation Support and Supervision Plan.*** During project implementation, the World Bank will supervise the project's financial management arrangements in two main ways. The first will be to review the project's interim unaudited financial reports, annual audited financial statements, and auditor's management recommendation letters. The second will be to perform on-site supervision with a frequency based on the assessed project's risk and performance and review the project's financial management and disbursement arrangements to ensure compliance with the World Bank's minimum requirements. The on-site supervision will include reviewing the following areas of the project's financial management: accounting and reporting, internal control procedures and external audits, planning and budgeting, funds flow, and staffing arrangements. A sample transactions review will also be conducted. The World Bank-accredited Senior Financial Management Specialist will perform implementation support and supervision. It is expected that the Financial Management Specialist will be granted access to all the necessary documents supporting the project transactions.

**52. *Use of country systems.*** Where feasible, the project will use elements of country's financial management systems available in the Ministry of Science and Education, such as staffing, planning and budgeting, internal controls (partially), and audits (possibly). In addition, the project will use the State Treasury system for holding a designated account.

## Procurement

**53. *Project Implementation Arrangements:*** The Project will be implemented by the Ministry of Science and Education through a PIU. The Ministry will be accountable for the execution of project activities, and implementation will rely on its existing structures, with the additional support of the PIU. The PIU, which will be housed within the Ministry of Science and Education and headed by a project manager, will be responsible for day-to-day project implementation, coordination and monitoring of project activities, safeguards, fiduciary functions, and reporting. The Project will finance contracts of various procurement categories, values, and complexity and grants. It is important that a Procurement Specialist be hired with general experience in procurement, preferably in managing procurement under projects financed by international financial institutions, as well as good knowledge of the English language. A POM (providing details about the overall project management processes and procedures) will be developed before Project Effectiveness and a GOM (defining, among other things, the procurement process for all activities financed from grants) before disbursement of the sub-grants.

**54. *Procurement Framework:*** The World Bank's procurement framework, effective as of July 1, 2016, will govern procurement under the Project. Procurement of contracts for goods, works, consulting, and non-consulting services financed from the Project will be carried out per the World Bank Procurement Regulations for Investment Project Financing (IPF) Borrowers—Procurement in IPF of Goods, Works, Non-Consulting and Consulting Services, (Regulations), Fourth Edition of November 2020. The World Bank's 'Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants' (revised as of July 1, 2016) (Anticorruption Guidelines) will apply to the project. National Procurement Procedure (NPP) is one of the options provided by the Procurement Regulations. Approaching the national market, the country's own



procurement procedures may be used according to the national public procurement framework. NPP may be applied for selected contracts under the various grants programs and subject to meeting the requirements of the Procurement Regulations. Based on value and nature of a contract, and where there is a need for international expertise for a specific assignment, international market approach might be more appropriate. In addition, in case any of the grant beneficiaries is not subject to the Croatian Public Procurement Law, the applicable Procurement Regulations provide for the option of Commercial practices (par 6.50). The specific acceptable commercial practices will be elaborated in the Grants' operations manual or the POM, as relevant.

**55. *Project Procurement Strategy for Development (PPSD):*** As required by the applicable procurement regulations, a PPSD prepared during Project preparation provides the basis for the procurement arrangements under the Project, including information on the risks for procurement and the proposed mitigation measures. The proposed procurement and review thresholds applicable to the Project shall align with the World Bank's most recent Thresholds for Procurement Approaches and Methods.

**56. *Procurement Documents:*** The Bank's Standard Procurement Documents (SPD) will be used as required by the Regulations. They are accessible at [www.worldbank.org/procurement](http://www.worldbank.org/procurement).

**57. *Use of Systematic Tracking of Exchanges in Procurement (STEP):*** The Project will use the World Bank's platform Systematic Tracking of Exchanges in Procurement (STEP) to plan, record, and track all procurement transactions subject to post and prior review under the Project. The tool will be used by the PIU initially to create and revise the Project's Procurement Plan, monitor performance, manage procurement procedures, and store related documentation for all steps in a procurement activity. The system will manage the exchange of information (such as bidding documents, bid evaluation reports, and no objections) between the implementing agencies and the World Bank.

**58. *Procurement Plan.*** A Procurement Plan covering the first 18 months of project implementation was developed during Project preparation and agreed during project negotiations. The Procurement Plan provides information on procurement packages, procurement approach and procurement procedures for each contract to be financed under the project. The Procurement Plan and all its updates will be posted through STEP on the Bank's external website. The Ministry of Science and Education will post the Procurement Plan and all its updates on its website. Given the demand-driven nature of the project, information on procurement planning under the relevant grants' programs will be elaborated during project implementation and when grant beneficiaries are selected. The PIU will be responsible to collect information on procurement as relevant from the beneficiaries of the various grant schemes under the Project components. The information on procurement will be collected in an excel table, compatible with STEP and the information will be uploaded in STEP for the records and monitoring purposes. The above referenced excel table is shared with the PIU.

**59. *Publication of procurement notices:*** The General Procurement Notice (GPN) and all procurement notices for contracts following the international market approach will be published in *United Nations Development Business* (UNDB) and on the World Bank's external website through STEP. Procurement notices for contracts following the national market approach will be published on the electronic system for public procurement, hosted by the official gazette—*Narodne novine*—on the Ministry of Science and Education website. As needed, they will also be published in national newspapers with a wide daily circulation.



**60. Procurement risk analysis:** Currently, there is no PIU in place, with the procurement function not being defined, nor is a procurement specialist available. The PIU will be established prior to the project's effectiveness. Based on the current limited capacity of the implementing agency for procurement, the risk rating for procurement is Substantial. This risk is subject to change based on review of the Implementing Agency's capacity for procurement and the status of addressing it through the proposed mitigation measures. The risk rating for procurement will be revisited after the first year of Project implementation. The procurement-specific risks, the proposed mitigating measures, and the risk owner are indicated in the PPSD.

**61. Frequency of procurement supervision and oversight:** Procurement implementation support missions will be carried out at least twice a year and on an as-needed basis. The procurement plan indicates the review arrangements for each contract to be financed from the loan proceeds. Contracts not subject to prior review by the World Bank, will be post-reviewed by the World Bank procurement specialist assigned to the Project. Post-review of contracts will be carried out once a year, with at least one out of five contracts being randomly selected for post-review.



## ANNEX 2: EU funding complementarity

**1. Croatia has gained access to EU funds, but they come with a steep learning curve—design and implementation have been challenging.** As of May 2022, Croatia disbursed over EUR 490 million in EU-funded grants to over 2,000 projects for the 2014–20 financial perspective. In the current perspective, the Ministry of Science and Education has planned approximately EUR 125 million in RDI support through the NRRP alone. Lessons from the previous financial perspective indicate the need for more strategic, efficient, and transparent RDI support program design. The implementation of ESIF funding places a significant burden on the public sector, applicants, and beneficiaries due to the demanding application process in ESIF-funded programs, a highly fragmented and complex selection process, significant delays due to difficulties in procuring expert reviewers, complexity and administrative burdens caused by the multitude of institutions involved in management and control, and the low efficiency of the selection and appeals processes. A study conducted by the European Parliament pointed to the regulatory and procedural complexity: ESIF reforms for 2014–20 added new rules and provisions that generated more difficulties with the implementation.<sup>82</sup> In the case of the NRRP, the ambitious timeframes and the limited room for adjustments in implementation could compromise the quality of the final results and increase the administrative pressure on the public sector and beneficiaries.

**2. DIGIT complements EU funds by raising institutional capacities and providing additional resources to enhance their effectiveness.** Given the expanded policy mix, Croatian policymakers face a pressing task. When paired with the Ministry of Science and Education’s ambitious reform efforts—such as the performance-based funding of research and restructuring of the Croatian Science Foundation—the tasks at hand will exert notable pressure on already overstretched institutional capacities. Activities planned under DIGIT seek to alleviate these pressures and build capacities to mitigate their reoccurrence. Capacity development for design, implementation, and M&E (Subcomponent 1.1) and funding to enhance the effectiveness of the program mix (Subcomponent 1.2) will provide targeted support to address outstanding challenges, bolster existing capacities where needed most, and test new approaches to policy. Additional technical and financial resources are also planned to complement the Ministry’s agenda. These include support for the implementation of the performance-based funding reform in research organizations as well funding to increase the internal capacities of research organizations as they implement tenants of the performance-based reform. Finally, investments in research infrastructure will provide a sound basis for future RDI while the diagnostic toolkit and technology scouting may—by raising the awareness of firms connecting the private sector with research—ensure that programs and research capacities are used more effectively.

**3. Additionally, DIGIT supports the achievement of targets under the NRRP.** Under DIGIT the Ministry of Science and Education will be assisted in achieving three core NRRP commitments (see Figure 2-1). Specifically, technical assistance implementing the performance-based funding reform may work towards attaining *C3.2.R1 (Reform and strengthening of the research and development capacities)*. The objective may be further propelled by investments in research and technology infrastructure, which may be contingent on adopting performance-based obligations in research organizations. Progress towards objectives *C3.2.R2 (Creating a Framework for attracting students and researchers to STEM and ICT fields)* and *C3.2.R3 (Improving the efficiency of public*

---

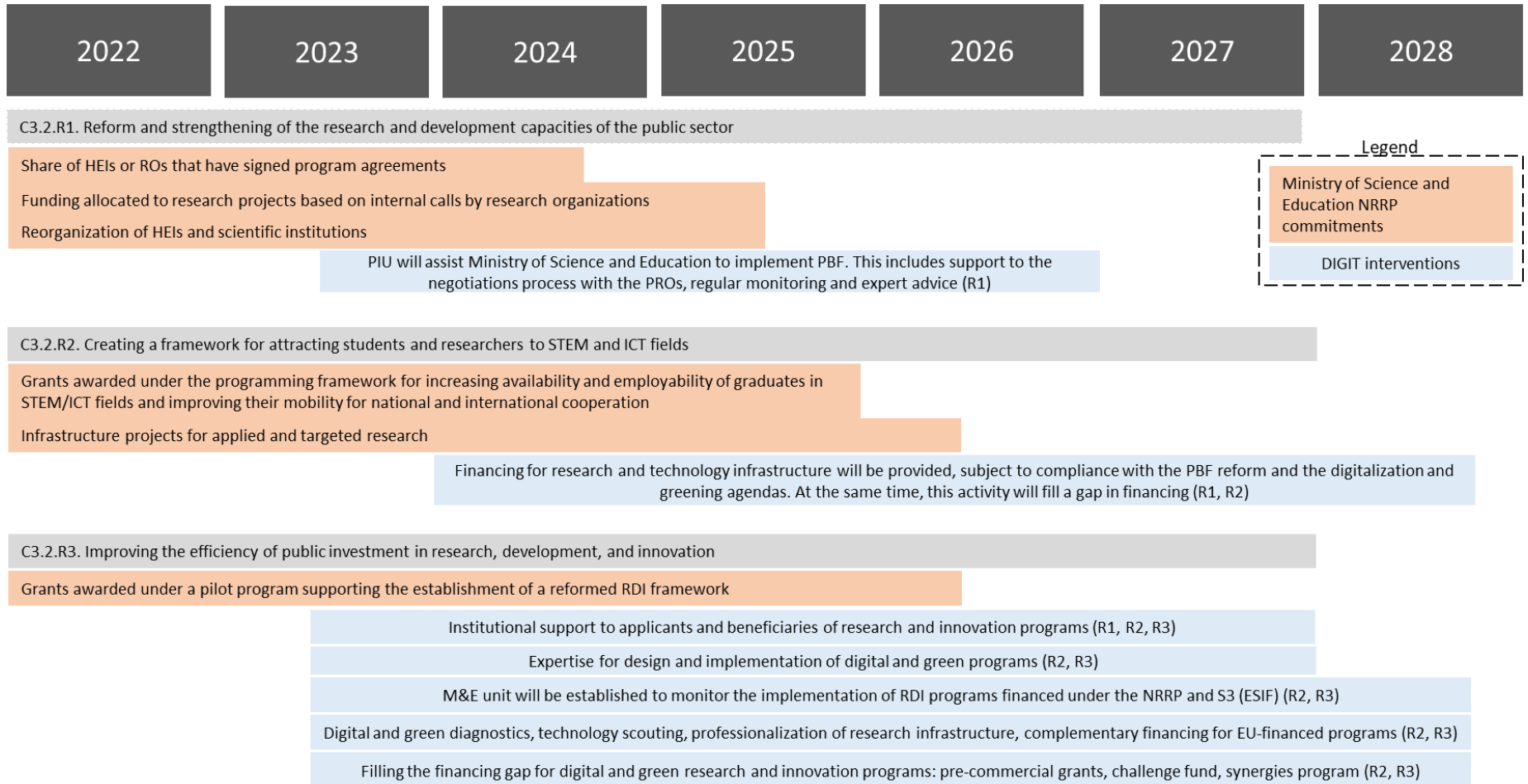
<sup>82</sup> European Parliament, Directorate General for Internal Policies of the Union. 2018. Financial Implementation of European Structural and Investment Funds.



*investment in research, development, and innovation*) will be supported through expertise for digital and green programs, bolstered M&E capacities, knowledge and awareness activities, project financing, and other related activities. All objectives will be underpinned by institutional capacity building for applicant and beneficiary support.



Figure 2-1 Complementarity of DIGIT activities with NRRP commitments and milestones



**Legend**

- Ministry of Science and Education NRRP commitments
- DIGIT interventions



**4. Moreover, DIGIT will contribute to delivering the overall S3 strategic framework and newly adopted ESIF.** The S3 is the governing strategy of RDI policy and a prerequisite for access to EU funds for RDI. Its overall objective (*to Enhance Croatia's research and innovation performance and capacity to boost competitiveness and promote digital and green transformation*) will be directly supported by DIGIT's digital and green emphasis, as well as interventions such as the Challenge program, Pre-commercial grants, and Synergy program, which help close crucial financing gaps. ESIF instruments are yet to be announced; however, DIGIT's technical assistance and novel programs (for example, pre-commercial grants, online diagnostic toolkit, technology scouting, Synergy program, and Challenge program) will contribute to specific objectives *1.i. (Development and strengthening of research and innovation capacities and adoption of advanced technologies)* and *1.v. (Development and strengthening of research and innovation capacities and adoption of advanced technologies)*.

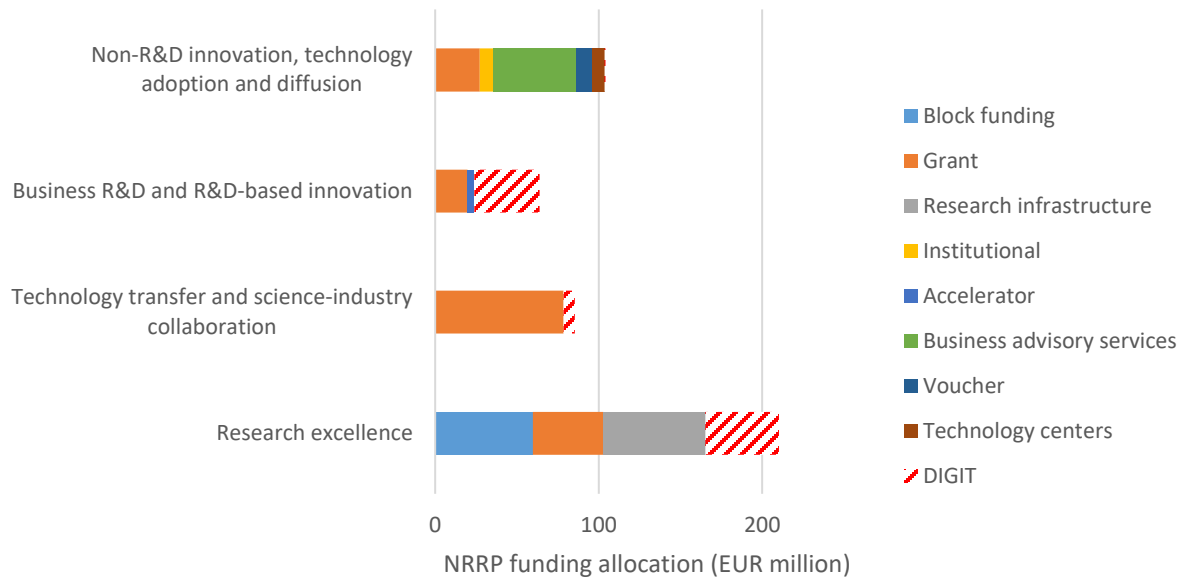
**5. DIGIT interventions fill gaps in the current policy mix.** Figure 2-2 shows how the DIGIT project complements the NRRP program mix. When it comes to research excellence, NRRP contributes block funding for performance-based agreements, as well as an array of grants for young researchers' development, mobility, scholarships, and research infrastructure. DIGIT boosts the financing available for performance-based funding, providing a stronger incentive for research organizations to participate. Next, DIGIT provides a small but potentially highly impactful contribution to technology transfer and science-industry collaboration through technology scouting and professionalization of research centers. These interventions are fairly innovative in their focus on soft support but can create significant positive spillovers by unlocking opportunities for future financing. Business R&D and R&D-based innovation have a relatively low allocation in the NRRP, mostly in start-up support and introducing new products and services to market. DIGIT covers this gap through grants for pre-commercial digital and green R&D and the challenge program. Although these interventions are open to collaboration with the research sector, they are intended primarily to spur business R&D. Finally, online diagnostics for digital and green technology adoption aim to boost the effectiveness of existing NRRP investments supporting digital technology adoption.

**6. DIGIT provides additional value by tailoring part of the interventions to digital and green research and innovation.** Funding for technology creation is planned in the national policy mix; however, it does not target green or digital innovation. Green filters exist solely through the requirement that beneficiaries of national policies abide by the EU's Do No Significant Harm policy. Abiding by this policy does not ensure that the funded research will actively seek to overcome climate and sustainability challenges. Digital technologies are not targeted and do not appear as a filter or a condition in national policy instruments.





Figure 2-2 DIGIT complementary funding for technology creation



Note: NRRP funding allocation is estimated based on planned investments under NRRP components 1.1.2 (Fostering innovation and digitalization of the economy) and 3.2 (Raising research and innovation capacity).



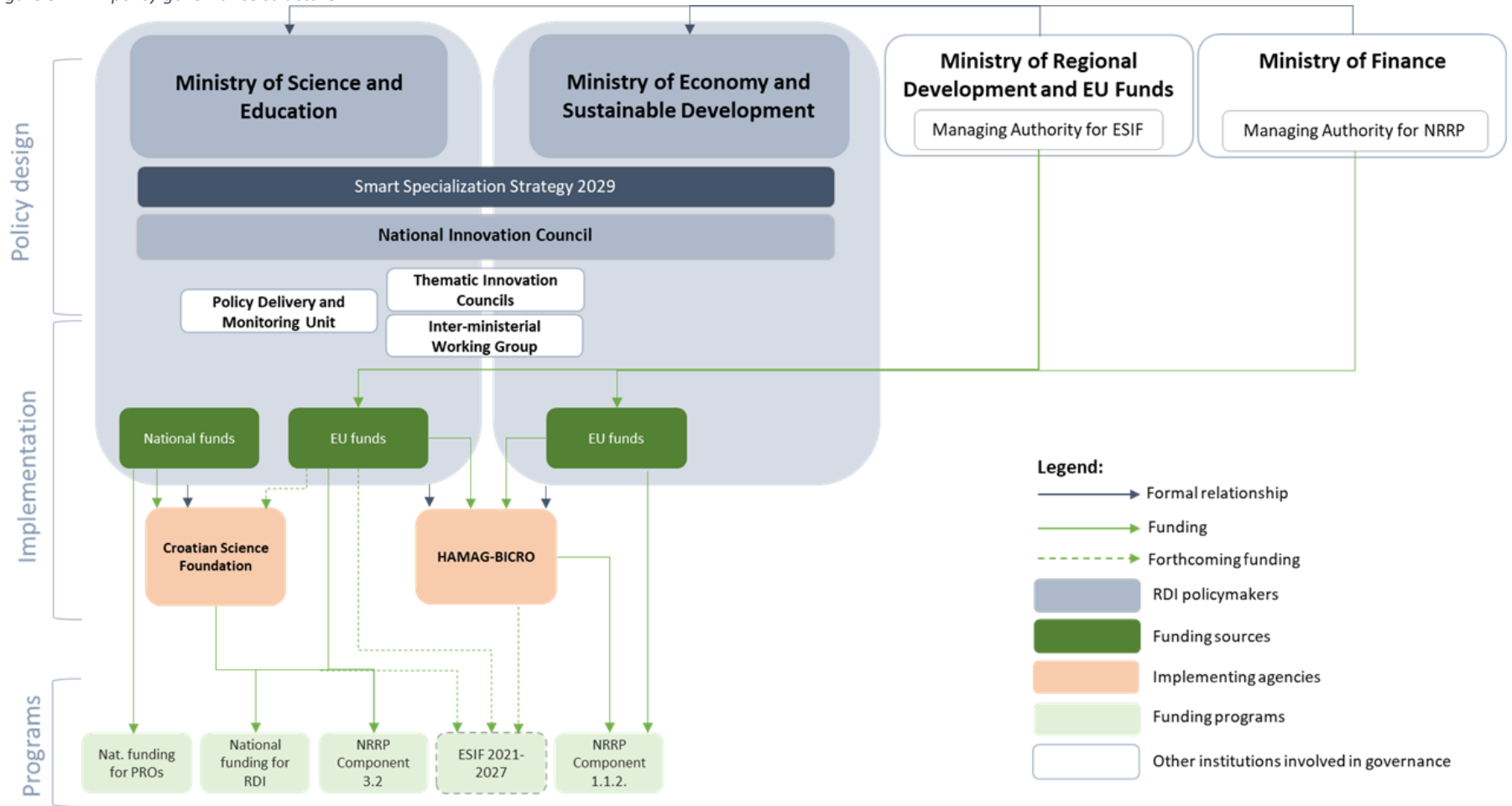
### ANNEX 3: Institutional landscape for RDI policy in Croatia

**1. The institutional landscape for RDI policy in Croatia is shaped by the division of the RDI policy agenda and the governance of EU funding.** Figure 3-1 provides a simplified illustration of institutional and funding linkages within the RDI policy space. At the strategic level, the Ministry of Science and Education and the Ministry of Economy and Sustainable Development share the RDI agenda, with the former being responsible for basic and applied research, private R&D, technology transfer, and industry-science collaboration and the latter being responsible for innovation, technology adoption, and market launch of new products and services. Their RDI policy plans are coordinated primarily through the forthcoming S3 2029. The two ministries coordinate at the strategic level through the National Innovation Council and at the operational level through the Interministerial Working Group. The governance framework of the S3 also involves the participation of industry and the research sector through Thematic Innovation Councils. The Ministry of Regional Development and EU Funds and the Ministry of Finance are managing authorities for EU funding (ESIF and NRRP, respectively). They, therefore, take the lead in establishing systems and procedures that can have important implications for the design and implementation of policy interventions. The Croatian Science Foundation and HAMAG-BICRO also play a role in implementing the national research and innovation program mix, and their roles differ depending on the intervention. The Ministry of Science and Education manages funds from the national budget for R&D (including funding for public research organizations and competitive funding for research projects), as well as European funding (NRRP and ESIF).

**2. The governance framework for RDI policy has faced horizontal and vertical coordination challenges.** In the last decade, overlapping authorities at both the strategic and operational levels mired policy implementation in bureaucracy and added notable strain on policy design, implementation, and M&E. From a horizontal perspective, the RDI agenda had considerable gaps. The Ministry of Science and Education focused on supporting research organizations, whereas the Ministry of Economy and Sustainable Development targeted firms. This division created gaps in areas in between, such as industry-science collaboration and research commercialization. Vertical coordination issues arose mostly from managing EU structural funding, which involves many institutions with different roles. For this complex institutional setup to work well, there needs to be a high degree of coordination and clear communication between institutions that have not always been forthcoming. Despite efforts to improve overall RDI policy governance arrangements, there is no indication that the upcoming ESIF framework will be managed differently from the previous perspective—this will likely impede the overall effectiveness of implementation and evaluation.



Figure 3-1 RDI policy governance structure





**3. The new S3 2029 takes an updated approach to policy coordination.** It aims to facilitate communication and decision-making between stakeholders and create stronger linkages between policy and Entrepreneurial Discovery Process governance and between policy and implementation governance. To achieve this, the S3 seeks to reestablish the role of the National Innovation Council with expanded coordination of research and innovation policy across different institutions involved in the national innovation system. This responsibility may include reports, recommendations, and decisions regarding S3 policy instruments and general innovation policies. Additionally, the National Innovation Council chairs (Ministry of Science and Education and Ministry of Economy and Sustainable Development) will establish a Policy Delivery and Monitoring Unit to provide analytical and technical support to the coordination of activities of the National Innovation Council and, accordingly, monitoring and evaluation of programs across the policy mix. Finally, the role of Thematic Innovation Councils as bodies for stakeholder inputs has been redefined to ensure consistent interaction with policymakers. These structures will be relevant in the context of DIGIT implementation, especially as it relates to technical assistance for applicant and beneficiary support, digital and green programming, and support of the M&E framework through the M&E Policy Analysis Unit. The ongoing implementation of NRRP programs (managed by the Ministry of Finance) and the upcoming ESIF framework (managed by the Ministry of Regional Development and EU Funds) will test the institutional arrangements and reveal new lessons as programs are deployed and evaluated.



ANNEX 4: Project contribution to climate change adaptation and mitigation

Activity	Project contribution to climate change adaptation and mitigation	Indicative budget (EUR million)
<b>Component 1: Enabling institutional conditions for digital and green research and innovation</b>		
<b>Subcomponent 1.1: Strengthening the institutional infrastructure for research and innovation policy</b>		
Capacity development for design, implementation, and M&E of research and innovation programs	<ul style="list-style-type: none"> <li>- Part of this activity will build up internal capacities for digital and green policy-making within the MSE to design and implement RDI support programs to support climate mitigation and adaptation. The emphasis will be put on RDI support programs that propel the dual transition. This emphasis may result in an uptake of green-centric policies or increased targeting of existing programs. The project will hire a green innovation policy expert with experience in sustainability-related technologies, who will work with policy-makers in reassessing existing policies and pivoting towards more sustainable inclusion of climate change-related measures and incentives and creating a framework that can better support climate-related innovation through the RDI ecosystem.</li> </ul>	0.5
	<ul style="list-style-type: none"> <li>- Technical assistance for M&amp;E will support data collection on green technology creation that will be used to inform policymakers and optimize future support for climate change adaptation and mitigation.</li> </ul>	0.25
Institutional support for performance-based funding reform in public research organizations	<ul style="list-style-type: none"> <li>- Research organization action plans developed as part of performance-based funding agreements may include objectives that have positive impacts on the environment and activities relevant to adaptation and mitigation opportunities in R&amp;D (for example, planning for dedicated financial resources for specialized programs or research grants for technologies, processes, or policies contributing to climate change adaptation). Although the Project activity will not determine the action plans set forth by institutions affected by the performance-based funding reform, it may contribute to effectively delivering such objectives.</li> <li>- The performance-based funding team will conduct workshops for beneficiaries that promote and support the achievement of green objectives in research organization action plans.</li> </ul>	0.25
Financing selected Research Infrastructure and Technology Projects	<ul style="list-style-type: none"> <li>- Priority will be given to infrastructure improvements with demonstrated sound environmental sustainability, energy efficiency, and use of renewable energy sources.</li> <li>- Technical designs and construction specifications will prescribe construction materials to ensure infrastructure resilience to climate change impacts due to extreme temperature changes and adverse weather conditions that could damage infrastructure. Projects will also contribute to the reduction of energy consumption and waste generation.</li> <li>- Upon completion, the infrastructure may also support research in</li> </ul>	25



Activity	Project contribution to climate change adaptation and mitigation	Indicative budget (EUR million)
	green-related fields (for example, climate adaptation and mitigation-related activities in digital technologies or transportation) or work towards popularizing green research.	
<b>Subcomponent 1.2: Strengthening the effectiveness of research and innovation financing</b>		
Funding to enhance the effectiveness of the RDI program mix	<ul style="list-style-type: none"> <li>- Part of the support for the peer review process will be provided for interventions that finance green technology creation (for example, research on or development of renewable energy, energy efficiency improvement, low-carbon technologies, or other technologies instrumental to achieving decarbonization).</li> <li>- New piloted interventions may target research and technologies in areas that support climate adaptation and mitigation.</li> </ul>	0.25
Online diagnostic and technology scouting	<ul style="list-style-type: none"> <li>- The green online diagnostic tool developed under this intervention will support green technology awareness and adoption. The tool will improve the firm’s understanding of its green technology needs and competitive position, thus spurring green technology take-up.</li> <li>- The data generated by the tool may inform policymakers about optimizing future RDI support for climate change mitigation.</li> </ul>	0.25
Professionalization of research centers	<ul style="list-style-type: none"> <li>- The PIU will provide training in green procurement, energy efficiency, and equipment optimization for participating professional staff.</li> <li>- Applicant research centers may be required to identify how their management will work towards improving energy efficiency and reducing emissions and waste generation.</li> </ul>	1
<b>Component 2: Programs for digital and green research and innovation</b>		
<b>Subcomponent 2.1: Pre-commercial digital and green R&amp;D support</b>		
Grants for pre-commercial digital and green R&D	<ul style="list-style-type: none"> <li>- Beneficiaries applying through the green filter will be required to demonstrate how their research addresses a sustainability challenge (for example, energy efficiency or circular economy) as part of the selection process, therefore it is expected that this activity will contribute to climate adaptation or mitigation.</li> <li>- The research projects will be in line with the Smart Specialization Strategy 2029, which places a significant emphasis on climate-friendly technologies through its thematic priority areas (i.e., smart and clean energy, smart and green transport, sustainable and circular food). Examples of research projects related to those areas that may be funded under the Project include bio-packaging for agricultural goods, smart sensors for soil quality management, and carbon capture for green hydrogen creation.</li> <li>- The PIU may train project beneficiaries in green procurement, sustainability, and environmental obligations to raise cross-sectoral awareness of climate change challenges and mitigation approaches</li> </ul>	4



Activity	Project contribution to climate change adaptation and mitigation	Indicative budget (EUR million)
	among project beneficiaries from various fields and sectors. This should also help raise awareness of energy efficiency, climate and energy smart initiatives, waste recycling and other environmental and climate issues.	
Challenge program	<p>- Depending on the articulated mission or challenge, the financing may entirely address green topics, including funding to research, prototype, and deploy a climate change mitigating or adaptive solution. A RES-powered microgrid (as described in Box 3) is an indicative intervention that would mitigate GHG and potentially improve the climate resilience of a remote community in Croatia by increasing energy resilience and reliability. Additional interventions to be financed via challenge program may be related to addressing the climate risks Croatia is exposed to the most, such as improving resilience to extreme weather (through climate-friendly and energy efficient technologies for heating and cooling), mitigating the risk of urban floods, innovative approaches to wildfires management, especially in coastal areas (e.g., cognitive mapping in wildfire management) or digital solutions for early phase management of rainfall-induced landslides.</p> <p>- The PIU may train project beneficiaries in green procurement, sustainability, and environmental obligations to raise cross-sectoral awareness of climate change challenges and mitigation approaches among project beneficiaries from various fields and sectors. This should also help raise awareness of energy efficiency, climate and energy smart initiatives, waste recycling and other environmental and climate issues.</p>	12
<b>Subcomponent 2.2: Synergies program</b>		
Synergies program	<p>- The program is likely to support Horizon Seal of Excellence projects that contribute to climate adaptation and mitigation. Horizon Europe encourages project applicants to contribute to climate-conscious missions such as <i>Adaptation to Climate Change; Restore our Ocean and Waters by 2030; 100 Climate-Neutral and Smart Cities by 2030; and A Soil Deal for Europe</i>. Examples of projects to be funded by the Synergies program may include research and innovation in rainwater waste management, sustainable agri-food value chains, nature-based solutions for urban planning, geospatial tools to support sustainable forestry and agriculture, or flood management in littoral communities.</p> <p>- The PIU may train project beneficiaries in green procurement, sustainability, and environmental obligations to raise cross-sectoral awareness of climate change challenges and mitigation approaches among project beneficiaries from various fields and sectors. This should also help raise awareness of energy efficiency, climate and energy smart initiatives, waste recycling and other environmental</p>	5



Activity	Project contribution to climate change adaptation and mitigation	Indicative budget (EUR million)
	and climate issues.	
Total project contribution to climate adaptation and mitigation		48.5





## ANNEX 5: Economic and Financial Analysis

1. **An economic and financial analysis (EFA) has been conducted across the project components to determine the value of the anticipated benefits relative to the costs associated with this project.** The Project Net Present Value (NPV) is estimated at EUR 62.9 million at a 12 percent discount rate,<sup>83</sup> and the Economic Rate of Return (ERR) at 24 percent based on the total project investments.
2. **In reference to this project valuation, several points are worth noting.** First, this calculation is indicative, using expected average parameters for the project beneficiaries and the resulting impact of the project components. Although these assumptions draw on the project team's discussions with potential beneficiaries, the results of other projects, and the economic literature, they do not precisely capture the impact that the project will have. The exercise of financially modeling the project helps ensure that project funds are allocated to investments and activities that will provide a return to the local population, along with helping identify key risks and thresholds for the project to achieve its desired impact. These types of projects can specifically take on higher-risk investments because of the social good that could result from them. As such, financial valuations of these investments may not be as high as those in other regions. However, the social value of such investments could be considerably higher.
3. **The methodology (detailed below) accounts only for the project's impact on direct beneficiaries rather than using a broader multiplier approach.** A broader approach would encompass positive externalities, spillover effects, and the overall growth of Croatia's RDI ecosystem. Additionally, investments under this project are expected to facilitate further investments from the EU and other donors, which could further amplify social returns. The value of such externalities is difficult to estimate; however, the social rate of return based on the growth of the RDI ecosystem can be upwards of 60 percent. Although this is not an exact estimate of the project's value, this high value of broader social benefits from the project is worth underscoring.

*Component 1: Enabling institutional conditions for digital and green research and innovation*

4. **The component Net Present Value (NPV) is estimated at EUR 24.9 million at a 12 percent discount rate and the Economic Rate of Return (ERR) at 20 percent.** The analysis for this component is based on the estimated value of research collaborations financed under the project. The component analysis is separated into two parts—the research infrastructure investments (EUR 51 million) and technology scouting (EUR 2.5 million). Due to difficulties in quantifying the precise impact of the technical assistance and soft interventions, this part of the component has been excluded from the analysis.
5. **Methodology:** Estimating returns associated with public research infrastructure investments is challenging for several reasons. Such investments are associated with long delays in impact. Additionally, defining the monetary value of research projects and outputs, even when commercialized, is subjective, and causality links are tenuous at best. As part of defining the methodology for this analysis, the following examples were examined:
  - The Croatia Second Science and Technology Project (P127308) used additional donor RDI financing as a proxy for the value of research projects. The ICR for the Croatia Second Science and Technology Project uses the same methodology but incorporates additional private investment generated for the sector. This analysis does not use this method because additional RDI financing is likely to fund new and separate research projects

<sup>83</sup> We estimate a 12 percent discount rate as the risk-adjusted opportunity cost of capital. Additional NPV estimates at other discount rates have also been provided as a measure of the sensitivity of our analysis.



rather than increasing the value of research directly impacted by investments under this project. Additionally, these additional investments could have occurred even in the absence of the project because they are primarily associated with separate donor-run programs.

- The Ex-Post Project Monitoring and Evaluation Report for the STP II project provides an additional discussion on the operational costs (including employment) of the specific infrastructure financed by the project. This analysis also excludes this method because operational costs can vary considerably based on the precise infrastructure financed.
- Given the constraints noted above, this analysis focuses on researchers expected to use the improved infrastructure facilities financed under Component 1. These research infrastructure investments are expected to reduce the failure rate of research projects and increase the value of research developed by researchers—specifically, higher quality research infrastructure will enable improved research quality and efficiency. The section below outlines the assumptions used in this analysis in further detail.
- RDI investments are expected to generate positive spillovers that impact the broader RDI ecosystem and the private sector as a whole. These include wider growth of the Croatian RDI and entrepreneurial ecosystem and the demonstration effect of project RDI support. Further, additional benefits include more efficient and lower energy use, reduced waste creation, and better ESG practices. Several social impact investment firms use a minimum threshold approach.<sup>84</sup> This means that direct investments are expected to generate at least a US\$2.50 social return for every dollar invested. Based on this estimate, the Social Net Present Value (SNPV) of the component research infrastructure investments is estimated at EUR 191 million at a 12 percent discount rate. The Social Economic Rate of Return (SERR) is estimated at 54 percent.

6. **Research infrastructure:** The estimates are based on the following parameters.

- Number of beneficiaries: The results framework estimates that 200 researchers will be able to work in improved research facilities due to the research infrastructure investments under this component.
- Failure rate: Among the research collaborations that go forward, the analysis assumes that the project's support will reduce failure rates by 10 percentage points (from 50 to 40 percent).
- Average research project value: The initial average research project value is assumed to be EUR 500,000. The analysis estimates that the value of this research will grow at 3 percent annually in the absence of the project's investments and an additional 25 percent over five years as a result of these investments. In all likelihood, successful research studies that come to fruition may end up valued considerably higher.
- Timeframe of impact: Due to the time required for R&D, we estimate that the impact of the project's investments will occur in the years following the actual R&D support. The analysis assumes an eight-year delay for projects to come to fruition.

7. **Technology diagnostics and scouting:** The estimates are based on the following parameters.

- Number of beneficiaries: The results framework estimates that the digital diagnostic and technology scouting activities will support 1,000 and 35 firms, respectively.
- Channel of impact: Beneficiaries of this activity are expected to demonstrate a lower failure and higher growth rate due to this support.
- Failure rate: Of the research collaborations that go forward, the analysis assumes that the project's support

---

<sup>84</sup> Harvard Business Review. 2019. *Calculation the Value of Impact Investing*. <https://hbr.org/2019/01/calculating-the-value-of-impact-investing>.



will reduce failure rates by 5 percentage points (from 30 to 25 percent for the diagnostic and 25 percent to 20 percent for the technology scouting activities).

- Firm revenue: The average firm revenue is assumed to be EUR 50,000. The analysis estimates that these beneficiaries grow at 3 percent annually without the project's investments and an additional 3 percent due to the diagnostic. For the technology scouting activity, the analysis assumes an additional 15 percent in revenue growth due to this activity.

**8. With the assumptions noted above, the component valuation and other key metrics are estimated as follows:**

- NPV at a 15 percent discount rate: EUR 12.1 million
- ERR: 20 percent
- NPV at a 12 percent discount rate: EUR 24.9 million
- NPV at an 8 percent discount rate: EUR 51.7 million

**9. Sensitivity analysis:**

- Reducing the average research project value by 20 percent reduces the component ERR to 16 percent.
- Increasing the average research project value by 20 percent increases the component ERR to 23 percent.
- Increasing the assumed failure rates with the project interventions by 20 percent reduces the project ERR to 8 percent.
- Reducing the assumed failure rates with the project interventions by 20 percent increases the project ERR to 29 percent.
- Reducing the number of technology diagnostic and scouting beneficiary firms by 20 percent reduces the component ERR to 19 percent.
- Increasing the number of technology diagnostic and scouting beneficiary firms by 20 percent maintains the component ERR at 20 percent.

*Component 2: Programs for digital and green research and innovation*

**10. The component NPV is estimated at EUR 38.0 million at a 12 percent discount rate, with an ERR of 31 percent.** The economic analysis of this component is based on increased revenues for companies and researchers receiving financial and technical support under Component 2.

**11. We calculate our estimates based on the following parameters:**

- Number of beneficiaries: The result framework estimates 15 beneficiaries under the Synergies Program. The RF also estimates 70 recipients under the pre-commercial grants and the Challenge Program as part of 35 consortia. Beneficiaries under the pre-commercial grants and the Challenge Program are expected to be of a smaller average revenue since these constitute earlier-stage investments.
- Channels of impact: The primary assumption in this analysis is that project beneficiaries will demonstrate additional growth above that without the project investments. Additionally, we assume that project investments will result in a lower failure rate among beneficiaries.
- Additional growth rate: We estimate a steady state revenue growth rate of 3 percent for firms without the project investments, with revenue growth assumptions totaling an additional 15 percent for all beneficiaries. These additional growth rates are applicable for one year, and then the growth rate returns to the steady state. Depending on the sector, high-potential start-ups can achieve 5 percent revenue growth on a *monthly* basis off of their lower revenue base.



A wide range of studies in different regions on the impact of different types of services for SMEs supports the above assumptions. Although specific data on this type of innovation support isn't available, we've provided a summary of a subset of supporting studies below:

- A World Bank MSME support project in Togo showed a return of 30 percent for beneficiaries, with a 40 percent return for female business owners in a randomized controlled trial conducted as part of a World Bank MSME support project in Togo.<sup>85</sup> Other projects implementing similar personal initiative training modules have demonstrated high potential returns from such interventions, especially for women-owned or -led businesses.<sup>86</sup>
- The Sarder et al. (1997) study “The Importance of Support Services to Small Enterprises in Bangladesh” found a 5–16 percent increase in employment, sales, and productivity with technology adoption support provided to SMEs.
- Tan and Lopez-Acevedo (2005) examined the impact of SME programs in Mexico using panel firm data. They found a 9–14 percent improvement in training and a 9 percent improvement in technology absorption. Various SME programs—Business Advisory Services, Technology Development, Credit, and Supplier Development (1992–2000)—in Chile presented similar results.
- Lopez-Acevedo and Tan (2010), “Impact Evaluation of SME Programs in Latin America and Caribbean” found an 8 percent increase in wages and a 9 percent increase in productivity as a result of these programs.
- Bloom et al. (2013)<sup>87</sup> demonstrated the importance of supporting managerial capabilities to improve firm productivity and growth based on evidence from India. Similarly, Bruhn et al. (2013)<sup>88</sup> document the impact of this type of support based on a randomized trial conducted in Mexico. Evidence from Colombia reported by Iacovone et al. (2019)<sup>89</sup> also demonstrates the impact of improving firm managerial capabilities. Based on a cross-country review, business training programs also help to increase SME profits and sales (McKenzie 2020).<sup>90</sup> Bloom et al. (2017)<sup>91</sup> underscore the importance of interventions to support management capabilities, technology adoption, and digitalization.
- The financing gap for MSMEs is vast, especially in emerging markets. Providing additional financing or addressing risks (both real and perceived) can stimulate the overall credit market.<sup>92</sup> Based on a study in

---

<sup>85</sup> World Bank. 2018. “New Mindset, Increased Profits: Lessons from an Innovative Entrepreneurial Training in Togo.”

<https://www.worldbank.org/en/news/feature/2018/01/18/new-mindset-increased-profits-lessons-from-an-innovative-entrepreneurial-training-in-togo>

<sup>86</sup> World Bank. 2019. *Profiting from Parity: Unlocking the Potential of Women's Businesses in Africa*. Washington DC: World Bank.

<sup>87</sup> Bloom, N., B. Eifert, A. Mahajan, D. McKenzie, and J. Roberts. 2013. “Does management matter? Evidence from India.” *The Quarterly Journal of Economics* 128 (1): 1–51.

<sup>88</sup> Bruhn, M., D. Karlan, and A. Schoar. 2013. “The impact of consulting services on small and medium enterprises: Evidence from a randomized trial in Mexico.” World Bank Policy Research Working Paper 6508. Washington, DC: World Bank.

<sup>89</sup> Iacovone, L., W. Maloney, and D. McKenzie. 2019. “Improving Management with Individual and Group-Based Consulting: Results from a Randomized Experiment in Colombia.” World Bank Policy Research Working Paper 8854. Washington, DC: World Bank.

<sup>90</sup> McKenzie, D. 2021. “Small Business Training to Improve Management Practices in Developing Countries: Reassessing the Evidence for ‘Training Doesn't Work’.” *Oxford Review of Economic Policy* 37 (2): 276–301.

<sup>91</sup> Bloom, Sadun, Van Reenen. 2017. Management as Technology?, NBER Working Paper 22327; Bruhn et al. 2018. The Impact of Consulting Services on Small and Medium Enterprises: Evidence from a Randomized Trial in Mexico, *Journal of Political Economy*, 126, 2, 635–687.

<sup>92</sup> International Finance Corporation. 2017. *MSME Finance Gap: Assessment of the Shortfalls and Opportunities in Financing Micro, Small, and Medium Enterprises in Emerging Markets*. Washington, DC.



Yemen, McKenzie et al. (2015)<sup>93</sup> note that matching grants and other financing opportunities for SMEs help incentivize firms to make investments in innovation that would otherwise be less likely.

- Business plan competitions that implement a marketing and screening mechanism also demonstrate positive results. A study of a program in Nigeria reported that beneficiaries showed a 20–37 percentage point increase in the likelihood of survival, a 21–23 percentage point increase in the likelihood of having ten or more workers, and a 23–25 percent increase in profits. A similar program in Kenya reported short-term results that supported firms were twice as likely to have an operational business, and their sales and profits were 47 percent higher than those in the control group.<sup>94</sup>
  - A *Harvard Business Review* study by Anne Marie Knott calculates the impact of R&D investments in the US by estimating a *Research Quotient* (RQ), which defines a relationship between firm inputs (capital, labor, and R&D investments) and firm output (revenues) based on regression analysis of American firms. Their analysis estimates that a 10 percent increase in the RQ results in an increase in market value of 1.1 percent, which can translate to a 10–20x multiple in firm revenues. Because this analysis examines R&D investments in established firms rather than start-ups, we have increased revenue growth assumptions for the project’s start-up beneficiaries.
- Reduction in failure rate: With the project investments, we assume a 20 percent reduction in the failure rate due to the assistance provided to beneficiaries. Although this assumption is broadly consistent with research on the impact of start-up accelerators and innovation programs, these are extremely difficult to predict; as such, we have specifically tested this for sensitivity.
  - Timeframe of impact: Due to the time required for innovation investments, we estimate that the impact of the project investments will occur three years following the support.

12. Additional assumptions are provided below:

	Pre-commercial and Challenge	Synergies
Number of beneficiaries	70	15
Failure rate w/o project intervention	50%	50%
Failure rate w/ project intervention	30%	30%
Average annual income (EUR)	500,000	1,000,000
Cost as a percentage of income		50%
Job creation (EUR revenue per job)	50,000	50,000
Average annual salary (US\$)	10,000	10,000
Annual revenue growth (w/o project)	3%	3%
Additionality to growth rate	15%	15%
Number of years that additionality applies	1	1

<sup>93</sup> McKenzie, David; Assaf, Nabila; Cusolito, Ana Paula. 2015. The Additionality Impact of a Matching Grant Program for Small Firms : Experimental Evidence from Yemen. Policy Research Working Paper;No. 7462. World Bank, Washington.

<sup>94</sup> World Bank: Competitiveness Policy Evaluation Lab Testing Interventions to Address Firm Constraints to Growth, November 2022.



13. With the assumptions noted above, the project valuation and other key metrics are estimated as follows:

- NPV at a 15 percent discount rate: EUR 25.7 million
- ERR: 31 percent
- NPV at a 12 percent discount rate: EUR 38.0 million
- NPV at an 8 percent discount rate: EUR 62.3 million

14. **Sensitivity analysis:**

- Reducing the estimated growth rate additionality for all project beneficiaries by 20 percent reduces the component ERR to 28 percent.
- Increasing the estimated growth rate additionality for all project beneficiaries by 20 percent increases the project ERR to 33 percent.
- Increasing the assumed failure rates with the project from 30 percent to 40 percent reduces the project ERR to 17 percent.
- Reducing the assumed failure rates with the project from 30 percent to 20 percent increases the project ERR to 43 percent.
- Reducing the estimated average annual beneficiary revenues by 20 percent reduces the component ERR to 24 percent.
- Increasing the estimated average annual beneficiary revenues by 20 percent increases the component ERR to 37 percent.