

Comprehensive study of Technology Transfer Ecosystem

Country: Croatia

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1. Introduction

The successful technology transfer process has a positive impact on society by stimulating innovation and economic growth. Building a successful and effective TT system on both national and HEI/PRO levels requires a significant amount of time and investment. The development of an effective TT system requires a clear strategic focus and implementation plan consistent with the various TT stakeholders' needs. The governance and regulative environment in which the TT stakeholders operate is an important prerequisite for their successful integration into the R&I and TT system. The legislative and regulative framework encompasses policies and regulations related to research and development (R&D), intellectual property rights (IPR), technology transfer, and incentives for innovation. The TT process is complex and long and requires continuous dedicated engagement of all stakeholders involved in the TT system, as well as continuous funding.

The main stakeholders in the Croatian TT ecosystem include higher education institutions (HEIs), research organizations, technology transfer offices (TTOs), private sector companies, start-up/spin-off companies, intermediaries such as incubators/accelerators, private and public funds (National and EU funds, VCs, and BAs) and government bodies. Higher education institutions (HEIs), research organizations, and researchers/innovators generate new knowledge by using the available research infrastructure with the support of available public or private funds. Moreover, there are various intermediaries in the TT process such as incubators, accelerators, innovation hubs, and incubation centers that provide support and the necessary resources and infrastructure to facilitate and manage the TT process and activities. These mechanisms help bridge the gap between academia and industry, fostering a conducive environment for innovation.

Croatia has achieved a remarkable improvement in its innovation performance and the country is gradually closing the gap with the EU. However, the research and innovation (R&I) system in Croatia continues to present low cooperation between academia and the private sector combined with declining patenting over the past decade (compared to EU-13) and limited licensing and spin-off activity. This is, to an extent, due to the lack of continuity in the programmes for funding technology transfer (TT) and the low attention paid to the role and capacity of TT professionals throughout the years. In addition, broader institutional factors such as the independent nature of university faculties, which often build their own TT units, make institutional cooperation on TT and interdisciplinary R&I challenging.

This study provides a comprehensive overview of the current TT system in Croatia that includes the analysis of the external and internal environment, relevant TT stakeholders, the legislative and regulative framework for TT, and available funding opportunities for R&I and TT.

1.1 Work methodology

To understand the national context for the TT system in Croatia it is important to analyze the governance, institutional, legislative, funding, and other relevant aspects related to R&I, technology transfer, and research infrastructure.

The methodology used for the preparation of this study included a multi-faceted approach to collect and gather comprehensive data on the current state of the technology transfer (TT) system in Croatia. It included desk research and data/information collection, literature review, and conducting surveys.

Desk research

Desk research and data/information collection were conducted by collecting and analyzing the existing legal framework, policy documents, studies, reports, and available online sources.

Literature Review

A thorough review of the existing literature was conducted to find the legislative frameworks, support mechanisms, and best practices in TT. This included academic papers, policy documents, reports from relevant institutions, and published case studies. These sources provided a foundation for this study, describing the TT framework in Croatia.

Surveys

Surveys were distributed to the selected key stakeholders involved in technology transfer activities, namely to the technology transfer offices and other relevant stakeholders within the Croatian TT system. The aim was to gather qualitative and quantitative insights into the challenges, opportunities, and perceptions of TT processes and to measure TT success using various indicators. In addition, the surveys were used to identify the best practices in TT in Croatia. The respondents were identified and selected through the existing networks and recommendations, and their willingness to participate and contribute was instrumental in providing a nuanced understanding of the TT environment. Although the received responses from those respondents who were willing to participate and to fulfill the surveys, most of them were unwilling to disclose financial data. The information gathered through surveys helped to validate the findings from the literature review, ensuring a well-rounded analysis.

2. Background/Environment

Croatia is a small, open economy and the latest entrant to the European Union. With a geographical size of 56 594 km², the population of Croatia is 3,850 894 (2023).¹

According to the European Innovation Scoreboard for 2023 Croatia is classified as an “Emerging Innovator” and has made significant progress in the last years in its innovation performance with a value of 69,6% of the EU average which can be defined as a “rapid improvement.” Due to the observed progress, Croatia is just a step away from becoming a “Moderate Innovator”. The highest

¹ https://european-union.europa.eu/principles-countries-history/eu-countries/croatia_en

increase in innovation performance in comparison with 2022 was demonstrated in Croatia with an increase of 37,8%-points. Croatia's public expenditure for research observed through the government budget allocations for R&D (GBARD) was 0,66 % of GDP which is still below the EU average. However, there is a relatively weak production of patents observed in Croatia, compared to EU13 terms, with their numbers from 2011 to 2022 declining by a third.² The total R&D personnel in 2022 amounted to 28 230, which was 2.9% more than in the previous year. Expressed as a full-time equivalent, there were a total of 17191.7 person-years employed in R&D in 2022 (i.e. persons in full-time employment in R&D).³

The Global Innovation Index (GII) ranks world economies according to their innovation capabilities. The GII Report for 2023 ranks Croatia 44th among the 132 economies featured in the GII 2023. Croatia ranks 28th among the 39 economies in Europe. According to the GII Report for 2023, Croatia performed worse in innovation outputs (ranked 44th which is lower than 2022 when it ranked 40th) than in innovation inputs (ranked 43rd which is higher than in 2022 when it ranked 45th). The expected innovation performance according to the income level (observed as GDP per capita) for Croatia is at expectations for its level of development. Croatia ranked highest in infrastructure, knowledge and technology outputs, and human capital and research while it ranked lowest in institutions, business sophistication, and creative outputs.⁴

Research in Croatia is performed in both public and private research organizations. The public R&D sector, with the leading role of universities, dominates in both research manpower and research activities. There are 10 public universities, 25 public research institutes, 11 public polytechnics, 3 public colleges, 3 private universities, 3 private polytechnics, 20 private colleges, 4 technology transfer offices at universities, 3 science-technology parks, and 11 research centers in the industry, each one of them playing an important role in the development of R&D sector in Croatia.^{5,6}

In 2023, the number of patent applications submitted to the State Intellectual Property Office (SIPO) amounted to 171, of which 164 were filed by resident and seven by non-resident applicants. Out of the total resident applicants, 29.9% were submitted by natural persons and 70.1% by legal entities. Among the non-resident applicants, the share of natural persons was 14.3% and the share of legal entities was 85.7% of applications. As regards the fields of technology, the highest share of patent applications in 2023 related to Chemistry (32.2%) and Electrical engineering (22.6%), while the lowest number related to Other fields (8.8%).⁷

The main funding bodies, together with the Ministry of Science, Education and Youth, are the Croatian Science Foundation (CSF), funding different programmes, research projects, and university reforms, and the Croatian Agency for SMEs, Innovations and Investments (HAMAG-

²<https://op.europa.eu/en/publication-detail/-/publication/82617640-1dd8-11ed-8fa0-01aa75ed71a1/language-en/format-PDF/source-search>

³ <https://podaci.dzs.hr/2023/en/58220>

⁴ <https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2023/hr.pdf>

⁵ <https://www.euraxess.hr/croatia/research-croatia>

⁶ [Ustanove iz sustava znanosti \(mzos.hr\)](https://www.mzos.hr)

⁷ <https://podaci.dzs.hr/2024/en/76952>

BICRO), supporting various innovation policy programmes, creating, implementing and financing innovation policy programmes for the commercial application of science. Throughout the Regional Competitiveness Operational Programme and Operational Programme Human Resources Development, Croatia is combining the European Regional Development Fund (ERDF) and the European Social Fund (ESF), while funding the development of science and research.⁸

Croatia's research, development and innovation (RDI) system is going through significant changes. Over the past decade, the Croatian government has made some good steps forward, such as the increase in gross RDI spending between 2011 and 2020. However, despite this visible progress, there is still a lot to be done.⁹ The Croatian government is planning to make significant improvements to its RDI policies as part of its 2018–2030 National Development Strategy and its new 2021–2029 Smart Specialisation Strategy. The country's Recovery and Resilience Plan also includes new funding programmes and major RDI reforms. The new incentives that encourage public research organizations to engage more strongly in technology transfer are acknowledged. However, the impact of this change will depend on the associated indicator system and the interventions addressing knowledge valorization and innovation performance in the research sector.¹⁰

The TT environment in Croatia has undergone significant evolution in the last 30 years. While the TT initiatives and building TT infrastructure have been present for many years, recent efforts have focused on enhancing the legislative frameworks, funding TT processes, and fostering collaborative networks necessary for effective TT. The country's increased participation in European Union (EU) research programs and international collaborations has contributed to the maturation of its TT environment.

2.1 RIS in Croatia

The European Innovation Scoreboard (EIS) provides a comparative assessment of the research and innovation performance of EU Member States and the relative strengths and weaknesses of their research and innovation systems. It helps Member States assess areas in which they need to concentrate their efforts to boost their innovation performance. The EIS 2023 distinguishes between four main types of activities – Framework conditions, Investments, Innovation activities, and Impacts – with 12 innovation dimensions. The performance of EU national innovation systems is measured by the Summary Innovation Index, which is a composite indicator obtained by taking an unweighted average of the 32 indicators

According to the European Innovation Scoreboard (EIS) 2023, Croatia is classified as an Emerging Innovator with performance at 69.6% of the EU average¹¹. The country's performance is increasing at a rate higher than the EU average (8,5%), with a performance gap to the EU becoming smaller. The rising trend in innovation performance since 2018 is presented in Figure 1. After an initial

⁸ <https://www.euraxess.hr/croatia/research-croatia>

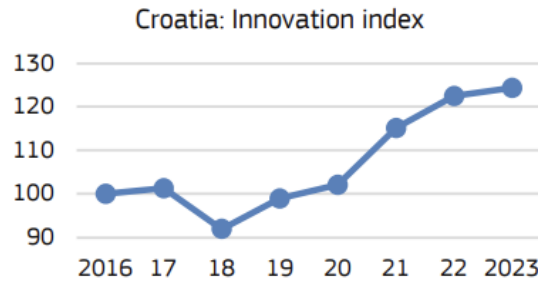
⁹ <https://op.europa.eu/en/publication-detail/-/publication/5dc0eb42-a0a7-11ed-b508-01aa75ed71a1/language-en/format-PDF/source-279709640>

¹⁰ Ibidem.

¹¹ European Innovation Scoreboard 2023 – Country profile Croatia, European Commission, 2023

decline, innovation performance has increased consistently since 2018, leading to a 24% performance increase in 2023.

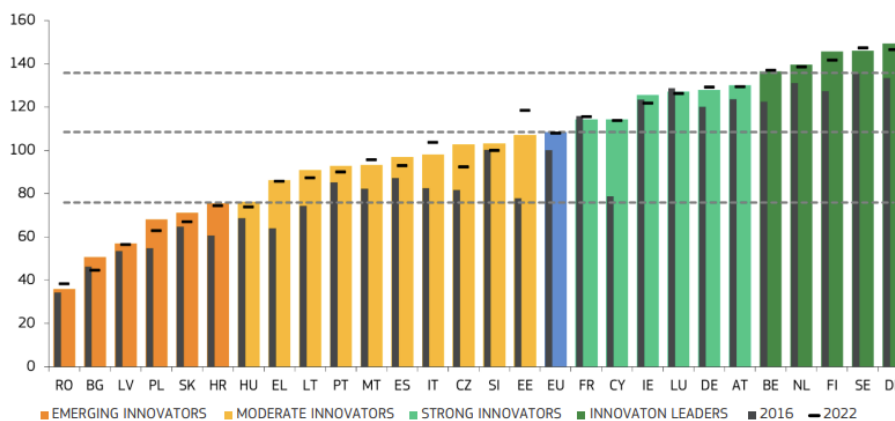
Figure 1. The innovation performance in Croatia for the observing period 2016 -2023¹²



Source: EIS (2023)

Croatia's innovation performance surpasses the average of other EU countries in the Emerging Innovator category. The position of Croatia in this category can be seen in Figure 2. Croatia is in the lead position in the group of countries classified as “emerging innovators.”

Figure 2: Performance of EU Member States' innovation systems



Source: EIS (2023)

The analysis of particular categories (i.e., indicators) helps to better understand the change in the innovation performance of the country. These categories include: PhD Graduates, Attractive Research Systems, Finance and Support, Firm Investments, Innovators, Intellectual Assets, and Relative strengths and weaknesses of the regional innovation ecosystem

PhD Graduates

Croatia's performance in terms of PhD graduates is measured under the human resources category, with a score of 55.5, indicating a slight decline over recent years. The positive change is observed in 2024 showing a strong increase (23.1). The population with tertiary education stands at 62.4, showcasing a slight decline.

¹² Ibidem.

Attractive Research Systems

The country's attractive research system presents a weak spot in Croatia's performance relative to the EU comparison scoring only 55.0, however reflecting a noticeable improvement ranging from 2.7 to 9.6 in performance change in comparison with 2022. The key indicator is International scientific co-publications (84.4) with a positive change of 9.6 compared to the previous year. The indicators Foreign doctorate students (41.6) and Most cited publications (43.9) scored still relatively low however showing a slight increase in comparison with the previous year. It demonstrates the significant room for improvement to strengthen the research base in the country.

Finance and Support

In the Finance and support indicator, Croatia scores high at 97.0, supported by a strong Venture capital expenditures indicator (134.9) with an increase of 61.1 compared to the previous year and a solid score in the R&D expenditures in the public sector indicator (84.4) showing a slight increase compared to the previous year (1.6). The Government support for business R&D indicator is still significantly below the EU average (62.6) however with substantial growth in comparison with 2022 (63.1).

Firm Investments

The Firm investments indicator, however, remains a weak aspect with a score of 38.0. The R&D expenditure in the business sector indicator score is low (36.8) showing a slight decline in comparison with the previous year (-1.5). However, the indicator Non-R&D Innovation expenditures have decreased significantly in the last year (-50.6) scoring low but significantly higher than the R&D expenditure in the business sector indicator. The Innovation expenditures per employee indicator show poor results scoring only 18.9 in 2023 with a continuous decline in comparison with the previous year (-7.1).

Innovators

The innovation activity presents a strong point for Croatia, with an overall score of 126.9. This includes high marks for the Product innovators among (SMEs) indicator (133.8) in 2023, however showing a significant decline of 17.8 in comparison with the previous year last year while the Business process innovators indicator score is high (120.9), with a visible continuous increase compared with 2022.

Intellectual Assets

The intellectual assets score is very low (46.7), demonstrated by a low performance in the PCT patent applications indicator (35.9) and Design applications indicator (34.8), however with a high performance related to the Trademark applications indicator (72.0).

The overall relative strengths and weaknesses of the Croatian innovation ecosystem can be summarized according to the EIS 2023 Report by taking into account all data and information in the Report, as presented in the table below.

Table 1: Relative Strengths and Weaknesses of the Croatian Innovation Ecosystem

Relative Strengths	Relative Weaknesses
<ul style="list-style-type: none"> Public-private co-publications (147.4) Venture capital expenditures (134.9) Product innovators (133.8) Business process innovators (120.9) Above basic digital skills (121.0) 	<ul style="list-style-type: none"> Innovation expenditures per employee (18.9) Environment-related technologies (19.7) Knowledge-intensive services exports (21.0) Lifelong learning (26.5) Design applications (34.8)

Source: Author, based on the EIS 2023 data for Croatia

Overall, Croatia is classified as an Emerging Innovator, with a performance level of 69.6% of the EU average. The country's innovation performance has increased notably since joining the EU, driven by improvements in research systems, innovative activity, and financial support mechanisms. However, challenges remain in firm investments, intellectual assets, and lifelong learning.

In terms of the quality of scientific research, Croatia still has room for improvement when it comes to the number of influential scientific publications (following the criteria or standards of each scientific field or individual discipline), cooperation between research institutions and the business sector, the number of patents and efficient transfer of technologies to the business sector. Although it belongs to the group of emerging innovators, Croatian innovation results are growing faster than the European average.

This analysis highlights the mixed landscape of Croatia's innovation environment, with notable strengths in public-private collaboration and venture capital, alongside significant opportunities for growth in business R&D and intellectual property rights protection.

The **Regional Innovation Scoreboard** classifies Croatia as an Emerging Innovator and includes four regions which is presented in Figure 3.

Figure 3: Croatian regions according to the Regional Innovation Scoreboard



Source: RIS Croatia (2023)

The four regions in Croatia are defined and presented in Figure 4.

Figure 4: Croatian regions according to the Regional Innovation Scoreboard

NUTS	Region	RII	Rank	Group	Change
HR	Croatia	69.6	--	Emerging Innovator	14.8
HR02	Panonska Hrvatska	60.6	196	Emerging Innovator +	5.5
HR03	Jadranska Hrvatska	66.9	186	Emerging Innovator +	12.3
HR05	Grad Zagreb	102.8	96	Strong Innovator -	22.2
HR06	Sjeverna Hrvatska	68.1	181	Emerging Innovator +	8.9

Source: RIS Croatia (2023)

Grad Zagreb (HR05) is the capital region and is classified as a Strong Innovator -, and performs above the EU average. The other three regions are classified as Emerging Innovators +. The innovation performance has increased for all regions and most strongly for Grad Zagreb (HR05). For the other three regions, the innovation performance has increased at a higher rate than that of the EU (8.5), however only for the Panonska Hrvatska (HR02) region the performance increase has been lower than that of the EU.¹³

2.2 Legislative Frameworks

The legislative and regulative framework has a significant role in supporting the development of the R&I and technology transfer system of every country. The current legislative and regulative framework in the Republic of Croatia relevant to the knowledge and technology transfer is:

1. **Smart Specialization Strategy (S3) until 2029¹⁴**
2. **National Development Strategy of the Republic of Croatia 2030**
3. **Intellectual property laws**
 - **Patent Act (OG No. 16/20) and Patent Regulations (OG No. 55/20)**
 - **The New Copyright and Related Rights Act (OG No. 111/2021)**
 - **Trademark Act (OG No. 14/19) and Trademark Regulations (OG No. 38/19)**
 - **Act on Industrial Design (OG No. 72/2004, 117/2007, 66/2011) and Industrial Design Regulation (OG No. 72/2004, 117/2007, 66/2011, 125/2013)**
4. **Labour Act**

1. SMART SPECIALIZATION STRATEGY (S3) UNTIL 2029

While the Smart Specialization Strategy (S3) 2016-2020 of the Republic of Croatia was important in the context of reforming Croatia's National Innovation System (NIS) the new Smart Specialization Strategy (S3) until 2029 will bring significant improvements in its implementation. The new S3 until 2029 is an umbrella document of public policies on investments in research, development, and innovation in the Republic of Croatia and aims to improve the overall Croatian innovation efficiency and capacities for strengthening competitiveness and promoting industrial digital and green transformation through three special objectives: **improvement of scientific excellence; bridging the gap between the research and business sectors; and increase of the innovation efficiency.** The positive aspect of the new S3 until 2029 is visible in the improved prioritization when it comes to science-industry collaboration.

¹³ https://ec.europa.eu/assets/rtd/ris/2023/ec_rtd_ris-regional-profiles-croatia.pdf

¹⁴ <https://mzom.gov.hr/UserDocImages//dokumenti/EUfondovi/PKK-2021-2027//S3-do-2029-Tekst-VRH-2023-12-13.pdf>

The stronger focus on the creation of higher value from the science-industry collaboration will create a critical mass that will engage in knowledge and technology transfer activities, as well as provide appropriate and targeted funding for science-industry collaboration. In addition, the new S3 until 2029 redefines the governance system which is important for the implementation and promotion of successful knowledge and technology transfer process by ensuring the appropriate institutional environment for collaboration. The new S3 until 2029 considers the proposed NRRP 2021-2026 Plan as a relevant source of funding and a basis for needed structural reforms in this respect. In addition, the new S3 is completely aligned with the National Development Strategy of the Republic of Croatia until 2030.

2. INTELLECTUAL PROPERTY LAWS

Croatia has a modern system of Intellectual Property Rights (IPR) which is fully harmonized with the European Union norms and standards. Croatia is a member of the European Patent Organization and a signatory of all of the most important international treaties in the field. The central body responsible for granting rights and coordinating the national IPR system is the **State Intellectual Property Office of the Republic of Croatia (SIPO)**. Intellectual property laws in Croatia are up-to-date with EU legislation and relevant international agreements.

- **The Patent Act** (OG No. 16/20) together with **the Patent Regulations** (OG No. 55/20) were enacted in 2020 and foresee two forms of patent protection procedures: the full examination and the registration of utility models (previously consensual patents). The supplementary protection certificates are possible to register in Croatia. There is a visible continuation of a well-organized and structured patent law over the last 20 years¹⁵.
- The **new Act on Copyright and Related Rights** (OG 111/21) modernized the copyright system following the needs of digital society and harmonized with the common legal framework of the European Union (Directives 2019/790 and 2019/789).¹⁶
- **The new Trademark Act** harmonized the legal framework for trademark protection. An appropriate legal framework has been established to protect traditional wine terms, traditional specialties guaranteed, geographical indications, and appellations of origin from unauthorized trademark registration by introducing appropriate absolute grounds for refusing trademark registration, and more detailed rules on registration and protection of collective and guaranteed trademarks are provided. The new **Trademark Regulations** were also adopted (OG 38/19) providing certain details, detailed rules, and forms for efficient procedures for registration and maintenance of trademark rights in value.¹⁷
- Industrial design protection is regulated in **the Act on Industrial Design** (OG 173/03, 76/07, 30/09, 49/11 and 46/17). Industrial design can be protected in Croatia in national procedure entirely carried out by the Office, in international procedure conducted through the Hague System for the International Registration of Industrial Designs, whereby the Office carries out a part of the registration process, via the registered Community design administered by the European Union Intellectual Property Office (EUIPO), and via the unregistered Community design, which is not subject to the registration process. The design in the national registration procedure is not examined on general conditions for design protection, that is novelty and

¹⁵ <https://publications.jrc.ec.europa.eu/repository/handle/JRC136807>

¹⁶ Ibidem.

¹⁷ Ibidem.

individual character. Those conditions may be examined upon a request of the interested party in the process of invalidation of a registered industrial design which is conducted by the Office.¹⁸

3. THE NATIONAL DEVELOPMENT STRATEGY OF THE REPUBLIC OF CROATIA 2030

The National Development Strategy of the Republic of Croatia until 2030 (NDS) is prepared in a way that links innovation policies and economic development. The relevant Direction in the NDS 2030 for technology transfer is Development Direction 1 Sustainable Economy and Society, and Development Direction 4 Balanced Territorial Development.

According to Development Direction 1 Sustainable Economy and Society, the economic growth and development of Croatia will be based on increased productivity in the public and business sectors, the creation and use of knowledge, and encouragement of investment, innovation, and new technologies to achieve a technologically dynamic and export-oriented economy. These issues are operationalized within Strategic Objective 1 (SO 1) Competitive and innovative economy, which includes several public policies aimed at the development of a globally competitive, green, and digital industry, the development of entrepreneurship and crafts, the development of science and technologies, the development of sustainable innovative and resilient tourism, and encouraging the development of culture and media¹⁹.

4. THE LABOR ACT

The Labor Act in the Republic of Croatia is an important act when it comes to the issue of ownership over IP rights at universities and their constituents (e.g., faculties) and PROs. At non-integrated universities where universities have limited power (e.g., the University of Zagreb, University of Split, University of Rijeka, etc.) the faculties are separate legal entities having their regulations and funding which directly impacts the employment relationship and ownership over the IPRs. According to the Labor Act, an invention created by the employee belongs to the employer. Some universities and faculties have created their internal regulations on technology transfer and intellectual property rights and have established their own technology transfer offices to manage the TT and IPR protection and commercialization process. These internal regulations regulate mutual relations related to the IP ownership over the scientific research results between the employee (i.e., researcher) and employer (i.e., university/PRO) and their ways of commercialization.²⁰

In addition to the legislative and regulative framework for TT, there are other relevant national and institutional plans, programs, and incentives for supporting and improvement of the TT system:

1. National Recovery and Resilience Plan 2021-2026 and supporting legislative acts

- **Act on the Croatian Science Foundation**
- **Act on Higher Education and Scientific Activity**
- **Act on the Improvement of Entrepreneurial Infrastructure**
- **Act on State Aid for Research and Development Projects**

2. National Guidelines for Technology Transfer

¹⁸ Ibidem.

¹⁹ Ibidem.

²⁰ Ibidem.

3. Technology transfer guidelines/IP policies at universities/PROs

1. NATIONAL RECOVERY AND RESILIENCE PLAN 2021-2026

The Croatian Government put a particular emphasis in its National Recovery and Resilience Plan 2021-2026 (NRRP) on the reforms and investments contributing to green and digital transition. The measures and activities foreseen by the NRRP will contribute to smart, sustainable, and inclusive growth; the creation of new jobs; economic productivity and competitiveness, and strengthening Croatia's economic, social, and territorial cohesion. The total amount of funding secured for NRRP is almost EUR 9.9 billion - EUR 6.3 billion in grants and around EUR 3.6 billion in favorable loans for the implementation period started in 2021 to 2026. Within the NRRP 2021-2026 Croatia's focus, among others, is on supporting measures for the research, development, and innovation framework that includes technology transfer.²¹

The NRRP 2021-2026 has overall 5 components and one initiative. The Component 3. Education, science, and research are relevant for technology transfer and amount to approximately EUR 1 billion (16 % of all investments from the NRRP). This Component is divided into 2 Sub-Components: 3.1. Reform of the education system, and 3.2 Raising the R&I capacity which is relevant for technology transfer. Within the Subcomponent 3.2. Raising the research and innovation capacity, the following reforms and investments in the NRRP are foreseen:²²

Reforms:
C3.2. R1 - Reform and strengthening of the capacity of the public scientific research sector for research and development
C3.2. R2 - Creating a framework for attracting students and researchers in STEM and ICT fields
C3.2. R3 - Improving the efficiency of public investments in the field of research, development and innovation
Investments:
C3.2. R1-I1 - Development of a system of programme agreements for financing universities and scientific institutes focused on innovation, research and development
C3.2. R1-I2 - Strengthening the institutional capacities of universities and scientific institutes for innovation
C3.2. R2-I1 - Development of an incentive model for advancing the career of researchers and conducting top scientific research in the STEM and ICT fields
C3.2. R2-I2 - Investing in research and technological infrastructure in STEM and ICT fields
C3.2. R3-I1 - Introducing a more functional programme framework for research, development and innovation project financing.

Source: NRRP 2021-2026, p. 849.

The NRRP 2021-2026 foresees the establishment or improvement of the framework for innovation incentives as well as the partnership between the research sector, economy, and society in innovation creation.²³

Development of specialized institutions for innovation commercialization such as scientific and technology transfer centers, and start-up and spin-off companies for innovative technologies will be supported. In addition, it is planned to improve the system of institutional financing of universities and scientific institutes to motivate scientific productivity, efficiency, and transfer of knowledge through direct investments and increased financing of scientific research activities. One of the important challenges concerning research and development (R&D) indicated in the

²¹ Ibidem.

²² Ibidem.

²³ Ibidem.

NRRP is the fragmentation (including at the level of institutions such as Zagreb University) ineffectiveness of policies in the field of research and innovation and the lack of results from research, development, and innovation investments²⁴.

The primary focus of the NRRP 2021-2026 funded programme framework is on competitive business-oriented research and innovation programmes such as applied research, experimental development, proof of concept, technology transfer, industry collaboration, and similar²⁵. The NRRP foresees the cooperation on programmes and projects within the NRRP through the **National Innovation Council**. It was established in 2018 as a coordination body for the implementation of the S3 for the period 2016-2020 and presents an umbrella council of the overall National Innovation System. The role of the National Innovation Council within the new S3 until 2029 will be even stronger, especially in the S3 governance system.²⁶

Act on the Croatian Science Foundation

Act on Croatian Science Foundation (OG 57/22) establishes the purpose of the Foundation as the development and promotion of science and technology to ensure sustainable scientific, technological, social, and economic development. The Foundation is the central organization for financing science in all scientific fields in the Republic of Croatia. To achieve its purpose, the Foundation allocates financial resources to:

- **basic research** (from the state budget) and **applied research** (with the help of NRRP) in the early stage of technology readiness and scientific research that is of strategic interest to the Republic of Croatia, and
- for the **development of the careers of researchers at the doctoral and postdoctoral level**.²⁷

Although the support for technology transfer is mentioned in the NRRP concerning the Act on Croatian Science Foundation, it cannot be recognized from the exact provisions of the Act how this goal shall be approached. Technology transfer and commercialization potential were not mentioned as the criteria for financial support from the Foundation, even though the NRRP indicates that this should be one of the aims of the reform of the Foundation in the new Act. The Statute of the Foundation only mentions that the Foundation shall finance, among many others, the programmes that support the cooperation between scientific organizations and the industry by financing the research projects which have possible technological applications aimed at social and economic development.²⁸

Act on Higher Education and Scientific Activity

Act on Higher Education and Scientific Activity (OG 119/2022) regulates universities as formally, substantially, and functionally separated from their faculties, which are separate legal entities. In addition, universities are entitled to establish a legal entity (i.e., faculties) for the performance of the mission of the university and satisfy the needs of the students and the university. Besides universities and faculties, the Higher Education and Scientific Research Act also regulates the

²⁴ Ibidem.

²⁵ Ibidem.

²⁶ Ibidem.

²⁷ Ibidem.

²⁸ Ibidem.

organizational structure and activities of public scientific institutes. They are also established as independent legal entities. The public research institutions are financed through agreements with the Ministry of Science, Education and Youth. Their budgets include basic, development, and implementation components. The development component is particularly important for intellectual property management and commercialization of research results, scientific projects, and programs. The institutional fragmentation of public universities affects governance processes and makes it difficult for universities to develop effective collaboration, reach their full research potential, and build innovation capacity. Most university functions that are, or should be, organized at the central level can also be replicated at the level of specific constituent units of the university. This makes it difficult to implement coherent and impactful strategies in areas such as technology transfer, support for entrepreneurship, utilization of research infrastructure, and science industry collaboration. Since universities in Croatia are not integrated, the consolidation of TT processes, activities, and capacities presents a challenge. Until now, the fragmented organizational structure of the university encouraged the fragmentation of TTOs.²⁹ The new Act on Higher Education and Scientific Activity, among other goals of scientific activity, also mentions the creation of innovations and patents, which is a novelty in comparison to the previous regulation.³⁰

The Ministry of Science, Education and Youth published a document “Catalog of Goals and Indicators” in September 2023. This document presents four strategic goals, special goals together with indicators of results and outcomes which a public higher education institution or a public scientific institute shall choose for the programme contract. The strategic and special goals are taken from the following strategic documents: National Development Strategy, Strategy of Education, Science and Technology, Strategy for Smart Specialisation (S3), National Plan for the Development of the Education 2021-2027, and NRRP 2021-2026. The second strategic goal is relevant for supporting TT: “The strengthening of orientation according to applied research and cooperation with the economy, which involves encouraging the commercialization of research work and results and overcoming the gap between scientific research and the business sector.” The indicators of results are: the number of project applications, the number of technology transfer projects, and the number of researchers engaged in the commercial projects.³¹

Act on the Improvement of Entrepreneurial Infrastructure

Businesses related to the development and improvement of entrepreneurial infrastructure in the Republic of Croatia are regulated by the Act on the Improvement of Entrepreneurial Infrastructure. According to this Act, entrepreneurial support institutions are divided into development agencies (country, local or specific activities), entrepreneurial centres, business incubators (entrepreneurial or for new technologies), entrepreneurial accelerators, business parks, science and technology parks, competence centres, and free zones.³²

Act on State Aid for Research and Development Projects

²⁹ Ibidem.

³⁰ Article 82 of the Act on Higher Education and Scientific Activity.

³¹ <https://publications.jrc.ec.europa.eu/repository/handle/JRC136807>

³² Ibidem.

Act on State Aid for Research and Development Projects (OG 64/18) regulates the rules and conditions for awarding state aid for research and development projects in the category of horizontal aid. It also regulates the competence of the authorities of the Republic of Croatia concerning the awarding of state aid for research and development projects, the procedure for determining the fulfillment of the conditions for exercising rights, keeping records and reporting, and other issues related to exercising the right to grants for research and development projects. The purpose of this Act is to increase private sector investment in research and development and the number of entrepreneurs who invest in research and development, to encourage the cooperation of entrepreneurs with organizations for research and dissemination of knowledge. The scheme for maximum support intensities is regulated: 100 % of the amount of eligible project costs for basic research, 50 % for industrial research, 25 % for experimental development, and 50 % for feasibility studies. Maximum support thresholds are regulated from EUR 300,000 per entrepreneur per project for fundamental research, to EUR 50,000 per feasibility study.³³

The changes in the legislative framework from the new Act on Higher Education and Scientific Activity and the Croatian Science Foundation Act set conditions for the research sector to align more directly with innovation activities and cooperation with the business sector.

2. NATIONAL GUIDELINES FOR TECHNOLOGY AND KNOWLEDGE TRANSFER

The National Guidelines for Technology and Knowledge Transfer were adopted in December 2022, providing a framework for the effective use of results from publicly funded research through proper management of intellectual property and the development of entrepreneurial culture and related skills in public scientific organizations. The guidelines form the basis for further projected investments in technology transfer activities, which will improve the national innovation system. The National guidelines for knowledge and technology transfer provide recommendations and practical advice to technology transfer offices (TTOs) and managers in research organizations to improve technology and knowledge transfer activities and results and therefore they represent an important step in the direction of defining and strengthening the position of TTOs in the Croatian innovation system. The objective of the Guidelines is to provide a framework for the effective use of results of publicly funded research through the proper management of intellectual property, increased commercialization, development of entrepreneurial culture and related skills in public scientific organizations, and for more successful interaction between the public and business sectors.

The Guidelines define certain criteria that must be met for both research organizations and their respective TT units to be eligible for public funding from national financial resources. The research organizations must meet minimum criteria, such as: having technology and knowledge transfer policies, transparent communication with scientists and the public, developed rules and technology transfer processes that are easily accessible to all parties involved in the process; either an internal technology transfer office or a signed contract with an external one; reporting protocols and communication channels with technology transfer office; having determined the transparent general rules for profit sharing, contract research, collaborative research, licensing and establishment of spinoff company.³⁴

³³ Ibidem.

³⁴ Ibidem.

Moreover, entities that perform the activity of technology and knowledge transfer must meet the minimum criteria to be eligible for funding which is more technical, such as that the particular technology transfer office: keeps records on providing services to scientists, has developed a methodology for determining service priorities, has a tool for recording of intellectual property and expertise of scientists, has developed and published a template licensing agreement and provides consultation to scientists on the licensing agreements, provides a template of a data confidentiality agreement and a template of the agreement on co-ownership of intellectual property, offers basic market analysis, offers a basic methodology for cost-benefit analysis, provides a basic valuation of intellectual property (determining the price and licensing conditions), and provides marketing activities, i.e. it has at least marketing activities oriented section on its website. If meeting the given minimum criteria listed above, research organizations and their technology transfer offices will be eligible to acquire financing from public resources for technology transfer activities.³⁵

3. TECHNOLOGY TRANSFER GUIDELINES/IP POLICIES AT UNIVERSITIES/PROs

The largest universities in Croatia have their regulations and guidelines related to IPR management, protection, and commercialization.

The University of Zagreb has the most detailed Guidelines and Rules on Technology Transfer enacted in September 2022. The Guidelines relate to intellectual creations resulting from scientific and artistic research and artistic creation and professional work in the University or one of its Faculties, which are independent legal entities. In addition to the Labour Act and other intellectual property laws, the most important part of the Guidelines and Rules is the one where it regulates in detail which intellectual property creations shall be considered to be created at the University or the Faculty and therefore belong to the employer and not the researcher if not otherwise specially agreed between the researcher and the employer, i.e. the Faculty. It is important to note that the faculties are employers and the researchers their employees. Therefore, all intellectual creations shall belong to the faculties, not the University. If the dean of the faculty decides so, the process of registration and commercialization may be conducted by the University and its technology transfer office. Therefore, cooperation with the University is voluntary. On the other hand, the dean of the Faculty is entitled to decide if the process of registration and commercialization shall be conducted by the Faculty. In this case, she or he may also decide to give the intellectual creation back to the researcher and allow him to dispose of it.³⁶

The University of Split issued Rules on the operation of the Office for Transfer of Technology of the University of Split (March 2022) and Intellectual Property Regulations (April 2022), which regulate that the process of technology transfer shall be conducted by a University technology transfer office and the competent body which is responsible to advise the rector on the registration and commercialization of a particular intellectual creation is an Intellectual Property Committee. The costs of the registration and commercialization procedure shall be borne by the University and in return the University shall own all intellectual property rights.³⁷

³⁵ Ibidem.

³⁶ Ibidem.

³⁷ Ibidem.

The University of Rijeka has issued its Intellectual Property Management Policy and Regulation on Intellectual Property Management. The **UNIRI Regulation on Intellectual Property Management** issued in 2010 regulates the procedures and interrelations of the University of Rijeka (hereinafter University) and its constituents and individuals, and all other persons, regarding the disclosure, evaluation, legal protection, and commercialization of intellectual products created at the University or any of its constituents. This Regulation concerns all intellectual products created as a result of research, scientific, expert, or any other activity at the University or its constituents, in which the means of the University or its constituents have been used (equipment, services, human potential, financial means, time, etc.), including especially those intellectual products created during the work or connected to the work at the University or its constituents, and those intellectual products created in the framework of projects done at the University or its constituents. **The UNIRI Intellectual Property Management Policy** provides guidelines for the intellectual property management for all the UNIRI staff (academic and administrative) and students (undergraduate, graduate, and postgraduate), to disclose, identify and protect, as well as commercialize, the intellectual property generated at UNIRI.

The University of Osijek issued Rules on Technology Transfer in July 2013. They regulate the establishment of a Committee for the evaluation of research results and the ranking and selection of projects eligible for the process of commercialization. The task of the Committee is to assess and rank University projects and recommend to the rector to decide on commercialization. The Committee also instructs the TTO to carry out the registration and commercialization procedure. The University bears the following costs: the procedure for assessing the eligibility and making recommendations for the registration of industrial property rights; the procedure for assessing the economic value of the respective intellectual creation and recommendation for a particular commercialization procedure; and the costs for the registration and the commercialization procedure. In return, the University shall become the owner of industrial property rights and copyrights.³⁸

This flexible system might seem less effective since all the decisions are left in the hands of different deans of the respective Faculties and there is no obligation to engage the Faculty or the University in the process of registration and commercialization. Nevertheless, taking into consideration the legislative framework regulating the system of the public research organization as separate and independent organizational units and laws on intellectual property created in the course of employment, this presents the optimal approach.³⁹

3. Strategy for TT

On the national level, there are several important policies, strategies, and plans in Croatia that emphasize the importance of TT from a strategic point of view.

Croatia's National Recovery and Resilience Plan 2021-2026 has a strategic strong focus and support on the framework for research, development, and innovation. The support for the development of institutions for the commercialization of innovations, such as scientific and

³⁸ Ibidem.

³⁹ Ibidem.

technological infrastructures, technology transfer centers, and start-up and spinoff companies for innovative technologies will be supported through the NRRP.

The Smart Specialisation Strategy until 2029 (S3 2029) aims to improve overall Croatian innovation efficiency and capacities for strengthening competitiveness through three special objectives: improving scientific excellence, bridging the gap between the research and business sectors, and increasing innovation efficiency. The new S3 by 2029 also takes into account the corresponding reforms and investments foreseen in the NRRP 2021-2026. The new S3 until 2029 recognized the NRRP as an important source of necessary structural reforms and financing.

The National Guidelines for TT provide directions for the activities and successful operation of TT offices at Croatian universities and other research institutions. Under the new legislative framework, technology transfer activities will be taken into account when assessing academic success, both at institutional and individual levels, making the role of the TTOs more important.

3.1 Global strategy of HEIs in TT

Universities and other research organizations in Croatia have incorporated the “Third Mission”⁴⁰ (i.e., technology transfer) into their institutional strategies and emphasize the importance of implementation and management of knowledge and technology transfer activities.

Most of the HEIs in Croatia have dedicated units for TT that are responsible for the implementation of TT activities. The established protocols and guidelines for the facilitation and management of the TT process are present at most of the HEIs in Croatia. In addition, most of the HEIs have nominated the vice-rectors who are responsible for the monitoring of TT activities at their respective institutions.

3.2 Map of Stakeholders

The main relevant actors in the Croatian national TT system are identified through the conducted desk research and include the Ministry of Science, Education and Youth (MSEY), the Ministry of Economy (ME), the State Intellectual Property Office (SIPO), the technology transfer units and departments at HEIs and PROs responsible for TT, science parks, centers of competence, centers of scientific excellence, state agencies implementing and managing various programs relevant for TT (e.g., proof-of-concept programs, technology transfer support programs), incubators and accelerators, and early-stage investment funds. The main actors in the Croatian TT system and their roles are presented below.

There are 10 public universities, 25 public research institutes, 11 public polytechnics, 3 public colleges, 3 private universities, 3 private polytechnics, 20 private colleges, 4 technology transfer offices at universities, 3 science-technology parks, and 11 research centers in the industry.⁴¹

⁴⁰ There is an increasing demand for universities to contribute to society by making good use of their knowledge and output to address growing societal and economic challenges. This so-called Third Mission adds to the two traditional purposes of academic institutions: research and teaching. The Third Mission has two key priorities: targeted use and transfer of academic knowledge to help resolve current societal and economical challenges, and transfer and utilization of technologies and innovations through cooperation with public and private enterprises.

⁴¹ <https://www.euraxess.hr/croatia/research-croatia>

The largest universities in Croatia – the University of Zagreb, the University of Split, the University of Rijeka, and the University of Osijek- have their own technology transfer offices responsible for managing and implementing TT activities. The same situation is with the largest research institute – the Ruder Bošković Institute having its own TT unit. Several faculties are very active in academia-industry collaboration and have their own TT units – Faculty of Mechanical Engineering and Naval Architecture of the University of Zagreb with their Centre for Technology Transfer, and Nikola Tesla Innovation Centre of the Faculty of Electrical Engineering and Computer Science of the University of Zagreb. Since universities in Croatia are not integrated universities meaning that their faculties are separate legal entities, they are entitled to have their own rules regarding the TT and IPR (if any). In addition, there are certain faculties and universities with active collaboration with the industry such as the Faculty of Transport and Traffic Sciences of the University of Zagreb and the University of Dubrovnik with their Office for Projects and TT to develop and improve their TT activities.

The **Ministry of Science, Education and Youth (MSEY)** is the main institution responsible for the development of the higher education and research system, the promotion of technological development, the preparation and adoption of acts and policy documents in the area of higher education, research, and technology transfer, and funding of the scientific and research activity. In addition, the MSEY is responsible for various funding programs related to research, innovation, and technology transfer through various programs such as the Program Competitiveness and Cohesion (PCC) and the NRRP.

The **Ministry of Economy's (ME)** main role is in programs that are related to the R&D and technology transfer activities (e.g., Increasing the Development of New Products and Services that Result from R&D activities program, etc.). The Ministry of Economy supports, among others, investments in projects for entrepreneurs (especially start-up or scale-up companies) in the initial or early stages of development and growth stages of high-tech companies and market-oriented R&D activities of scientific organizations and the business sector following S3 priorities, including the collaborative R&D projects.

The NRRP emphasizes a clear division of responsibilities according to the stages of the life cycle of research and development projects, where the Ministry of Science, Education and Youth (MSEY) will focus on support in the earlier stages of technology readiness levels of projects, and the Ministry of Economy (ME) on supporting activities related to later stages of technology readiness levels and commercialization of results.⁴²

The **State Intellectual Property Office of the Republic of Croatia (SIPO)** was established in 1991 and is the state administrative body with responsibilities in the field of protection of intellectual property rights. SIPO is the anchor institution of the intellectual property system and one of the few institutions that continuously strives to develop the national TT system. Collaboration with individuals and institutions is done through their public Information centre open to anyone interested in IPR. In addition, the Academy for IP, is a functional unit, that organizes different types

⁴² <https://publications.jrc.ec.europa.eu/repository/handle/JRC136807>

of training and workshops for academia, industry, SMEs, and representatives of the judiciary system. With some R&D institutions, SIPO has continuous cooperation, even jointly organizing courses on IP or custom workshops and training programs within EU projects. SIPO was actively involved in numerous projects that helped shape the national TT ecosystem framework and actors.⁴³

The Croatian Agency for SMEs, Innovation and Investments (HAMAG-BICRO) was established by the Government of the Republic of Croatia to enhance SME development and promote investment and innovation. The Agency is an independent institution under the supervision of the Ministry of Economy. It is the central agency responsible for supporting SMEs and innovation activities. It is responsible for the implementation of all business research and innovation-related ESIF measures, for some programmes designed by the Ministry of Science, Education and Youth (i.e., Proof of Concept (PoC) and Support for Technology Transfer programmes), as well as for providing support in the implementation of the Smart Specialisation Strategy (S3) and the Innovation Strategy.

Technology transfer offices at universities and PROs in Croatia with their activities and responsibilities have an important role and present a basis for an effective technology transfer process. Today, these offices are expected to meet increased internal and external pressures especially since policymakers consider universities as key actors within the national innovation ecosystems. The roles and activities of the technology transfer office in Croatia differ from university to university. The main and general function of a technology transfer office is to provide a formal and effective mechanism for the commercialization of the universities'/PROs' research results.

The **University of Zagreb** is the oldest and largest university in Croatia. The technology transfer at the university is managed by its **Centre for Research, Development and Technology Transfer (CRDTT)** with 3 departments for technology transfer, business development, and EU projects. The role of the Centre is: to assist research groups at the university in securing financial support for research and development, to connect research groups with partners from the business sector, and to help establish collaboration in the development of technology and commercialization of intellectual property created at the university, and to provide support to researchers and students in establishing companies and knowledge-based businesses.⁴⁴ Most of the team is employed on a temporary and project basis and is insufficient in terms of numbers and range of specialized skills to fulfill all the tasks it should do according to the TT regulations.⁴⁵

The **University of Split Technology Transfer Office (UNIST TTO)** operates under the Department for Science and Innovations. It is a central point for connecting science and the industry and a starting point for finding partners in the industry who need the knowledge and research-analytical capacity of the University. The Office operates to increase the commercialization of the University's intellectual property and strengthen the link between the University and the industry.

⁴³ Ibidem.

⁴⁴ <https://cirtt.unizg.hr/en/about-us/>

⁴⁵ <https://publications.jrc.ec.europa.eu/repository/handle/JRC136807>

Through its activities, it promotes an innovation culture and entrepreneurial spirit among students and scientists and provides advice and support in the transfer of knowledge and research results from the University to the economy to address societal challenges and increase economic competitiveness. The activities of the Office are focused on fostering knowledge-based entrepreneurship and the commercialization of knowledge and scientific research results.⁴⁶

The central point for issues in the field of innovation and knowledge transfer at **the University of Rijeka** is the **Centre for Innovation Initiatives (UNIRI CII)**, which operates within the University Centre for Research and Innovation. The Centre for Innovation Initiatives provides support for the implementation of the university's innovation policy, and some of its tasks include monitoring and evaluating the innovation capacity and production of the University and its constituents, proposing and developing new ideas/tools regarding the improvement of the University's innovation capacity, improving the visibility of the University in the field of research and innovation and the popularization of science, informing the University and constituents about the possibilities of financing and participating in innovation projects, conducting activities within existing EU projects in the field of innovation and knowledge transfer, as well as monitoring innovation activities at the level of YUFE and YERUN networks.⁴⁷

The **University of Osijek** manages its knowledge and technology transfer activities through the **TERA Tehnopolis Ltd.** Founded in 2002 as a limited liability company and as a result of cooperation between Josip Juraj Strossmayer University, the city of Osijek and Osijek-Baranja County. The activities of TERA Tehnopolis, a limited liability company for supporting new technologies, innovations, and entrepreneurship, aim to connect science and economy and secure the infrastructural, financial, and consulting support for innovative and technologically based projects. The Technology Transfer Office within the Tera Tehnopolis commercializes the intellectual property of the University of Josip Juraj Strossmayer of Osijek and strengthens the link between the University and the economy.^{48,49}

The knowledge and technology transfer process at the **Faculty of Electrical Engineering and Computer Science of the University of Zagreb (UNIZG FER)** is organized and managed through **the Nikola Tesla Innovation Centre (ICENT)**, a stand-alone institution established in 2015 to support the development of technologies up to TRL 4-6. The ICENT is sustainable and self-financing through projects. In addition to managing numerous projects, the ICENT supports intellectual property protection and commercialization and operates an incubator established by the FER.⁵⁰

The **Faculty of Mechanical Engineering and Naval Architecture of the University of Zagreb** is another faculty known for its collaboration with industry. Founded in 1996, **the Centre for Technology Transfer (CTT)** is a limited liability company responsible for knowledge and technology transfer at the Faculty of Mechanical Engineering and Naval Architecture. Its 5 main

⁴⁶ <https://www.unist.hr/innovations-and-knowledge-transfer/16631>

⁴⁷ <https://uniri.hr/en/science-and-research/technology-transfer/>

⁴⁸ <https://tera.hr/en/about-us/>

⁴⁹ <https://tera.hr/en/technology-transfer-office/>

⁵⁰ <https://publications.jrc.ec.europa.eu/repository/handle/JRC136807>

pillars of activity are Knowledge Transfer to the economy, Projects, Lifelong Learning, Incubation and Acceleration of Ideas, and Incubation of Start-up and Spinoff Companies with the Start-up Incubator.⁵¹

The **Science and Technology Park of the University of Rijeka (Step Ri)** was funded by the University of Rijeka and runs a pre-incubation and incubation programme. These programmes are aimed at students, researchers, or existing start-ups associated with the University of Rijeka. So far, more than 200 potential entrepreneurs and start-ups have been supported. However, they see a major challenge in motivating researchers to fully dedicate themselves to start-up development. Step Ri continues to maintain close relationships with early-stage investors and is an active member of a regional network of business support organizations where they share their knowledge with other parks and incubators.⁵² Step Ri provides consulting programs and advising processes for the establishment of start-ups, new products and services development, scaling-up of existing businesses, IPR protection support, assessment, and commercialization strategies for SMEs and researchers who want to become entrepreneurs.

The **Zagreb Innovation Centre (ZICER)** is the largest start-up center in Croatia. It offers incubation and acceleration programs. In recent years, the main focus has been on the start-up accelerator called Start-up Factory. The program offers convertible loans, mentors, coaching, and networking. Originally, the program was focused on smart city solutions, but today it supports start-ups from all areas of the national smart specialization strategy. Today, ZICER hosts about 100 start-ups. About 10-15 percent of the companies have generated some kind of intellectual property. Recently, ZICER has also put more emphasis on technology transfer. They have been promoting their services to faculties and thus manage to attract 2-3 start-ups coming from HEI or PROs every year.⁵³

There are certain HEIs and PROs in Croatia that have their incubators or are involved and have collaborations with particular existing ones. The examples are:

- TERA Technopolis Ltd. is certified to implement an acceleration program, whose role is to give intellectual services to support the development of technologies at TRL 5-8 stages;
- The Centre for Research, Development and Technology Transfer of the University of Zagreb (UNIZG CRDTT) is running a sector-specific pre-acceleration program in partnership with Lean Startup Croatia and Biocentre;
- The Faculty of Electrical Engineering and Computing of the University of Zagreb has its incubator SPOCK focusing on teams and startups from the University of Zagreb, annually hosting approximately 5 teams;
- The Centre of Technology Transfer at the Faculty of Mechanical Engineering of the University of Zagreb also runs its own business and student incubator;
- The Ruđer Bošković Institute collaborates with the Start-up Factory program run by ZICER; and
- The University in Split runs its incubator for high technologies called SPINIT.⁵⁴

⁵¹ Ibidem.

⁵² Ibidem.

⁵³ Ibidem.

⁵⁴ Ibidem.

Despite there is a large number of incubators and accelerators, the number of start-ups or spin-offs that have emerged from HEI or PRO is still very small.

4 TT Structures

The current technology transfer structure at Croatian universities and PROs is organized according to the particular university/PRO strategy and needs. The technology transfer units at universities and PROs in Croatia are mostly established and function as organizational units (e.g., Centers) within the institutions and without legal personality. These units currently facilitate and manage the TT operations, business development, and the preparation and implementation of various national and EU projects and programs, and provide support in these areas at the University/PRO level. They usually support the implementation of innovation policy at universities/PROs by monitoring and evaluating its innovation capacity, proposing new ideas and tools for improvement, enhancing the universities/PROs visibility in research and innovation performance, informing researchers on funding opportunities, and participating in EU projects related to innovation and knowledge transfer. These units work closely with relevant departments within the University's central administration (which holds legal entity status), as well as with similar offices at various University faculties and institutes, which operate as separate legal entities such as the Centre for Research, Development and Technology Transfer of the University of Zagreb, and Centre for Research and Innovation of the University of Rijeka. On the other hand, there are also examples where the technology transfer is performed by dedicated companies, such as Ruđer Inovacije Ltd., founded by the Ruđer Bošković Institute, and Tera Tehnopolis Ltd., founded by the Josip Juraj Strossmayer of the University of Osijek. When the implementation of technology transfer process and activities are assigned to a dedicated company, it opens up the potential for creating a larger organization with more specialized roles, enabling a wider range of services for researchers and startups. One such example is Tera Tehnopolis Ltd.

Technology transfer offices at universities implement TT activities and provide various services to researchers. The TT structures and activities for particular universities in Croatia are presented.

The Center for Research, Development, and Technology Transfer within the University of Zagreb operates as an organizational unit without a legal personality. The Center currently coordinates activities of the Technology Transfer Office, Business Development Office, and EU Projects Office in support of research groups at the University. These offices also cooperate closely with all other relevant offices within the Rectorate of the University of Zagreb (as the legal entity), but also with the offices for technology transfer, projects, and others, which are on the University Faculties (faculties and art academies have the status of constituents with legal personality, they are separate legal entities). The University of Zagreb **Technology Transfer Office** provides support for innovation creation, development, and knowledge and technology transfer. The support is aimed at: Project Cycle Management, Innovation Development, Knowledge and Technology Transfer, and Intellectual Property Management. The Project cycle management support includes the identification of national and international funding sources for the University's primary activities and constituents (NPOO, ESIF, Union Programs), Development of project ideas, formulation of project ideas into project proposals, Finding partners/networking, Support in the processes of application, contracting and project implementation,

Communication with contractual and intermediary bodies/donors, and Training of researchers, teaching and non-teaching staff on project cycle management.⁵⁵

The **University of Split Technology Transfer Office** operates to increase the commercialization of the University's intellectual property and strengthen the link between the University and the industry.

The activities implemented by the Office are focused on fostering knowledge-based entrepreneurship and the commercialization of knowledge and scientific research results and include: establishing and enhancing collaboration between the research and business communities, establishing contacts for participation in research and development programs, Intellectual property protection and strategy, entrepreneurship training for researchers and students, establishing contacts with business partners, creating opportunities for business internationalization and entry into new markets, providing education with current and applicable entrepreneurial knowledge, and addressing other issues related to starting and successfully conducting entrepreneurial activities. Procedures of intellectual property protection and technology transfer process at the University of Split are regulated by the Rulebook on intellectual property and the Rulebook on the work of the Technology Transfer Office. Furthermore, to foster the commercialization of research results in 2022 Fund for IP Protection was established ruled by the Procedures for managing the funds allocation.⁵⁶

The **University of Rijeka Centre for Innovation Initiatives** implements and provides various activities and services. To raise awareness of the importance of the protection and management of intellectual property developed at the University and to accelerate the process of its commercialization, the Centre for Innovation Initiatives: encourages the development of intellectual property at the University, identifies, evaluates, and protects the intellectual property of the University, commercializes the intellectual property of the University, and encourages collaboration between the academic community and the economy. Centre for Innovation Initiatives provides the following services to scientists in transferring the results of research and professional work of the University to the economy: educating scientists and students of the University on the importance of technology transfer and intellectual property, expert assessment of the commercial potential of research results, advising on the possibilities of intellectual property protection and modes of commercialization, finding a commercialization partner, finding funding sources, presenting and promoting the results of scientific research and professional work to the scientific, professional, and general public. In addition, the scope of work of the Centre includes the implementation of the UNIRI-INOVA Call for proposals for institutional financing of interdisciplinary scientific and development projects involving stakeholders from the economy and/or the community, which encourages the transfer of knowledge between the academic community and the economy.⁵⁷ The University of Rijeka where the Centre for Innovation Initiatives (CII), as a part of the University's Centre for Research and Innovation, collaborates closely with the Science and Technology Park of the University of Rijeka (Step Ri) on knowledge transfer activities. While the CII focuses on the initial TRL phases, the Step Ri assists with commercializing scientific discoveries, licensing, and product development, and offers incubation and office lease services.

⁵⁵ <https://cirtt.unizg.hr/en/researcher-support/>

⁵⁶ <https://www.unist.hr/innovations-and-knowledge-transfer/16631>

⁵⁷ <https://uniri.hr/en/science-and-research/technology-transfer/>

The structure of **TERA Tehnopolis Ltd.** is designed to flexibly support TT through a range of services provided by its Technology Transfer Office. It is a hierarchically shallow, lean organizational approach (director and expert associates) with each agent within the organization playing a role in facilitating TT. This approach ensures that TERA Tehnopolis can effectively meet the needs of projects, driving their growth and advancement. The Technology Transfer Office takes care of all aspects of the technology transfer of the J. J. Strossmayer University in Osijek and strengthens the ties between the University and the economy. The work of the Technology Transfer Office includes the following stages: Idea formation, From idea to product, Commercialization, Aftercare and control, and IP portfolio management. The Technology Transfer Office helps researchers go from initial idea to product, covering all issues around ownership, validation, commercialization agreements, intellectual property protection, and valuation. In the domain of intellectual property, TTO provides services for guiding researchers through the process of presenting inventions, preparing relevant forms and manuals for researchers, and developing the evaluation process to help the research organization in decision-making related to the continuation of the commercialization process. In the validation process, basic legal and market validations are made. During commercialization, TTO prepares an internal agreement on commercialization that defines the roles and responsibilities of all parties (inventor, department, faculty, university, TTO), and transparently and clearly defines the distribution of income from commercialization. To decide on the protection of intellectual property, in the first step, TTO prepares a cost-benefit analysis for the possible protection of intellectual property and provides researchers with project evaluation services. In the process of commercialization, TTO provides support to researchers based on the type of commercialization such as contract research, collaborative research, intellectual property licensing, and spin-out companies. Aftercare and control include keeping records of information on all partners and potential partners, attracting new partners through social and networking activities, and preparing long-term programs for partners with defined rules, access for researchers and students, etc. Within the IP portfolio management, TTO maintains data on the IP portfolio and monitors patent maintenance costs on an annual basis.⁵⁸

The responses gathered from collected surveys identified the common services covered by the TT structures at universities: advising researchers to identify results with commercial value, evaluating the commercial potential of the disclosed innovations, finding the industrial partners, commercializing innovations, providing administrative functions in support of the IP protection and technology transfer functions, and advising on the creation and management of spin-offs. In addition, almost all respondents agreed that particular aspects of the existing TT structure that require improvement are in the areas of economic resources, relevance, training of the personnel involved, marketing orientation, and contact with the rest of the ecosystem (industrial companies or target audience).

There is an informal cooperation between TTOs and TTO representatives present in Croatia. They meet occasionally at different universities or PRO and discuss relevant issues related to the TT on national and institutional levels. It is recommended that TTOs join forces and create a formal network/consortia, which would bring several benefits to the whole network and the overall Croatian TT ecosystem. Some of the concrete benefits would include peer-2-peer exchange of knowledge and experience, joint resources to provide improved TT support services, increased critical mass of competencies and central promotion of promising technologies and projects interesting to investors, shared industry networks for commercialization, increased number of

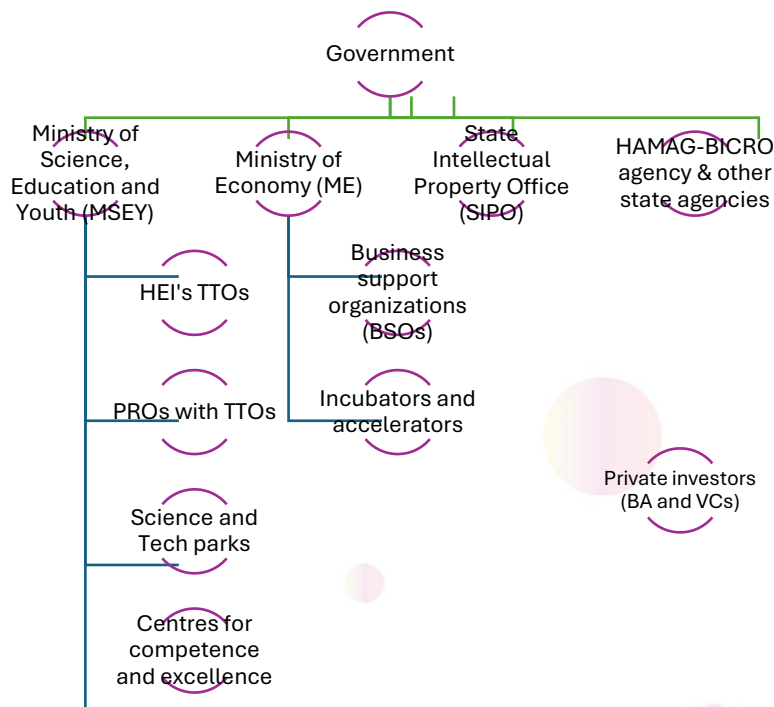
⁵⁸ <https://tera.hr/usluge/ured-za-transfer-tehnologije/>

successful cases proving the positive impact of TTOs, concentration of resources for implementation of larger projects and events for greater visibility and promotion of TT, and acting jointly and coherently in a dialogue with government in the design of policy measures.⁵⁹

4.1 TT System Scheme

The scheme of the TT system in Croatia is presented in Figure 5.

Figure 5: **TT system in Croatia**



Source: Author

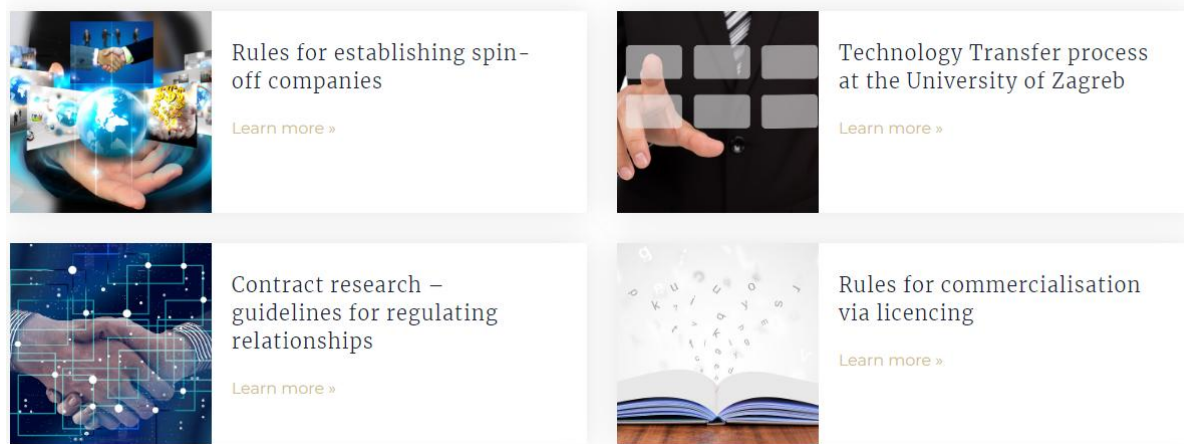
4.2 TT Procedures

HEIs and their respective Technology Transfer Offices (TTOs) in Croatia are responsible for the implementation, management, and monitoring of TT procedures in their respective organizations.

While the survey respondents generally agreed that Croatia has a general procedure for technology transfer (TT) rather than specific procedures for each type, a review of available documents and online sources shows that these general procedures do contain sections addressing specific forms of technology transfer. The specific information related to the management of the TT process at the University of Zagreb available online for the general public is presented in Figure 6.

⁵⁹ <https://publications.jrc.ec.europa.eu/repository/handle/JRC136807>

Figure 6: Specific information related to the TT activities at the University of Zagreb⁶⁰



The "Rulebook on Intellectual Property Management at the University of Rijeka"⁶¹ states that the University can co-found a spin-off company with a maximum share of 25%, along with other regulatory elements specific to this type of transfer. Similarly, documentation from the University of Zagreb also explicitly regulates the establishment of spin-off companies by the University and its faculties.⁶² In addition to this type of technology transfer, the issues of intellectual property licensing and trademark use are also specifically mentioned and regulated. The University of Zagreb issued recently (in August 2022) the most comprehensive regulation and guidelines for technology transfer.⁶³

These documents are designed to address the unique requirements and challenges associated with different types of technology transfer, whether it involves patents, licensing agreements, spin-offs, or collaborative research and development (R&D) projects. These documents usually have attachments with different templates that help in the process, such as the invention disclosure form.

Most HEIs in Croatia have detailed procedures explained regarding the **Patent licensing**. This process includes disclosure procedure, evaluation, decision-making procedures, internal agreements regulating relationships regarding ownership and future royalties, patent filing, negotiating licensing agreements, and managing royalties. For technology transfers that involve the creation of a **new company (spin-offs)**, specific guidelines explain how to structure the company, secure funding, and protect the technology. When technology transfer involves collaboration between universities or research institutions and industry, procedures include drafting collaboration agreements, handling IP ownership, and ensuring compliance with national and EU regulations. For the **Material Transfer Agreements (MTAs)** between institutions, some faculties or their centers like the Centre for Proteomics of the Faculty of Medicine⁶⁴ of the

⁶⁰ <https://cirtt.unizg.hr/en/technology-transfer-regulations/>

⁶¹ <https://uniri.hr/o-sveucilistu/dokumenti-i-propisi/>

⁶² <https://cirtt.unizg.hr/en/technology-transfer-rules-en/rules-for-establishing-spin-off-companies/>

⁶³ <https://cirtt.unizg.hr/wp-content/uploads/2023/04/Smjernice-upravljanja-intelektualnim-vlasnistvom-na-Sveucilistu-u-Zagrebu-okvir-update.pdf>

⁶⁴ <https://capri.com.hr/>

University of Rijeka, have their procedures in place to manage these exchanges, ensuring that the terms of use, IP rights, and confidentiality are clearly defined. All respondents to the questionnaires agreed that the costs related to services in each case are not well-defined. Therefore, the specific forms of technology transfer are incorporated into the general documents regulating technology transfer. However, the experts in the field emphasize that these provisions may not be sufficiently detailed and there is a need to define costs associated with services in each case.

4.3 Strengths and Weaknesses of TT Units/Offices

Technology Transfer (TT) units/offices within Croatian higher education institutions (HEIs) and research institutes exhibit both strengths and weaknesses that influence their effectiveness in fostering TT and commercializing research outcomes. According to the received answers from surveys, below, in the table, are identified strengths and weaknesses observed in TT units/offices.

Strengths	Weaknesses
University management support to TT activities	Unstable funding for TT activities
Willingness of TT staff to learn and advance their services	The high number of skilled professionals leaving
Development of supporting tools and regulations	Project-based contracts
Scouting ideas/technologies	The low number of TT personnel
Interacting with financial stakeholders	Assessing IP potential, validating technologies
Scope of work	Securing TTO Staff skills, Organising the TTO for optimum growth - undefined strategy of human resources development in this field of work
Organizational flexibility combined with expertise and experience	Accessing finance
Comprehensive services	Limited Financial Resources
Bridging and transformative power	Resource Constraints for Scaling Up
Flexibility	Challenges in Market Penetration and Commercialization
Strengths of a network	TT is not a priority within strategic objectives

4.4 TT Structure Best Practices

Technology Transfer Offices (TTOs) in Croatia have an important role in consulting researchers about the process of turning research results into valuable assets ready to be offered to the industry. From the conducted survey an overview that highlights the best practices of Croatian TTOs, focusing on how their organizational structures enhance the technology transfer process is presented.

THE CENTRE FOR RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER, UNIVERSITY OF ZAGREB

The structure of the Technology Transfer (TT) framework at the University of Zagreb is characterized by its comprehensive approach to promoting knowledge and technology transfer, as well as entrepreneurial activities. It encompasses a wide range of initiatives and programs, including incubators, accelerators, innovation forums, and industry-academia partnership programs. A key feature of this structure is the establishment of a robust institutional regulatory framework for managing intellectual property (IP). This framework is supported by the adoption of critical documents, such as the "Guidelines for the Management of Intellectual Property" and the "Rulebook on the Management of Intellectual Property" at the University of Zagreb.

A holistic and proactive approach to technology transfer and intellectual property management resulted in the collaborative development of these documents, with input from the Commission for Innovation and Technology Transfer, and support from the University of Zagreb Rector and Senate. In addition, there is a Vice-rector for Innovation, Technology Transfer, and Cooperation with the Economic Sector responsible for the TT activities. This ensures that the framework is not only aligned with institutional goals but also responsive to the needs of the university's constituents. By creating a coordinated mechanism for managing IP, this structure strengthens the university's capacity to protect and commercialize its innovations, thereby enhancing its impact on both academia and industry.

THE CENTRE FOR INNOVATION INITIATIVES, UNIVERSITY OF RIJEKA

The TT structure at the University of Rijeka shares similarities with those at other Croatian universities. It stands out due to its particular features: a vice-rector responsible for innovation and knowledge transfer, an overarching support service from the Centre for Innovation Initiatives (CII) within the University Centre for Research and Innovation, and the Expert Council for Research and Innovation, which includes vice-deans overseeing research and innovation. The presence of a vice-rector responsible for innovation and knowledge transfer ensures high-level and focused leadership. This role centralizes responsibility for coordinating innovation efforts and managing technology transfer activities, which enhances strategic alignment and accountability. The University Centre for Research and Innovation acts as a comprehensive support service for research and innovation activities. This integration facilitates streamlined processes and better coordination among different units involved in technology transfer and research. The Expert Council for Research and Innovation, composed of vice deans in charge of research and innovation, offers a structured approach to overall governance. This Council helps to align the university's innovation strategies with its academic and research goals, ensuring that policies and initiatives are effectively implemented and monitored within the University.

TERA TEHNOPOLIS LTD.

TERA Tehnopolis Ltd. has established a flexible and modular support system that adjusts to the specific needs of each TT project. This adaptability is crucial in a region where TT projects are still developing. By customizing support services based on project requirements, TERA Tehnopolis

ensures that resources are utilized efficiently and effectively, addressing the unique challenges of each initiative. The organization actively develops and provides tools and services that offer partners access to critical knowledge, expertise, and technologies. TERA Tehnopolis supports pilot projects, testing, and experimentation, which are essential for refining innovations and assessing their potential. Additionally, it offers extensive business consulting, training sessions, and workshops in areas such as business planning, market analysis, financial planning, and strategy development. These efforts are designed to build the capabilities of partners and drive successful TT outcomes.

TERA Tehnopolis collaborates with partners to refine business models and scale operations while ensuring robust protection of intellectual property (IP). The organization provides expert consulting on strategies, technology implementation, and process optimization. A significant aspect of this support is IP Management, where TERA Tehnopolis offers advice on patents, trademarks, and copyrights. Through targeted training and workshops, it equips entrepreneurs and SME managers with the skills needed to navigate and thrive in the IP landscape. TERA Tehnopolis plays a key role in fostering collaboration by initiating contacts and facilitating partnerships between private enterprises, universities, and development agencies. This network-building activity promotes knowledge exchange and joint projects, thereby strengthening the overall innovation ecosystem. By creating opportunities for collaboration, TERA Tehnopolis helps integrate diverse expertise and resources, enhancing the impact of technology transfer efforts.

STEP RI SCIENCE AND TECHNOLOGY PARK OF UNIVERSITY OF RIJEKA LTD.

Step Ri has appointed a dedicated individual to oversee and facilitate the TT process. This role is instrumental in coordinating with professionals across various departments within the university and connecting with external partners through a network. This coordination enhances knowledge exchange and fosters collaboration across different organizational formats, including higher education institutions (HEIs) and private companies.

A key component of Step Ri success is its use of its infrastructure to incubate start-ups and spin-offs. Step Ri provides tailored facilities and resources designed to support the growth of early-stage ventures. By offering such infrastructure, Step Ri creates an environment conducive to the development and scaling of new companies, which is crucial for effective technology transfer.

In addition to its infrastructure, Step Ri benefits from a team of its experienced consultants and mentors. These experts provide essential guidance on various aspects of business development, including market entry, business planning, and strategic growth. Their mentoring helps start-ups with the potential to protect their IP to navigate the complexities of technology transfer and commercialization, thereby enhancing their chances of success.

A notable strength of Step Ri is its ability to build technology transfer capacity within the University of Rijeka while maintaining flexibility in its operations and financial self-sustainability since they are established as a „not-for-profit“ company. Furthermore, as a self-sustaining entity, the Step Ri model ensures long-term viability and independence, which is critical for sustaining its impact and continuing to foster innovation. Step Ri’s integrated approach to technology transfer, characterized by dedicated oversight, collaborative networks, strategic use of infrastructure, and expert mentoring, demonstrates a robust model of best practice. This approach not only drives

successful technology transfer outcomes but also ensures the organization's flexibility and sustainability, making it a leading example in fostering innovation and entrepreneurship.

5 TT Instruments

There are several programs used to promote technology transfer (TT) from Higher Education Institutions (HEIs) in Croatia and involve:

- Organization of seminars, workshops, and info days,
- Using the opportunities through the EEN network,
- Regional Innovation Matchmaking Platform (RIMAP) and dedicated funding schemes,
- Creation of Spin-offs,
- Licencing agreements,
- Research contracts, and
- Cooperative research agreements.

Seminars, Workshops, and Info Days on Intellectual Property Rights (IPR) and Commercialization

These events are crucial for raising awareness and capacity building among researchers at universities/PROs regarding intellectual property and its commercialization. They often cover topics like patent searching, application processes, and strategies for converting research into marketable products. For example, during World Intellectual Property Day on April 26, each year in many locations in Croatia, TTOs and other support organizations organize events to promote IP protection and commercialization. Such events also emphasize the importance of ethical research and help institutions improve their innovation outputs by translating research into potential patents, etc.

Enterprise Europe Network (EEN)

The EEN provides a platform for SMEs, including spin-offs from universities, to find international partners and access new markets. It offers a valuable service by enabling the offer or request of technology through its network. EEN helps universities and research institutions by connecting them with businesses interested in licensing new technologies or forming joint ventures. This network plays a vital role in ensuring that innovations developed within universities reach the market. Some actors in the TT system, like STEP RI Science and Technology Park of the University of Rijeka, are partners in the EEN consortium in Croatia offering support in the country to everyone, free of charge.

Regional Innovation Matchmaking Platform (RIMAP) and INOVA funding program

To motivate researchers to engage in knowledge transfer, the University of Rijeka has developed the **UNIRI-INOVA funding program**. Each year, the University announces a Call "UNIRI-INOVA" for financing or co-financing interdisciplinary scientific and development project proposals from the University of Rijeka scientists in cooperation and through networking with partners and stakeholders from complementary parts of the so-called five-fold innovation spirals, all with the aim of two-way transfer of knowledge and consequent regional economic and social development. The purpose of the Call is to support and encourage the achievement of the goals and quantitative and qualitative indicators of the University Strategy for the period 2021-2025, as well as internationally relevant indicators and goals of the European Strategy for Universities. Proposed projects can cover all forms of knowledge transfer but to participate, applicants are

obligated to post a profile for collaboration with other HEIs, RO, or industry on a **Regional innovation matchmaking platform (RIMAP)** which is publicly available, created by the Regional Development Agency PRIGODA in cooperation with the University of Rijeka for introducing the potential collaboration capacity between industry and academia in Primorje-Gorski Kotar County.

Creation of Spin-offs

HEIs support the creation of spin-off companies by providing resources, mentorship, and sometimes financial support to faculty, staff, or students who wish to commercialize their research through entrepreneurship. It helps bring academic research to the market. This not only contributes to economic growth but also provides practical experience and potential financial returns for the institution.

Licensing Agreements

Licensing agreements allow HEIs to grant external organizations the rights to use, produce, or sell a particular technology or intellectual property (IP) developed at the institution. These agreements can be exclusive or non-exclusive and typically include terms for royalties or lump-sum payments. Licensing enables HEIs to monetize their IP while ensuring that their innovations reach the market. It also fosters industry-academic partnerships and encourages further development of the licensed technology.

Research Contracts

Agreements between HEIs and external entities (such as companies or government agencies) to conduct specific research projects that outline the scope of work, deliverables, timelines, and funding. They facilitate the commercialization of research outcomes by providing the industry with access to academic expertise, while also generating revenue and real-world applications for HEIs.

Cooperative Research Agreements (CRAs)

The Cooperative Research Agreements involve collaborations between HEIs and external partners, such as private companies or other research institutions, to jointly conduct research and development (R&D). These agreements allow both parties to pool resources, share knowledge, and accelerate the development of new technologies or innovations. They often include terms regarding IP ownership, commercialization rights, and profit-sharing.

These programs, individually or in combination, help HEIs translate their research into tangible products, services, or companies, ultimately driving innovation and economic growth.

5.1 Exchange of Research Staff with Companies

The mobility actions and mechanisms for the mobility and exchange of the research staff in Croatia are mostly oriented to the various fellowship programs (Marie Skłodowska-Curie Actions) and Erasmus mobility schemes. Despite desirable, university-business mobility is still not sufficiently developed and supported.

Particular HEIs in Croatia have introduced the elective or compulsory course named **“Professional Practice”** for undergraduate and graduate students. Professional practice in higher education is extremely important for all stakeholders in the education process. It opens the door to the world of work for students. Through professional practice, students enrich their

practical knowledge and skills and gain their first work experience. Professional practice is also of particular importance for employers since it can be a source of future employment and one of the foundations of building human resources and resources. Undergraduate and graduate students get to know work in the profession through professional practice or in professions outside of the profession, to further shape their career development and acquire professional qualifications skills, and competencies that will one day increase their competitiveness in the labor market. By acquisition of this work experience already during studies enables independence in performing certain tasks, and students are put in direct contact with potential future employers, facilitating their future employment.

There are certain programs available for mobility and training such as Start-ups/spin-offs of young researchers, Development Research Grants, and the Entrepreneurship Traineeships Program.

5.2 Internationalization of Knowledge Transfer

Instruments for the internationalization of KT and TT in Croatia are designed to facilitate collaboration, enhance global reach, and leverage international networks for the commercialization and dissemination of research outcomes. There are several instruments available for the internationalization of KT and TT and the selected ones are elaborated.

- **International Collaboration Agreements**

There are many formal agreements initialized between HEIs, research institutes, and companies within international consortiums working together on a specific project. Often, they use support from Departments for EU Projects or Technology Transfer Offices (TTOs) to properly address matters such as the creation of project proposals, budget IP protection, and commercialization of technology. Each partner in the consortium gains access to international expertise, markets, and funding opportunities, enhancing the impact and scalability of research outcomes.

- **EU and national funding initiatives**

The EU's key funding program for research and innovation, **Horizon Europe**, allows Croatian entities to participate and to get significant support for international collaborative projects now with a framework programme for 2021-2027 and with an initial budget of 95.5 billion€.

Researchers have an opportunity to apply for the **Marie Skłodowska-Curie Fellowships program** to come to work in European research groups or for European Research Council grants to establish a research group in Europe. They can be included as partners in research consortia submitting collaborative research proposals and if they plan to establish a start-up or a Small or Medium sized Enterprise in Europe, they can apply for funding from the **European Innovation Council**⁶⁵.

An intergovernmental network supporting market-oriented R&D and innovation projects, **EUREKA** and **Eurostars** instrument, invite Croatian companies and research institutions to apply for funding through international collaboration. **Eurostars** is a funding instrument that supports

⁶⁵ https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/europe-world/international-cooperation_en

innovative SMEs and project partners (large companies, universities, research organizations, and other types of organizations) by funding international collaborative R&D and innovation projects. Innovative SMEs must have the leading role.

The EU-funded programs such as **Erasmus+** support mobility and cooperation between universities, researchers, and industry partners across Europe.

- **Regional and Bilateral Programs**

Croatia has several regional and bilateral agreements with countries in Europe and broader to promote scientific and technological cooperation, which often include mechanisms for technology transfer.

The Central European Initiative (CEI) promotes regional cooperation among Central, Eastern, and South-Eastern European countries. It includes often capacity building by transferring and sharing know-how and Croatia is part of that initiative. All CEI Member States have an opportunity to apply for funding through the **CEI Cooperation Fund** (established in 2001) which co-finances activities aimed at strengthening cooperation among the CEI Member States where one of the focused sections involves technology transfer.⁶⁶

Another initiative for which Croatia has been eligible since 2013 is **Innovation Norway**, the most important Norwegian Government instrument for innovation and development of Norwegian enterprises and industry. It supports companies in developing their competitive advantages and in enhancing innovation. Croatia became eligible in 2013 after joining the EU and becoming the signature of the EEA agreement. Until now, applicants from Croatia received 103.4 m€. Grants from EEA in total 56.8 m€ and Norway Grants 46.6 m€.⁶⁷

Another example of bilateral cooperation and programs is the **Croatian-Swiss Research Programme (CSR)**. The total budget of the Programme is CHF 4,670,000 (Swiss contribution 85.7% and Croatian 14.3%). The CSR finances joint research projects between principal investigators in the total amount of CHF 400,000 for three years.⁶⁸

There are other bilateral programs developed with several countries that are available to Croatian researchers and students. Applicants have to apply with international scientific research project proposals to receive support from actual agreements with countries: Albania, Austria, France, India, China, Hungary, Macedonia, Germany, USA, and Slovenia.⁶⁹

- **International Research and Enterprise Networks**

Croatia has six of its business support organizations in the **EEN (Enterprise Europe Network)**, a network that helps SME businesses innovate and grow on an international scale. It provides partnership opportunities, advice, and other needed support for SMEs in Croatia. European research, development, and innovation projects (RDI) is one of the strategic services provided by the European Enterprise Network (EEN) to support innovation and research within European

⁶⁶ <https://www.cei.int/>

⁶⁷ <https://eosmidlene.regjeringen.no/english/>

⁶⁸ <https://hrzz.hr/en/funding-programmes/international-cooperation/>

⁶⁹ <https://mzom.gov.hr/istaknute-teme/medjunarodna-suradnja-i-eu/bilateralna-suradnja/199>

enterprises. These projects are aimed at encouraging cooperation between companies, research institutions, and other stakeholders to develop new products, services, or technologies and to boost the competitiveness and sustainability of the European economy.⁷⁰

Internationalization of knowledge and technology transfer activities through specific instruments and strategies not only promotes global collaboration but also enhances the competitiveness and impact of research outcomes. By leveraging international networks, agreements, and programs, HEIs and research institutions in Croatia can effectively bridge research excellence with market opportunities worldwide, driving innovation and societal impact on a global scale.

5.3 Tools Used to Publicize the Generated Knowledge

HEIs and research institutions promote their technology transfer (TT) and knowledge transfer offers through a variety of available tools and platforms to reach potential industry partners, entrepreneurs, and investors. The common tools and methods used for promoting their offerings in Croatia are:

- Technology Transfer Offices (TTOs) websites,
- Technology Catalogues and Databases,
- Technology Fairs and Exhibitions,
- Brokerage Events and Matchmaking Platforms, and
- Social Media and Online Presence.

TTOs websites

There are certain websites hosted by universities' TTOs or institutional research offices that showcase the available technologies, licensing opportunities, and services. The aim is to provide a centralized platform for industry stakeholders to explore technologies and expertise offered by the HEIs/PROs. This type of initiative is still insufficiently used and underdeveloped since only a few TTOs are using this opportunity. One such website offering technologies is hosted by the Centre for Research, Development and Technology Transfer of the University of Zagreb⁷¹.

Technology Catalogues and Databases

Online catalogues or databases present detailed information about available patents, inventions, and technologies ready for licensing or commercialization. The initial collection of inventions can be made by organizing an event and allowing the organizer to put all data on the webpage.

One example of such an event is "BUDI UZOR[®]", organized by TERA Tehnopolis Ltd.⁷² every year, an international exhibition of innovations, prototypes, and student and high school business plans intended for innovators and holders of business ideas who want to test the market value of their innovation, business ideas, and start a business. From the very beginning, the exhibition has been oriented towards innovators, students, and high school students, and since 2008, the European Entrepreneurial Network has played a significant role in the organization of the exhibition, which greatly facilitates the internationalization of business through cooperation and technology transfer.

⁷⁰ <https://www.een.hr/usluge/europski-rdi-projekti/>

⁷¹ <https://cirtt.unizg.hr/prilike-za-komercijalizaciju/>

⁷² <https://tera.hr/budiuzor/inovacije/>

Another example is from the University of Rijeka in the form of a Catalogue of Knowledge⁷³ which is a collection of scientific projects to attract further interest in science or industry. In addition, the Regional innovation matchmaking platform (RIMAP) is a digital innovation standalone platform⁷⁴ serving primarily industry and research organizations in Primorsko-Goranska County for the transfer of knowledge between the academic community and the economy to develop the innovation ecosystem in the region.

The European Enterprise Network (EEN) database of technology offer and technology request opportunities⁷⁵ is the biggest database in the world, with thousands of technology profiles to connect SMEs and research organizations across borders, within the EU, and wider in which Croatia has access.

Technology Fairs and Exhibitions

Participation in national and international technology fairs, exhibitions, and innovation showcases facilitates direct engagement with researchers, industry professionals, investors, and entrepreneurs interested in exploring collaborations or licensing opportunities.

In Croatia, there is an event organized every year - the Enterprise Research Innovation Conference (ENTRENOVA). It is a multi-disciplinary conference dedicated to examining, comprehending, and discussing the economic, management, organizational, marketing, and other issues related to innovation, information technology, and R&D driven by enterprises. ENTRENOVA is organized by IRENET (Society for Advancing Innovation and Research in the Economy) Croatia, in cooperation with the Faculty of Tourism and Hotel Management (Kotor, Montenegro) and University North (Croatia). IRENET is the premier association for information technology experts, undergraduate, graduate, and postgraduate students of business, economics, information technology, and related disciplines, and companies, especially SMEs that seek to improve their competitiveness with information technology, research, and innovation in business and economy.

Partnership in EEN through a consortium of six organizations in Croatia gives certain advantages to companies to participate in international fairs assisted by those organizations. One such event is the Trade fair for medical technology & healthcare – MEDICA⁷⁶, organized in Düsseldorf (Germany) every year, often offering B2B prearranged meetings related to technology transfer.

Brokerage Events and Matchmaking Platforms

Participation in brokerage events and online matchmaking platforms connects researchers, technology providers, and industry partners. Usually, they are organized during the fair exhibition, such as MEDICA, since those events attract many participants and offer internalization of tech transfer. “Meet in Italy for Life Sciences (MIT4LS)”⁷⁷ is another big fair near Croatia focusing on MedTech that offers prearranged B2B meetings to participants using matchmaking platforms, however, there are other similar opportunities in other EU countries.

Social Media and Online Presence.

⁷³ <https://uniri.hr/znanost-i-istrazivanje/katalog-znanja/>

⁷⁴ <https://rimap.uniri.hr/>

⁷⁵ <https://een.ec.europa.eu/partnering-opportunities>

⁷⁶ <https://www.medica-tradefair.com/>

⁷⁷ <https://meetitalylifesciences.eu/en/>

TT units at universities and PROs need to have an active presence on social media platforms (e.g., LinkedIn, FB, Instagram) to promote TT activities, share success stories, and engage with a broader audience. Incubators, accelerators, and hubs use those channels to enhance visibility, attract potential collaborators, and foster community engagement around innovation and technology transfer initiatives. One such incubator, STEP RI d.o.o., a science and technology park of the University of Rijeka is using different social media channels to promote activities within the University of Rijeka and regional industry⁷⁸.

By leveraging these promotional tools and platforms, Universities and PROs can effectively showcase their technology transfer offers, attract potential collaborators, and facilitate the commercialization of research innovations. Strategic use of these tools not only enhances visibility and engagement but also strengthens the institution's role in driving economic growth through innovation and knowledge transfer.

5.4 Barriers to the Commercialization of Knowledge Generated in HEIs

The journey of the knowledge and technology commercialization of research results generated by the research institutions in Croatia often faces barriers that hinder successful commercialization. Understanding these challenges can lead to the creation of an effective system for knowledge and technology commercialization. The most common barriers recognized by experts who answered the survey are:

- Dealing with IPR protection and licensing in the organization,
- Relevance of IP protection and management in the curriculums,
- The research carried out in HEIs is basic and non-oriented type, very far from the market, and
- Companies do not have a culture favourable to the acquisition of patents or licenses.

Dealing with IPR protection and licensing

The process of patenting and licensing of IPRs is usually time-consuming, intensive, and legally complex. For new employees in the field, it takes years to "learn by doing", and they are often recruited from the research organization itself. Consequently, many research organizations in Croatia lack adequately trained professionals to manage and protect intellectual property. Delays in obtaining IP protection or initiating licensing negotiations can slow down or even jeopardize technology transfer and market entry, which is often the case.

Relevance of the IPR protection and management in the research organization curriculum

Croatia is actively developing a functional technology transfer ecosystem, focusing on raising awareness among higher education institutions (HEIs) and providing funding for the process. However, there is less emphasis on incentivizing researchers' involvement by linking it to career advancement criteria. The 2022 Law on Higher Education and Scientific Activity missed the opportunity to introduce significant changes in this area, leaving the integration of successful technology transfer into academic promotion largely unaddressed.

⁷⁸ <https://hr.linkedin.com/company/science-and-technology-park-rijeka> or https://www.instagram.com/stepri_edu.cen/

The research carried out in HEIs is mostly basic and non-oriented type, very far from the market

This situation is largely due to historical and structural factors within the Croatian academic system. Traditionally, universities in Croatia have focused on fundamental research rather than applied research that directly addresses market needs. This focus is partly driven by the way research funding is structured, with limited emphasis on industry collaboration or commercialization. Additionally, there has been a lack of incentives for researchers to engage in market-oriented projects, which is reflected in the criteria for academic advancement. The system also faces challenges related to insufficient infrastructure for technology transfer and a lack of strong links between academia and industry. Efforts are being made to improve this situation, including increasing awareness about the importance of applied research and technology transfer. However, significant cultural and policy changes are still needed to fully align Croatian academic research with market demands.

Companies do not have a culture favourable to the acquisition of patents or licenses

Croatian companies generally do not have a strong culture of acquiring patents or licenses from research institutions. This situation stems from a combination of factors. Many companies, particularly small and medium-sized enterprises (SMEs), may not fully understand the benefits of patents and licenses or lack the resources to pursue them. In addition, the Croatian industry often focuses more on immediate operational concerns rather than long-term innovation and strategic planning, leading to lower investment in research and development (R&D). Fragile links between academia and industry further weaken the drive for innovation and patenting. Furthermore, the regulatory environment and economic challenges in Croatia can make the patenting process seem too complex and costly, particularly for smaller firms. As a result, the overall engagement in patenting and licensing within the Croatian industry remains relatively low.

5.5 TT Instruments Best Practices

The best practices provided and identified by the survey respondents are:

SPIN-OFF COMPANY DEVELOPMENT FROM FUNDAMENTAL RESEARCH AT THE FACULTY OF CHEMICAL ENGINEERING AND TECHNOLOGY OF THE UNIVERSITY OF ZAGREB

This best practice involves a systematic approach to translating fundamental research conducted at the Faculty of Chemical Engineering and Technology into specific commercial spin-off companies. The practice encompasses various stages including identification of potential research projects, development of business models, securing funding, and providing continuous support to foster the growth of spin-off companies. The development of this practice started in 2015. This best practice is about bridging the gap between fundamental research and commercialization. It includes the following key aspects:

- Identifying research projects with high commercial potential.
- Providing researchers with training and resources for business development.
- Facilitating partnerships between researchers and industry stakeholders.
- Assisting in securing intellectual property rights and patents.
- Offering incubation and acceleration services to nurture spin-off companies.
- Providing ongoing mentorship and support to ensure the sustainability and growth of spin-offs.

The main factors contributing to the success of the best practice were: strong collaboration between academia and industry, a comprehensive support system including training, mentoring, and funding, a robust network of industry partners and investors, effective intellectual property management, continuous monitoring and support for spin-off companies, and utilization space and equipment for prototype construction.

The challenges faced in the implementation of the best practice and what actions have been taken to address them were:

- **Challenge:** Securing initial funding for spin-offs.
Action: Established partnerships with company firms based on which the first commercial contract was put in place.
 - **Challenge:** Bridging the gap between academic research and market needs.
Action: Regular industry-academia workshops and feedback sessions.
 - **Challenge:** Providing adequate business training to researchers.
Action: Expose researcher to solving industrial problems with constrain in time and resources.
- Certain aspects of the best practice be improved through more exposure to the particular business challenges and increasing the complexity of the particular task.

This best practice is highly applicable in other academic and research settings, particularly those with strong research capabilities but limited commercialization experience. It can be adapted to fit the specific needs and resources of different institutions.

The main impact of the best practice is visible in the successful establishment of multiple spin-off companies that contribute to economic growth, increased commercialization of innovative research from the Faculty of Chemical Engineering and Technology, enhanced collaboration between academia and industry, and development of a robust entrepreneurial ecosystem within the academic institution.

THE DIGITAL INNOVATION HUB (DIH TERA)

The Digital Innovation Hub (DIH TERA⁷⁹) exemplifies a successful practice within TERA TEHNOPOLIS's technology transfer structure. This hub plays a crucial role in helping companies become more competitive by leveraging digital technologies to improve business and production processes, products, or services. The key features are:

1. **Access to Advanced Technologies:** DIH TERA provides companies with access to the latest knowledge, expertise, and technologies. This includes support for implementing pilot projects, testing, and experimenting with digital innovations, which is critical for staying competitive in today's market.
2. **Comprehensive Support Services:** The hub offers a range of services that include business counseling, training, and support in intellectual property protection. These services are designed to enhance the innovation management capacities of SMEs, helping them to efficiently manage and implement innovative processes.
3. **Collaboration and Networking:** DIH TERA facilitates collaboration among various stakeholders, including universities, development agencies, and innovative SMEs. This network fosters a conducive environment for knowledge exchange and joint projects, enhancing the overall innovation ecosystem.

⁷⁹ <https://european-digital-innovation-hubs.ec.europa.eu/edih-catalogue/dih-tera>

4. **Focus on Sustainability:** One of the hub's core objectives is to promote sustainable development through the adoption of advanced technologies. By integrating digital solutions that are environmentally and economically sustainable, DIH TERA ensures that technological advancements contribute positively to long-term development goals.
5. **Education and Capacity Building:** DIH TERA organizes training sessions and workshops aimed at building the capacities of entrepreneurs and SME managers. These educational activities are essential for equipping businesses with the skills needed to navigate and thrive in the digital economy.

DIH TERA has significantly contributed to the regional economy by enhancing the digital capabilities of local businesses. This initiative not only improves the competitiveness of SMEs but also supports the broader goal of fostering a knowledge-based economy through effective technology transfer and innovation support.

This practice showcases TERA TEHNOPOLIS's commitment to bridging the gap between research and the market, ensuring that innovative ideas are effectively developed and commercialized.

The organization responsible for the provision of this best practice in the management of technology transfer processes, including digital services, innovative approaches, and project support services, is DIH TERA (Digital Innovation Hub TERA). DIH TERA is located in Eastern Croatia, specifically encompassing organizations from five counties in that region. The duration of this best practice is till the end of 2040.

The best practice of DIH TERA centers on managing technology transfer processes, focusing on digital services, innovative approaches, and project support. Key aspects include a "one-stop-shop" model providing comprehensive services to enhance competitiveness through digital technologies and a robust technological infrastructure supporting pilot projects and innovation testing. Business and financial support strengthen the innovation ecosystem, and the consortium includes diverse organizations from Eastern Croatia, such as universities and SMEs with digitalization expertise. DIH TERA operates regionally, nationally, and internationally, connecting companies with global service providers. Key services include digital maturity assessments, technology integration support, skills and training programs, and access to finance through client profiling and advisory services. The support process begins with a needs analysis, followed by a tailored work plan involving advisory support, education, prototyping, and project proposal preparation. Focus areas include sustainable food supply chains, AI in quality control, blockchain in food certification, precision agriculture, and additive manufacturing. International collaborations with projects like D-Rural and Horizon2020 extend their technical competencies and service offerings.

The success of DIH TERA's best practice in managing technology transfer processes can be attributed to several key factors. Their comprehensive "one-stop-shop" model streamlines services for businesses, while strong technological infrastructure provides access to cutting-edge technology and expertise. Collaboration with a diverse consortium of universities, development agencies, and IT-experienced SMEs, along with extensive national and international partnerships, enriches their ecosystem. Tailored support processes ensure relevant assistance, and a focus on innovation in areas like AI, blockchain, and precision agriculture demonstrates their commitment to advanced technologies. Skill development programs, access to funding, and regional and international reach further enhance their services. A proven track record, support from public and

private sectors, adaptability, responsiveness, and recognition through patents and awards underscore their effectiveness. These factors collectively create a successful model for supporting digital transformation and innovation, contributing to business competitiveness and growth.

DIH TERA has faced several challenges in implementing its best practices for managing technology transfer processes. These challenges include resource limitations, keeping up with rapidly evolving digital technologies, coordinating efforts among multiple stakeholders, addressing skill gaps, overcoming market resistance, navigating regulatory hurdles, and managing cultural differences in international projects. To address these challenges, DIH TERA has taken various actions. They have actively participated in national and international funding programs, such as Horizon2020 and Interreg, to secure necessary resources. Additionally, they have developed partnerships with public and private sector entities to pool resources and expertise. Continuous investment in technological infrastructure and collaborations with international consortia and research institutions have helped them stay technologically current. Effective collaboration mechanisms have been established, including clear communication channels and governance structures to manage collaborations efficiently. Regular meetings and updates ensure alignment and coordination among stakeholders. To bridge skill gaps, DIH TERA offers a wide range of workshops, seminars, and training sessions, partnering with educational institutions to develop tailored training programs. To build awareness and trust, DIH TERA demonstrates the value and impact of digital transformation through pilot projects and success stories. They provide risk assessment and mitigation strategies to address businesses' concerns. Navigating regulatory landscapes is facilitated by employing legal and regulatory experts and engaging with policymakers to advocate for supportive environments. Cultural differences in international projects are managed through cultural sensitivity training and regular cross-cultural exchanges, fostering strong, trust-based relationships. By addressing these challenges through strategic actions, DIH TERA has successfully implemented its best practices in technology transfer processes. Their proactive approach in securing resources, fostering collaborations, bridging skill gaps, and navigating regulatory and cultural hurdles has been instrumental in overcoming obstacles and driving success.

To improve certain aspects of DIH TERA's best practice in managing technology transfer processes, they could diversify funding sources to reduce dependency on specific programs by seeking private investments, crowdfunding, or forming strategic alliances with industry leaders. Additionally, implementing a continuous learning program to keep the team and stakeholders updated with the latest technological trends and investing in research and development to explore emerging technologies like artificial intelligence, blockchain, and the Internet of Things could further strengthen their services.

Studying DIH TERA's best practice is important because it provides valuable insights into effective strategies for managing technology transfer processes. This knowledge can help other organizations enhance their digital transformation efforts, improve collaboration among stakeholders, and overcome common challenges such as funding limitations, skill gaps, and technological advancements. Additionally, understanding their proactive approach to securing resources, fostering innovation, and navigating regulatory and cultural hurdles can serve as a model for similar initiatives, ultimately contributing to broader regional and international digitalization goals.

DIH TERA's best practice is highly applicable in other settings, particularly in regions looking to enhance their digital transformation efforts. The comprehensive "one-stop-shop" model, strong technological infrastructure, and tailored support processes can be adapted to various contexts. Additionally, their approach to collaboration, funding diversification, skill development, and overcoming regulatory and cultural challenges provides a robust framework that can be replicated by other organizations and regions aiming to foster innovation and competitiveness through digital technologies.

The main impact of DIH TERA's best practice has been the significant enhancement of digital transformation and innovation capabilities among businesses in Eastern Croatia. By providing comprehensive support, cutting-edge technological infrastructure, and fostering strong collaborations, DIH TERA has enabled companies to become more competitive, implement advanced digital solutions, and successfully navigate the challenges of digitalization. This has not only improved the operational efficiency and market reach of these businesses but also strengthened the overall innovation ecosystem in the region.

THE UNIVERSITY OF RIJEKA RIMAP DIGITAL PLATFORM AND “UNIRI INOVA” FUNDING INSTRUMENT

The University of Rijeka, each year announces a Call for a “UNIRI-INOVA” funding program for co-financing interdisciplinary scientific and development project proposals from University of Rijeka scientists in cooperation and through networking with partners and stakeholders from complementary parts of the so-called five-fold innovation spirals, all with the aim of two-way transfer of knowledge and consequent regional economic and social development. The purpose of the Call is to support and encourage the achievement of the goals and quantitative and qualitative indicators of the University Strategy for the period 2021-2025, as well as internationally relevant indicators and goals of the European Strategy for Universities. Proposed projects can cover all forms of knowledge transfer but to participate, applicants are obligated to post a profile for collaboration with other HEIs, ROs, or industries on a **Regional innovation matchmaking platform (RIMAP)**⁸⁰, created by Regional Development Agency PRIGODA in cooperation with the University of Rijeka for introducing the collaboration capacity between industry and academia in Primorje-Gorski Kotar County.

The Regional Development Agency of the Primorje-Gorski Kotar County (PRIGODA) in cooperation with the University of Rijeka and with the support of Step Ri Science and Technology Park of the University of Rijeka Ltd. are providing this best practice. The RIMAP digital platform has been operational since 2020, and the UNIRI-INOVA financing or co-financing program started in 2022.

The key aspects of the best practice involve several critical elements that make the system effective. Firstly, multiple actors were involved from the beginning to create a database of research capabilities and industry needs, to improve the knowledge and technology transfer system, regionally. These actors included the regional University, a development agency, and a regional business support organization (BSO). Each of them used their communication channels to start editing profiles from both, industry and academia, which was essential for the digital

⁸⁰ <https://rimap.uniri.hr/>

platform to work. Another important element is the funding provided by the University for innovative or R&D projects, which are required to be first registered on the platform. This condition significantly boosted the completion of the platform with academic profiles. Since then, the digital platform has become the most comprehensive source of information and the reference place to find partnerships and initiate two-sided knowledge and technology transfers at a regional level, with the potential to expand nationally.

Sharing the vision and good collaboration between stakeholders have been the main factors contributing to the success of the best practice.

The challenges faced in the implementation of the best practice and actions taken to address them were through the awareness rising and getting the profiles registered on the platform in the beginning and through offering funds with a precondition of asking applicants to register on the platform, firstly, was the key action that made it work.

Certain aspects of the best practice can be improved by taking action towards the industry to boost their interest and by using incentives.

Studying this best practice is important since it is one example of how to motivate researchers to post their profiles on the platform and to attract industry players to do the same. There are no constraints in the implementation of this best practice in another setting.

The main impact of this best practice is visible in the greater visibility of the University and companies and their capacity for collaborative project proposals, regionally since it provides an enabling tool for advancing knowledge and technology transfer in both directions (academia-industry-academia).

FACULTY OF TRANSPORT AND TRAFFIC SCIENCES UNIVERSITY OF ZAGREB

The Faculty of Transport and Traffic Sciences, through its Project and Technology Office, implements high-quality incentive programs for technology transfer. The Office is involved in all activities related to cooperation with industry and the transfer of scientific knowledge to the industry. A good example of promoting technology transfer is through the Faculty's foundation. Additionally, the Faculty creates preconditions for technology transfer through its Economic Council. The Economic Council of the Faculty of Transport and Traffic Sciences is an advisory body of the Faculty, composed of members who are representatives of reputable institutions and companies from industries relevant to the Faculty's activities.

The best practice is about the establishment of an Office within the Faculty that provides support to all other faculty bodies in all activities directly or indirectly related to technology transfer. The foundation is a good example, closely connected to the Office. The Foundation was established with the goal of providing the necessary funds for doctoral research at the Faculty, establishing a system of competitions, selection, and funding of research topics. The Office manages the processes of internal competitions, criteria, idea selection, etc. One of the main criteria for selecting topics is the applicability of the doctoral candidate's research to the industry.

By encouraging and financially supporting doctoral scientific research and creating conditions that allow it to be conducted in the industry, the Faculty aims to enhance the collaboration between the academic community and the business sector.

the Faculty's Economic Council is another example of good practice within the Faculty. Indirectly, the Economic Council influences the creation of experts who will be capable of conducting research suitable for technology transfer to the industry. Founded in 2015, the Economic Council consists of companies from Croatia's transport and logistics sectors, with the aim of advancing cooperation between the Faculty and the business community.

The Council plays a key role in improving the Faculty's work and positioning it as a leading institution in the fields of transport and logistics in Croatia.

Members of the Economic Council actively participate in shaping the Faculty's study programs, determining the industry's needs, and advising on topics for final and graduate theses, as well as doctoral research.

Through initiatives like the Faculty's foundation and the involvement of the Economic Council, the Faculty strives to create a stronger bond between research, education, and industry needs.

The success of the best practice at the Faculty of Transport and Traffic Sciences is primarily attributed to a few key factors. First, the establishment of the Office for Projects and Technology Transfer has played a crucial role, as it provides centralized support for all activities related to technology transfer within the Faculty. This office ensures that both internal and external collaboration runs smoothly, connecting academic research with industry needs.

Second, the strong integration of the Faculty's foundation into this system provides essential funding for doctoral research, fostering innovation and ensuring that research topics are aligned with industry applicability. The clear criteria for selecting research projects, focused on their potential for technology transfer, is another factor driving success.

Finally, the Economic Council serves as a bridge between academia and industry, involving business leaders in shaping study programs, research topics, and internships. This collaboration ensures that the Faculty produces experts capable of conducting research that can be directly applied in industrial contexts, which significantly enhances the success of technology transfer initiatives.

The biggest challenge in establishing the Office for Projects and Technology Transfer was the difficulty in keeping track of all professional and scientific projects. Initially, the Office relied heavily on paper-based administration, which was time-consuming and inefficient. This issue was resolved by developing a faculty-wide application for managing all professional and scientific projects. The introduction of this digital platform significantly streamlined procedures in the Office, allowing staff to focus on more creative and strategic tasks.

Regarding the foundation, the initial challenge was securing funding. However, this issue was quickly resolved through the support of companies that were already collaborating with the Faculty. These companies made donations, motivated by the belief that the projects funded through the foundation could also benefit their own business operations in the future.

Certain aspects of the best practice can be improved by hiring new staff, as well as through the education and training of both new and existing personnel. Bringing in additional skilled professionals would help distribute the workload more efficiently, allowing the Office for Projects

and Technology Transfer to operate more effectively. Additionally, continuous professional development for current staff would enhance their ability to manage complex projects and adapt to evolving industry needs. Furthermore, collaboration with other offices at different faculties and universities could be elevated to a higher level. By fostering stronger inter-faculty and inter-university partnerships, the exchange of knowledge, resources, and best practices would be enhanced, ultimately benefiting all parties involved.

The establishment of the Office, along with the foundation and Economic Council, showcases how structured support systems can bridge the gap between research and practical application in the industry. Understanding how these mechanisms work can offer valuable insights for other institutions aiming to enhance their own technology transfer processes.

Moreover, this best practice highlights the importance of integrating funding, project management, and industry collaboration in fostering research that has real-world impact. By studying this model, other academic institutions can adopt similar approaches to create conditions that encourage innovation, improve research outcomes, and strengthen ties with industry stakeholders, ultimately benefiting both academia and the business sector.

This best practice is highly applicable in other academic and institutional settings, especially where there is a need to strengthen the connection between research and industry. The establishment of an office dedicated to managing projects and facilitating technology transfer can be easily replicated in other universities or faculties. The processes for organizing funding, managing research projects, and fostering collaboration with the business sector can be adapted to fit the specific needs and structures of different institutions.

The main impact of this best practice has been the continuous growth in the number of scientific research projects year after year. There has also been an increase in EU funding for our research ideas, reflecting the improved quality and relevance of our projects. Faculty members are more active in pursuing research, knowing they have strong support from the Office. Additionally, the Office itself is expanding, both in terms of staff numbers and their competencies, further enhancing its ability to support research and technology transfer initiatives.

6 Economic Indicators and Funding

Most of the institutional financing for science, technology, and innovation in Croatia is delivered by the Ministry of Science, Education and Youth (MSEY) through public funding of higher education institutions and public research institutes. Nevertheless, this mainly covers salaries of academic staff and researchers and other wages and overheads.⁸¹

The Ministry of Science, Education and Youth (MSEY) has earmarked additional funding for technology transfer support programmes from the European Structural and Investment Funds (ESIF). Support for technology transfer in Croatia is structured in two complementary programmes: the **Technology transfer support programme**, and the **Support programme for technology transfer offices**. These programmes were created as a follow-up to the existing Proof of Concept (POC) Programme. Therefore, solutions that successfully pass the POC process will

⁸¹ <https://publications.jrc.ec.europa.eu/repository/handle/JRC136807>

likely be ready for activities under the Technology Transfer Support Programme. Both programmes aim at increasing the number of technology transfer processes in research organizations in Croatia⁸². Activities envisaged under technology transfer programmes that will be carried out by Technology transfer offices (TTO) include consulting and support activities for the innovation process at various stages, including patenting and other activities related to the protection of IP rights, preparation of market analyses and business plans and preparation of IP protection strategy, procedures related to licensing, contracting, and implementation of agreements on commercialization, consulting and services for access to the so-called pre-seed funding and support for new product development. Technology transfer programmes implemented by the MSEY are a form of continuation of financing the TT activities in the previous financial period. The Croatian Agency for SMEs, Innovation and Investments (HAMAG-BICRO) had a Call for proposals Support to Technology Transfer Offices (TTO program) to strengthen the role of technology transfer offices (TTOs) at universities and public research institutes in Croatia as central places for stimulating and implementing technology transfer activities. The program was financed through the Second Technological Development Project (STP II), a loan from the World Bank. In addition, the MSEY manages two programmes supporting the TT and the proof-of-concept: the **new proof-of-Concept support program**, and the **programme support of “Start-up/spin-off companies of young researchers.”**

The **Technology Transfer Support Programme** primarily finances applied research projects in three categories: technical validation, business validation, and project management with a maximum duration of 24 months. This programme supports the implementation of R&D activities for the development or further improvement of developed solutions and technical validation before the commercialization phase. The project’s beneficiary is a research organization in charge of carrying out technical validation activities, including prototyping, demonstration, piloting and technology testing, and verification. The beneficiary must also have procedures and adopted documentation in place at the time of application following the checklist of procedures and documentation relating to the transfer of technology, which is part of the National Guidelines on Technology Transfer. Project beneficiaries may implement in cooperation with partner organizations that carry out the tasks of TTO.⁸³

The **Technology Transfer Offices Support Programme** provides funding for the projects of units performing the tasks of the technology transfer office (according to the checklist of activities of the Technology Transfer Offices, which is part of the National Technology Transfer Guidelines) through the implementation of specific services, such as market analysis, concept development or strategies for product development and/or commercialization, intellectual property verification and protection, development of an intellectual property management strategy, development of the business model, certification, and analysis of regulatory conditions. Such services will be provided by the technology transfer offices for researchers and research teams autonomously up to their level of competence and will outsource specific activities to external specialist experts. The call is intended for technology transfer offices, be they part of a research organization or set up as a separate legal entity. To demonstrate the capacity of the technology transfer office, the

⁸² Ibidem.

⁸³ Ibidem.

call requires that the conditions relating to the performance of technology transfer activities be met following the National Technology Transfer Guidelines. If the TTO operates in a research organization, then the applicant is a research organization and implements the project independently. If the technology transfer office is set up as a separate legal entity, then the technology transfer office is the applicant, and a partnership is mandatory with the research organization that owns the intellectual property rights and employs the researcher whose research results are the subject of the project activity. The role of the partners is to support the implementation of the project from the technological aspect of the project activities.⁸⁴

The **new Proof-of-Concept program** has been available since November 2022. The purpose is to increase the willingness to develop new products and processes through improved research and development and innovation capacities of companies and scientific organizations. The aim is to award grants to micro, small, and medium-sized enterprises and scientific organizations to co-finance pre-commercial activities in the early stages of developing new products, services, and technological processes, to identify the potential for commercialization, guide further development, and reduce investment risk. Grants can range from just under 30,000 EUR to a maximum of 70,000 EUR.⁸⁵

The **“Start-up/spin-off companies of young researchers” programme** aims to promote entrepreneurship among young researchers by providing incentives to create their own start-up/spin-off companies. It is intended for the creation of a start-up/spinoff company (co-)owned by one or more young researchers employed in a public research institution. A start-up/spinoff company must not be older than five years and must be based on original research or technologies developed in a research institution. This call can support the company in further improvement of the technological solution, performance verification, and other activities that precede commercialization and help to increase the marketability of the research and development results. As part of the project, training young researchers in entrepreneurial skills is mandatory for start-up companies. The lowest funding amount for a single project is 66,000.00 EUR, and the highest is 200,000.00 EUR.⁸⁶

The Act on State Aid on Research and Development Project aims to increase the overall private sector investment in R&D. The beneficiaries are profit or income taxpayers (SMEs and large companies). The type of aid is tax relief (additional deduction of the profit tax or income tax base, for justified costs of research and development projects or costs of feasibility studies), and the period of implementation is up to 3 years from the start of the project. The responsible body for this Act is the Ministry of Economy⁸⁷.

The Croatian Science Foundation (CSF) is the central organization for financing science in all scientific fields in the Republic of Croatia. To achieve its purpose, the Foundation allocates financial resources for basic research (from the state budget) and applied research (with the help of NRRP) in the early stage of technology readiness and scientific research that is of strategic

⁸⁴ Ibidem.

⁸⁵ Ibidem.

⁸⁶ Ibidem.

⁸⁷ <https://stip.oecd.org/stip/>

interest to the Republic of Croatia, and for the development of the careers of researchers at the doctoral and postdoctoral level.

Within the **Program Competitiveness and Cohesion 2023-2027** the Ministry of Science, Education and Youth (MSEY) plans to invest in research, technology, and innovation (RTI) infrastructure to support market-driven research and address the technology needs of the business sector. Emphasis will be placed on applied research, technology transfer, and the development of skills for smart specialization. Additionally, the Ministry of Economy (ME) aims to support SMEs in their business development and competitiveness through financing, investments in assets, and promoting entrepreneurship, particularly among women and youth.

Croatia's National Recovery and Resilience Plan 2021-2026 (NRRP) is focused on the measures supporting the framework for research, development, and innovation which includes technology transfer as well. Among five components and one initiative, the NRRP envisages Component 3. Education, science and research, which is relevant for technology transfer. Approximately EUR 1 billion (16%) is reserved for this component. The primary focus of the NRRP-funded programme framework will be competitive business-oriented research and innovation programmes such as applied research, experimental development, proof of concept, technology transfer, industry collaboration, and similar.

Investments in infrastructure and organizational reform in the RDI sector in Croatia are under the responsibility of the Ministry of Science, Education and Youth (MSEY). To strengthen the capacity for RDI in public research organizations investments were made in the development of RDI infrastructure (renewing and modernizing existing facilities and building new ones, acquiring major scientific equipment), part of the initiative was also investment in the organizational reforms/changes on public research organizations that contributed to improvement in the functioning of public research organizations as well as in the quality, scope and relevance of their research activities. The objective of the initiative is to transform public research organizations into internationally competitive scientific institutions that create new scientific, social, and economic value.⁸⁸

The **new framework for attracting students and researchers to STEM and ICT fields** managed by the Croatian Science Foundation and the MSEY aims to provide support to the advancement and career development of researchers in STEM and ICT fields. The new framework includes new incentive conditions for work in the research ecosystem and open access to technological infrastructures for connecting academia and business sectors. The goal of the new framework for the development of researchers' careers is to increase the number and quality of researchers and experts in the scientific and, consequently, the business sector to strengthen the innovation potential. The planned programs include: **STEM and ICT scholarships** (increased availability and employability of graduates in STEM and ICT fields at the undergraduate and graduate level through the Scholarship Award Program), **Career development for young researchers** (developing the careers of young researchers through the improvement of their capacities and the experience gained through their involvement in research work), **Development research support** (increasing

⁸⁸ <https://stip.oecd.org/stip/>

the international recognition and visibility of the Croatian research system by implementing a program that supports the system of career development and advancement in Croatian research organizations), **Mobility program** (improvement of research and development capacities of young researchers through mobility activities and knowledge transfer at the international level), **Start-up/spin off companies of young researchers** (encouraging the entrepreneurial activity of young researchers through incentives for starting their own start-up/spin-off company), and **Entrepreneurship Traineeships Programme** (creating the entrepreneurial spirit of young researchers through the adoption of entrepreneurial skills for research activities).⁸⁹

There is a funding Program relevant to the collaborative research of the scientific community and the business sector - the **Targeted Scientific Research Program**. The Program provides grants for applied research projects implemented in collaboration between researchers and the business sector. The aim is to bring research work closer to the needs of the economy. The intervention will stimulate research aimed at solving a specific problem in the economy or society. The funded projects are expected to produce public-private co-publications, international patent registrations, and knowledge spillovers between research and business sectors. The program supports forming long-lasting partnerships between academia and business, incentivizes young researchers to collaborate with businesses, and supports businesses to engage more in cutting-edge research. The collaboration will help research organizations to co-design research with business partners, with more practical relevance. It will also help businesses to understand academia and, in the long run, benefit from the cutting-edge research. The Estimated budget expenditure range per year (in EUR) is 5M-20M Eur and the responsible body for implementation is the Ministry of Science, Education and Youth (MSEY).⁹⁰

Additional financing for technology transfer projects will be available through **the Technology Transfer Fund**. The Croatian Bank for Reconstruction and Development (HBOR), the European Investment Fund (EIF), and the Slovenian export and development bank (SID Bank) signed an agreement on establishing the first regional platform for launching a fund for financing commercialization of innovative technological solutions and intellectual property of Croatian and Slovenian universities and research institutions worth at least EUR 40 million. The activities will be focused on those projects at the proof-of-concept stage. At least EUR 15 million will be invested from the fund in the projects of Croatian scientific institutions. According to the EIF analysis, it is estimated that in the next 5 years, universities and research centers in Slovenia and Croatia will generate more than 350 patent applications and 100 spin-off companies which could be financed via the CEETT platform.⁹¹

The TTOs in Croatia are facing significant challenges regarding the funding of their staff and activities. The activities and funding of TTOs are largely project-based. Consequently, the size of the staff and the intensity of support activities depend entirely on the current project funding and therefore vary over time. To survive, TTOs have had to focus on winning projects and dedicate a

⁸⁹ Ibidem.

⁹⁰ Ibidem.

⁹¹ <https://www.hbor.hr/technology-transfer-platform-worth-eur-40-million-established-by-hbor-sid-bank-and-eif/613>

large part of their staff to this purpose. Industry links are mainly maintained on a personal level. It is the researchers who have contacts with the industry and initiate the process of collaboration. With current resources, TTOs are not in a position to proactively seek technology buyers. It is up to the researchers to disclose the invention and drive commercialization. The main role of TTOs is to support IP protection, but there is a lack of consistent availability of funding to file applications and maintain IPR.⁹²

6.1 Distribution of the Budget Among the Involved Agents

The mutual relations in the commercialization of the research results at universities and PROs are usually guided through the national and institutional regulations related to the IPR ownership and protection, relevant laws (i.e., Labour Law), and other relevant policies (if exist). These policies are different at every research institution.

On the national level, there are previously elaborated **National Guidelines for Technology Transfer** that provide recommendations and practical advice to technology transfer offices (TTOs) and managers in research organizations to improve their technology and knowledge transfer activities. The objective of the Guidelines is to provide a framework for the effective use of results of publicly funded research through the proper management of intellectual property, increased commercialization, development of entrepreneurial culture and related skills in public scientific organizations, and for more successful interaction between the public and business sectors.⁹³

The University of Zagreb has the most detailed Guidelines and Rules on Technology Transfer. The new IP management guidelines and IP management rulebook regulate IP ownership and set guidelines for industry engagement and all faculties are now required to comply with them. These regulations have been designed so that they do not conflict with the faculty-level rulebooks already in place and faculties still have the right to determine important details such as revenue sharing models, and they have the right to decide whether they want to market IP on their own. The scheme for division of revenues after cost deduction is 40:40:20 between the researcher, Faculty, and the University, respectively, but only if the dean of the Faculty decides to leave the registration and commercialization process to the University and if the University accepts to conduct those processes. In other cases, where the dean decides to conduct the process of registration and commercialization by the Faculty, the scheme for the division of revenues shall be regulated by the Faculty and may vary. Nevertheless, in this case, the University shall gain no revenues at all.⁹⁴

The University of Split with its Rules on the operation of the Office for Transfer of Technology and the Intellectual Property Regulations regulates that the process of technology transfer is managed by the University technology transfer office. The IP registration/protection costs and commercialization procedure will be covered by the University and in return the University will own all intellectual property rights. The scheme for dividing the revenues granted from the commercialization guarantees that the researcher will, after deduction costs, acquire 40 percent

⁹² <https://publications.jrc.ec.europa.eu/repository/handle/JRC136807>

⁹³ <https://stip.oecd.org/stip/>

⁹⁴ <https://publications.jrc.ec.europa.eu/repository/handle/JRC136807>

of the total revenues. The other 40 percent goes to the Faculty and the rest of 20 percent goes to the University.⁹⁵

The University of Osijek's Rules on Technology Transfer provides a scheme for dividing the revenues generated from the commercialization (after deduction of costs) between the researcher, University, and Faculty, whereby the share of the researcher declines from 70 percent to 20 percent depending on the amount of income from commercialization.⁹⁶

7 Human Resources and Training

Stable and sufficient financial and human resources are a prerequisite for successfully implementing knowledge and technology transfer activities at universities and PROs. There is an evident lack of TT staff with relevant skills at universities and PROs in Croatia which means that on average each TTO has 1 or 2 specialized staff. This makes it very difficult to implement TT activities at HEIs and PROs. In addition, the lack of dedicated and continuous funding on both national and institutional levels in Croatia for TT makes it even more difficult.⁹⁷ There is no specialized training for the TT staff engaged in TT units at research organizations in Croatia. Most of them are developing their skills through the learning-by-doing model.

All technology transfer offices indicated that the rules, guidelines, and procedures so far applied did not create remarkable results in technology transfer, on the contrary, there seem to be no incentives for the researchers to approach the Faculties and Universities for support. Also, all TTOs indicated that the funds allocated to them were not sufficient for registration procedures and commercialization costs. Therefore, the described rules and guidelines did not have satisfactory practical application. It seems that the lack of financial support to the TT Office which would be allocated for registration and commercialization costs represents one of the largest obstacles for successful technology transfer.⁹⁸

Due to irregular financial support, the TTOs had to rely on project funding. Therefore, TTO staff had to focus on applying for and managing publicly funded projects, neglecting the development of critical specific skills for TT. Nevertheless, they all appear to have at least basic knowledge of the TT process and commercialization, while their knowledge of IP rules and procedures seems to be at a higher level.⁹⁹

Industry links are mainly maintained on a personal level. It is the researchers who have contacts with the industry and initiate the process of collaboration. With current resources, TTOs are not in a position to proactively seek technology buyers. It is up to the researchers to disclose the invention and drive commercialization. The main role of TTOs is to support IP protection, but there is a lack of consistent availability of funding to file applications and maintain IPR.¹⁰⁰

⁹⁵ Ibidem.

⁹⁶ Ibidem.

⁹⁷ Ibidem.

⁹⁸ Ibidem.

⁹⁹ Ibidem.

¹⁰⁰ Ibidem.

The TTOs in Croatia know each other and maintain good relations, but throughout the years there has not been a systematic cooperation between them. More recently, within the framework of the National TT Networks, meetings have been organized on a more regular basis and hosted each time by a different TTO. As a rule, the TTOs cooperate with local/regional incubators and accelerators.¹⁰¹

Under the NRRP, there are specific funding programs such as Developing Skills for Smart Specialization, Industrial Transition, and Entrepreneurship – a program that supports the improvement of skills for smart specialization and industrial transition in the research sector. Skills development programs for researchers include skills for technology and knowledge transfer to the economy, student entrepreneurship incubation activities, knowledge exchange activities through mobility and STEM/ICT scholarships and internships, and professional practice in SMEs. The intervention is expected to result in increased involvement of higher education institutions in the S3 EDP and an increased partnership network with industry.

8 Relationships Between the Agents of the Ecosystem

There are various agents of the knowledge transfer and/or technology transfer ecosystem in Croatia that facilitate the movement of knowledge, technology, and innovation from the source of creation to the exploitation or upgrade. These agents play critical roles in ensuring that new technologies and knowledge are effectively transferred and utilized across different sectors.

Universities and Research Institutions generate new knowledge and technologies through research and development. They often have dedicated **technology transfer offices (TTOs)** to manage the commercialization of innovations and to regulate the relationship between the researchers and HEIs. A good practice example comes from the University of Zagreb and its Centre for Research, Development and Technology Transfer which created rules and regulations for TT to help researchers and constituents within the university and to manage and facilitate the KT and TT process¹⁰².

Other important agents are **Industry and Corporations** whose role is to adopt and implement new technologies and knowledge to develop new products, services, or processes. They often collaborate with research institutions to access cutting-edge research. An example of such collaboration is between the Faculty of Medicine of the University of Rijeka and the pharmaceutical company JGL¹⁰³ in the Primorje-Gorski Kotar County.

Government and Agencies provide funding, create policies, and establish regulations that facilitate knowledge and technology transfer in Croatia. They also may conduct research and transfer technology to the private sector. One of the most important programs for supporting private and public sectors was conducted by HAMAG BICRO, a key government agency responsible for supporting small and medium-sized enterprises (SMEs), innovation, and

¹⁰¹ Ibidem.

¹⁰² <https://cirtt.unizg.hr/en/technology-transfer-regulations/>

¹⁰³ <https://www.jgl.hr/novosti/jgl-postao-nastavna-baza-rijeckog-medicinskog-fakulteta>

investment in Croatia. Through their specific funding programs relevant to technology transfer, Proof-of-concept and Razum, they invested significant financial resources in both research organizations and SMEs.

Incubators and Accelerators play distinctive roles in supporting start-ups and early-stage companies in developing and commercializing their ideas and new technologies. They provide mentorship, funding, and networking to innovators and funders, who play a critical role in the first crucial years of every start-up. HAMAG BICRO created a **BOND network** of BSOs to provide its members with continuous education, standardization of their services, direct exchange of knowledge, and the possibility of creating new business opportunities.

The EIS 2023 Report for Croatia showed that **venture capitalists and investors** are more active than in previous years bringing forward their critical role to provide necessary funding and financial support for the commercialization of new technologies investing even in early-stage, deep tech projects. **Vesna Deeptech Fund** is one such example. The Vesna's mission is to invest in deep tech projects and startups by accessing cutting-edge technologies through our core partnerships with research institutions and transfer these technologies out to commercially viable products in companies/start-ups.¹⁰⁴

Non-profit foundations and organizations such as the Croatian Science Foundation on the national and the FIPRO Foundation on the regional level significantly impact funding research and commercialization of innovation, regionally. The FIPRO Foundation financially supports small and medium-sized entrepreneurs in the development and commercialization of innovative products and services by granting grants and/or multi-year interest-free loans. The goal of the FIPRO Foundation is to encourage innovation and the development of technological entrepreneurship in Rijeka and the Primorje-Gorski Kotar County, to connect the scientific community and the economy, and to facilitate the transfer of knowledge and technology between scientists and entrepreneurs.¹⁰⁵ Additionally, there are many regional alliances of innovators that provide basic support to innovators regarding IPR and help them organize to attend fairs and to expose their inventions.

Intellectual Property (IP) Lawyers offer expertise and advisory services to protect IP rights (patents, copyrights, and trademarks) and cover the demand for such a service in Croatia. The list of certificated patent lawyers is available on the website of the State Intellectual Property Office (SIPO)¹⁰⁶, but other lawyers are offering these services as well.

All of the previously mentioned agents work together in a dynamic TT ecosystem to ensure the successful transfer and commercialization of knowledge and technologies, driving innovation and economic growth.

¹⁰⁴ <https://vesnavc.com/>

¹⁰⁵ <https://www.fipro.hr/>

¹⁰⁶ <https://www.dziv.hr/en/representation-before-sipo/about-representation/>

9 Public Administration

The new Smart Specialization Strategy until 2029 of the Republic of Croatia redefines the governance system which is important for the implementation and promotion of successful knowledge and technology transfer process by ensuring the appropriate institutional environment for collaboration.

The Croatian Government put a particular emphasis on its National Recovery and Resilience Plan 2021-2026 (NRRP) to, among other, incentivize the TT activities at Croatian research organizations. Within the NRRP Croatia's focus is on supporting measures and policies for the research, development, and innovation framework that includes technology transfer.¹⁰⁷ The Component 3. Education, science, and research is relevant for technology transfer and amount to approximately EUR 1 billion which presents 16 % of all investments from the NRRP). The NRRP 2021-2026 foresees the establishment or improvement of the framework for innovation incentives as well as the partnership between the research sector, economy, and society in innovation creation.¹⁰⁸

The National Guidelines for Technology and Knowledge Transfer were adopted in December 2022 by the Ministry of Science, Education and Youth (MSEY), and provide a framework for the effective use of results from publicly funded research through proper management of intellectual property and the development of entrepreneurial culture and related skills in public scientific organizations. The guidelines form the basis for further projected investments in technology transfer activities, which will improve the national innovation system. The National Guidelines for Knowledge and Technology Transfer provide recommendations and practical advice to technology transfer offices (TTOs) and managers in research organizations to improve technology and knowledge transfer activities.

The Ministry of Science, Education and Youth (MSEY) is very proactive in providing support to TT activities at Croatian research institutions and manages various funding programs for TT as previously elaborated in the study (e.g., Support programme for technology transfer, Support programme for technology transfer offices, etc.).

10 Conclusions

The main characteristics observed through the conducted desk research and study results related to the TT system in Croatia indicate that there is still room for improvement. Despite there were certain initiatives in the past that provided financing to support TT activities at research institutions the TTOs were faced with a lack of staff with relevant TT skills, non-continuous financing of TTOs in terms of available support programs for TT that would result in a commercially viable projects to implement. There were only a few successful projects from HEIs and PROs in which TTOs significantly contributed to their commercialization.

The system in Croatia is faced with many challenges that include insufficient collaboration between academia and industry, the existing lack of relevant entrepreneurial skills among

¹⁰⁷ <https://publications.jrc.ec.europa.eu/repository/handle/JRC136807>

¹⁰⁸ Ibidem.

researchers, and limiting funding opportunities for early-stage commercialization activities. However, there are certain opportunities to enhance the TT system such as the existence of TTOs at universities and PROs, the enhanced international collaborations with other HEIs and PROs, and continuous awareness-raising activities and events to promote academia-industry collaborations and partnerships.

Introduction of the National Recovery and Resilience Plan 2021-2026, the Smart Specialization Strategy until 2029, and National Technology Transfer Guidelines (National TT Guidelines), in combination with a strong national commitment to TT, present a significant step toward ensuring relevant preconditions for the establishment of the structured and functional TT system in Croatia, to secure the stable funding for TT, and in this way to encourage universities and public research organizations to strongly engage in technology transfer.

An important aspect to be improved in the context of the TT system in Croatia is to increase R&D investments, especially in the business sector. In addition, it is also important to increase the investments in basic research since it is a basis for quality applied research resulting in new knowledge and innovation. From the institutional perspective, it is important to invest in the human resources working in TT and in the infrastructural capacities of universities and PROs to secure the necessary scientific capacities to be internationally competitive and have commercial potential.

11 Bibliographic References

1. European Commission, Directorate-General for Research and Innovation, Račić, D., Cvijanović, V. (2022) PSF to support early stages of innovation and science-business linkages: background report. Publications Office of the European Union. <https://data.europa.eu/doi/10.2777/387591>
2. Bole, D., Galabova, L., Haley, C., Kokorotsikos, P., Matanovac-Vučković, R., Rizzuto, C., Taylor, S., Vladut, G. and Zambelli, M., Strategic evaluation of the technology transfer and IPR protection systems of Bulgaria, Croatia and Romania and recommendations for their enhancement, Kaymaktchiyski, S., Battiston, A. and Jiménez, V.M. editor(s), Publications Office of the European Union, Luxembourg, 2024, doi:10.2760/375746, JRC136807., available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC136807>
3. European Commission, Directorate-General for Research and Innovation, (2023) PSF to support early stages of innovation and science-business linkages in Croatia: final report. Publications Office of the European Union. <https://data.europa.eu/doi/10.2777/772993>
4. European Commission, Secretariat-General (2024), COMMISSION STAFF WORKING DOCUMENT 2024 Country Report - Croatia Accompanying the document Recommendation for a COUNCIL RECOMMENDATION on the economic, social, employment, structural and budgetary policies of Croatia, available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52024SC0611>
5. Government of the Republic of Croatia, National Reform Programme, 2023, available at: https://commission.europa.eu/document/download/fec2933e-154c-45b7-ac6a-51795ca12a78_en?filename=2023_CROATIA_NRP_EN.pdf