Comprehensive study of Technology Transfer Ecosystem

Country: Slovenia

WP2:A4

Prepared by Jožef Stefan Institute (JSI)

Date: October 2024

Authors

Robert Blatnik, Tomaž Lutman, Marijan Leban, Tinkara Mlinar, Urška Florjančič

Foreword

The study has been prepared by members of the STEIDA project group at the Jožef Stefan Institute (JSI), as part of the WP2 - Best Practices in Technology Transfer Ecosystem / A4 - Comprehensive study of Technology Transfer Ecosystem. All individuals have contributed as experts and practitioners and not as representatives of JSI. The views expressed in the report are those of the experts and do not necessarily represent the views of JSI or any organisations with which any expert is affiliated.

Abbreviations

Slovenian National Innovation System (NIS)

Knowledge and Technology Transfer Ecosystem (KTTE)

Knowledge and Technology Transfer (KTT)

Knowledge and Technology Transfer Offices (KTOs)

Technology Transfer Office (TTO)

Intellectual Property (IP)

Intellectual Property Rights (IPR)

Slovenian Intellectual Property Office (SIPO)

European Innovation Scoreboard (EIS)

Higher Education Institutions (HEIs)

Public Research Organizations (PROs)

Jožef Stefan Institute (JSI)

International Technology Transfer Conference (ITTC)

Strategic Research and Innovation Partnerships (SRIPs)

Content

1 Introduction

In this study we refer to the **knowledge and technology transfer ecosystem (KTTE)** as an integral component of the innovation support environment in Slovenia.

Slovenian National Innovation System (NIS) is a multifaceted framework designed to foster research and development (R&D) and stimulate innovation across various sectors. By introducing recently adopted national law on scientific research and innovation activities (ZZrID) (1), the **knowledge and technology transfer (KTT)** is becoming an **integral part of the scientific research and innovation system**. According to ZzrID, the scientific research and innovation system is "*a consistence of the entities and performers of scientific research and innovation activities, which collaborate and connect with each other, encompassing multiple levels of development. An integral part of scientific research and innovation activities is the supportive environment that fosters (international) project work, networking, partnership cooperation, knowledge and technology transfer, as well as the creativity and entrepreneurship of those engaged in scientific research and innovation activities*".

Within the scope of this study, we outline the development of **the knowledge and technology transfer ecosystem (KTTE) in Slovenia**, the present status of Slovenia's innovation performance within the European Union as reported in the European Innovation Scoreboard 2024, legislative frameworks, the main actors and stakeholders within Slovenian KTTE, the role of Knowledge and Technology Transfer Offices (KTOs) as fundamental instruments for KTT processes, the best practises of KTT, relationships between the agents of the KTTE, funding mechanisms, human resources and training. We also emphasise main challenges, risks, and opportunities for future development and progress of KTTE in Slovenia.

1.1 Work methodology

To conduct a comprehensive study of the Slovene technology transfer ecosystem, we employed a two-part methodology. First, we conducted desk research that included an extensive survey distributed to 37 Slovene organizations, encompassing higher education institutions (HEIs), public research organizations (PROs), incubators, and technology parks. Second, we performed a thorough literature review of relevant national legislative documents, strategies, professional articles to provide context and support for the survey findings.

2 Background/Environment

2.1 Slovenian national innovation system

Slovenian National Innovation System (NIS) is a multifaceted framework designed to foster research and development (R&D) and stimulate innovation across various sectors. Drawing inspiration from successful models in Austria, Ireland, and Germany, Slovenia has tailored its approach to meet its unique needs.

Slovenia has developed and approved policies, strategies, action plans aimed at coordination among different parts of the innovation system. The strategic direction for R&D and innovation is set by key

governmental bodies: Ministry of the Economy, Tourism and Sport, Ministry of Higher Education, Science and Innovation, Slovenian Research and Innovation Agency (ARIS), SPIRIT Slovenia Business Development Agency, Slovenian Enterprise Fund (SPS) and regional and local development agencies.

To bridge the gap between research and industry, Slovenia has established various intermediary institutions, such as: Technology Centres and Platforms, Centres of Excellence and Clusters, Financial Intermediaries, Technology Parks and Business Incubators, University Incubators and Knowledge and Technology Transfer Offices (KTOs). Strategic Research and Innovation Partnerships (SRIPs) are established to align research efforts with industry needs and national priorities in the target areas of the Smart Specialization Strategy (S4). KTOs are located within public research organizations (PROs) and manage the commercialization of scientific findings and intellectual property rights.

The education and research landscape is dominated by three major PROs which are contributing substantially to the country's innovation output: University of Ljubljana and University of Maribor are the two largest universities, offering a wide range of programs and engaging in significant research activities. Jožef Stefan Institute (JSI) is the largest research institute in Slovenia, specializing in natural sciences and technology.

The enactment of the new Scientific Research and Innovation Activities Act (ZZrID) in Slovenia in 2021 (1) has redefined the national innovation system by integrating scientific research and innovation policies.

With the introduction of this new law the knowledge and technology transfer (KTT) is becoming an integral part of the scientific research and innovation system. The ZzrID defines the scientific research and innovation system as "*a consistence of the entities and performers of scientific research and innovation activities, which collaborate and connect with each other, encompassing multiple levels of development:*

- *The fundamental scientific research level, which pertains to basic and applied research, typically up to and including proof of concept;*
- *The research and development level, which involves industrial research and experimental development, typically up to and including demonstration in a comparable environment;*
- *The developmental innovation level, which relates to experimental development, up to and including commercialization of solutions in the market or their use by end users.*

An integral part of scientific research and innovation activities is the supportive environment that fosters (international) project work, networking, partnership cooperation, knowledge and technology transfer, as well as the creativity and entrepreneurship of those engaged in scientific research and innovation activities".

The scientific research and innovation system is therefore inherently linked to the knowledge and technology transfer (KTT) system. In this study, we refer to the knowledge and technology transfer ecosystem (KTTE) as an integral component of the innovation support environment.

2.2 Development of the knowledge and technology transfer ecosystem (KTTE) in Slovenia

Historically speaking, the development of the technology transfer ecosystem in Slovenia has evolved through several phases, shaped by the country's transition from a socialist economy to a market-

driven system, integration with the European Union, and efforts to promote innovation and collaboration between academia and industry.

Before the independence of Slovenia in 1991, the innovation and technology transfer were limited by the socialist economic structure. Research and development were largely concentrated in state-owned enterprises and public institutions, including universities and research institutes. There was minimal collaboration with the private sector, as most industries were publicly owned. Intellectual property (IP) protection and commercialization were not priorities under the socialist regime. Nevertheless, during the period of transition to a new socio-economic system, the Jožef Stefan Institute (JSI), the leading scientific public research institute, established its first company in 1987, which later became the first spin-off company through privatization and the ownership entry of employed researchers and some members of the institute's management.

When Slovenia gained independence in 1991, an intensive push towards a market-oriented economy was done. Slovenia aimed to establish a competitive economy based on knowledge and innovation, leading to the early development of the technology transfer ecosystem. Following the transition to a market economy a significant decline in the volume of industrial research conducted by JSI for large, socially-owned industrial companies under the previous economic system, a strategic need has arisen for the Institute to increase its involvement in international projects. In 1994 the first Technology Transfer Office (TTO) in Slovenia was established at JSI, the largest national research institute in Slovenia, with the aim of integrating industry, small and medium-sized enterprises and academia into EU research and innovation programmes and promoting transnational technology transfer to EU countries and vice versa, thus supporting the technological needs of Slovenian industry.

At that time JSI also co-founded the first Technology Park (today Technology Park Ljubljana) and the Republic of Slovenia also launched the Slovenian Intellectual Property Office (SIPO) which strengthened the IP landscape, encouraging more structured IP management and commercialization efforts. As the late 1990s marked the establishment of the first technology parks, the first private and university incubators arose in early 2000s.

Integration of Slovenia with the European Union in 2004 was a major catalyst for the development of its technology transfer ecosystem. The Slovenian science and research activities are financed from public funds - in part from the national public budget, partly from the EU budget (European projects).

To effectively manage regional development initiatives and comply with EU structural funding requirements—ultimately supporting the country's socio-economic growth and integration within the European framework—Slovenia has been divided into 12 statistical regions and two cohesion regions: Eastern and Western Slovenia.

As shown in Figure 1, the statistical regions are grouped into the two cohesion regions, Eastern and Western Slovenia, with characteristics presented in Table 1. The division into two cohesion regions was first applied during the 2014–2020 programming period for the distribution of EU funds. Since 2016, the Western Slovenia Cohesion Region has been reclassified as one of Europe's developed regions, while Eastern Slovenia remains one of the less developed regions.

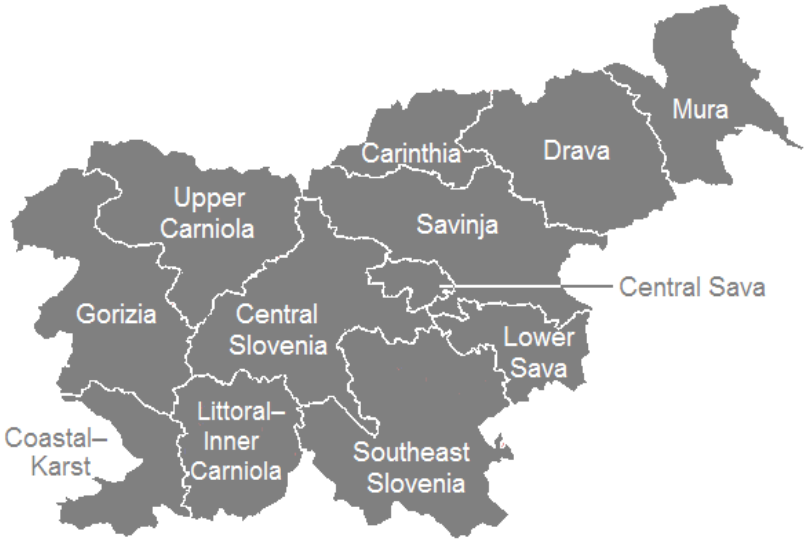

Figure 1: The Eastern Slovenia Cohesion Region consists of eight development regions, i.e., Pomurska (Mura), Podravska (Drava), Koroška (Carinthia), Savinjska (Savinja), Zasavska (Central Sava), Posavska (Lower Sava), South-eastern Slovenija and Primorsko-notranjska (Littoral-Inner Carniola), while the Western Slovenia Cohesion Region includes four development regions, namely: Gorenjska (Upper Carniola), Goriška (Gorizia), Obalno-kraška (Coastal-Karst) and Central Slovenia.[1]

	Eastern Slovenia Cohesion Region	Western Slovenia Cohesion Region
Population	1,105,046	1,003,931
Area (km2)	12,433	7,840
No. of development regions	8	4
No. of municipalities	148	64
Population density (no. of inhabitants per km2)	88.9	128.1

Table 1: Data for Slovenian Cohesion Regions, Source: Statistical Office of the Republic of Slovenia, 2021[2]

EU membership provided access to significant funding through programs like Horizon 2020, the Structural Funds, and various innovation-related initiatives. In the early 2000s, the Slovenian government began adopting more explicit policies to foster innovation and technology transfer, recognizing the need to build bridges between academic research and industry. The public research organizations (PROs) are well aware of the fact that the increase in competitiveness of the Slovenian economy also depends on the quality of the cooperation between science and industry. However,

[1] https://en.wikipedia.org/wiki/Statistical_regions_of_Slovenia, 12.12.2024
[2] https://www.gov.si/en/topics/cohesion-regions-in-slovenia/, 12.12.2024

looking at the commercialization side of Intellectual Property Rights (IPR), in the end of the first decade of the 21st century, it was obvious that the knowledge and technology transfer potentials were not being fully exploited. The reasons could be sought in the less developed parts of the innovation support system – the intermediaries, which would assist in the commercialization of IPR – the Technology Transfer Offices (TTOs). (2)

Even though changes have been observed during the first decade of the 21st century, in European and national legislation, the problem of operationalization of TTOs through dedicated financing in fact remained open. A situation at the end of the first decade of the 21st century was still a gross neglect of the TTOs and their activities by the government. On the one hand this forced most TTOs to have only one or two employees, mainly dealing with other issues of the institution (e.g. PR, research project administration). The two exceptions in size and activities, JSI with 6-15 employees and later TehnoCenter University of Maribor with 4-8 employees at the time, however, had little institutional financial support, and had to provide financing for their work from projects (EU projects, work for industry). Thus, the long-lasting effort for financial support to the TTOs from the side of the government began already in 2008.

In the next decade, the technology transfer ecosystem in Slovenia matured significantly, driven by both internal initiatives and international cooperation. Public-private partnerships became more common, and the role of intermediary organisations like TTOs, innovation centres, and business incubators became more prominent.

The Slovenian government, in collaboration with the Association of Technology Transfer Professionals of Slovenia (SI-TT), initiated efforts to finance Technology Transfer Office (TTO) activities starting in 2009. These initiatives can be categorized into three main phases:

1. INO Projects (2008–2011): The Technology and Innovation Agency (TIA), supported by the Ministry of Science, funded INO projects in 2008, 2009, and 2011. These projects involved partners such as Slovenian Business and Regional Development Agencies and some Public Research Organizations (PROs). The primary focus was on promotional activities and event organization, emphasizing metrics like the number of leaflets produced and workshops held. However, there was less emphasis on key performance indicators (KPIs) that directly impacted industrial progress, such as the number and value of contracts or patents filed.
2. KTT Project (2013–2014): The initial Knowledge Transfer Consortium (KTT) project, running from 2013 to 2014, marked the first systematic (though not sustainable) funding of technology transfer in Slovenia. National funds from the Ministry of Economy supported this initiative, which included six partnering PROs.
3. KTT-2 Project (2017–2022): Following a three-year hiatus without financing, the government decided to finance the TTO consortium of main Slovenian PROs with a 5-year project. The KTT-2 project was launched in 2017, extending through 2022. The project's mission was twofold: the strengthening of links and increasing the cooperation of PROs and industry and the strengthening the competences of TTOs, researchers and enterprises. Most (80%+) of the finances were for human resource support.
4. Following these two KTT projects, in 2024, the Ministry of Higher Education, Science, and Innovation (MVZI) and the European Union, through the European Regional Development Fund, supported the KTOs of Slovenian PROs for the third time. This initiative resulted in the formation of two consortia of Slovenian PROs: one comprising all three Slovenian public universities, coordinated by the University of Ljubljana, the largest Slovenian university, and the other consisting of nine Slovenian public research institutes and a higher education faculty,

coordinated by the Jožef Stefan Institute. Both consortia aim to enhance the infrastructure and effectiveness of knowledge transfer in Slovenia. Each consortium is running a project from April 12, 2024, to February 28, 2029, with a total budget of €2.15 million allocated to each.

The objectives of both KTT/KTO projects are:

- Strengthening Existing KTOs: Enhance the capabilities of current Knowledge Transfer Offices to improve their efficiency in facilitating the transfer of research outcomes to industry.
- Establishing New KTOs: Set up KTOs in institutions that are beginning to engage in professional knowledge transfer activities, thereby expanding the national network.
- Improving Collaboration: Foster better cooperation and knowledge exchange among KTOs and their respective PROs in the first place and other stakeholders within the innovation ecosystem to streamline processes and share best practices.

The objectives of KTT/KTO projects are aligned with the EU policy and recommendations of the European Commission (EC). The EC has underscored the importance of effective knowledge valorisation—the process of transforming research and innovation results into societal and economic value in several key policy documents:

- 2008 Commission Recommendation: Highlighted the need for structured management of intellectual property in knowledge transfer activities, providing a Code of Practice for universities and public research organizations.[3]
- 2022 Council Recommendation: Introduced guiding principles for knowledge valorisation, advocating for comprehensive strategies to maximize the societal benefits of research and innovation.[4]
- 2023 Commission Recommendations: Issued Codes of Practice on the management of intellectual assets and standardization, aiming to enhance the practical implementation of knowledge valorisation across Member States.[5]

Today, Slovenia has a well-established, though still developing, knowledge and technology transfer ecosystem (KTTE), mainly characterised by a solid research infrastructure, active participation in international collaborations, and supportive government policies. The key research institutions and HEIs have Knowledge Technology Transfer Offices (KTOs) dedicated to managing IP, licensing technologies, facilitating collaborations between researchers and businesses, spreading awareness and knowledge about IP and its commercial potential among researchers, and offering support in establishing spin-offs and spin-outs. These offices are crucial for bridging the gap between research outputs and market needs. The governmental efforts in the last decade to foster networking of TTOs by financial support of KTO consortia at PROs aim to strengthen Slovenia's knowledge transfer ecosystem.

However, Slovenian KTTE faces challenges in scaling innovations to the global marketplace. Barriers include a lack of venture capital, limited access to global markets for small businesses, and sometimes a gap between academia and industry needs in terms of applied innovation. This mirrors broader issues identified in the European Union (EU), as highlighted in the Draghi Report (3):

- Innovation Gap: The EU lags behind the United States and China in translating research and development into market-ready products. This gap is attributed to fragmented markets,

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32008H0416&utm
[4] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022H2415&utm
[5] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023H0499&utm

cumbersome regulations, and insufficient funding for high-risk ventures. The report notes that "no EU company with a market capitalization of €100+ billion has been set up from scratch in the last 50 years."

- Regulatory Environment: Excessive regulation and lack of audacious capital in Europe hinder the growth of ambitious, high-risk start-ups. The report emphasizes the need for a more streamlined regulatory framework to foster innovation.
- Capital Markets Integration: The EU's fragmented capital markets impede the scaling of innovative enterprises. A unified capital market is essential to provide the necessary funding and liquidity for start-ups to grow and compete globally.
- Scaling Innovations: Both Slovenia and the broader EU struggle with bringing innovations to the global market, often due to regulatory hurdles and limited access to growth capital.
- Market Fragmentation: The lack of a cohesive single market within the EU creates barriers for start-ups aiming to scale across member states.
- Investment in High-Risk Ventures: There is a scarcity of bold investment in sectors like nuclear fusion and quantum computing, which require substantial funding to thrive.

To address some of the above-mentioned challenges, in 2024 first Deep Tech Vesna Venture Capital Fund was founded to make early investments in cutting-edge technologies in the area Climate & Environment Tech, Advanced Materials & Enabling Tech, and Artificial Intelligence & ICT, that are created at Slovenian and Croatian PROs. The Vesna Deep Tech Venture Fund addresses challenges in scaling innovation to the global marketplace by:

1. Investing in Early-Stage Innovations: The fund allocates resources to up to 80 projects in Slovenia and Croatia, focusing on the "proof-of-concept" phase to transform research into market-ready businesses.
2. Facilitating Technology Transfer: By supporting the commercialization of research and the protection of intellectual property, Vesna enhances the practical application of academic innovations, bridging the gap between research institutions and industry.
3. Strengthening Research-Industry Linkages: The fund collaborates with university technology transfer offices to establish consistent frameworks for intellectual property transfer, fostering stronger connections between research entities and the market.
4. Providing Financial Support: With a total of €49 million, including contributions from the European Investment Fund and national development banks, Vesna offers substantial funding to advance scientific research and innovation in the region.

Through these initiatives, Vesna addresses some of the key challenges in the Slovenian innovation ecosystem, promoting the commercialization of research and enhancing the global competitiveness of innovations from Slovenia and Croatia.

2.3 EIS in Slovenia

The European Innovation Scoreboard (EIS) 2024 report on Slovenia (4) provides a comprehensive overview of the country's innovation performance within the European Union. In 2024, Slovenia is classified as a "Moderate Innovator," with an innovation index that is 91% of the EU average. This places it above the average performance level of other Moderate Innovators, which stands at 84.8%. However, Slovenia's performance growth is slower than the overall EU increase of 10%.

Below is a more detailed analysis of Slovenia’s EIS 2024 with a particular emphasis on certain topics.

PhD Graduates: Slovenia's performance regarding new doctorate graduates is at the EU average (100.0%), but it has seen a significant decline since 2017 (-69.5%). The volatility and decline in the number of PhD graduates are concerning as it impacts the country's ability to sustain a high level of research and innovation. This trend could be linked to insufficient support or incentives for post-doctoral education, which may reduce the country's capacity to produce highly skilled researchers needed for advanced research and development (R&D).

Attractive Research Systems: Slovenia scores above the EU average in this category, with a performance index of 102%. This includes a high share of international scientific co-publications (152%) and an increase in foreign doctorate students (96.7%). Slovenia's research system is relatively attractive, particularly for international collaboration. The strong performance in attracting foreign doctorate students suggests that the country is becoming a more appealing destination for advanced studies, likely due to the quality of research institutions or favourable conditions for international students.

Finance and Support: Slovenia's performance in this area is below the EU average, with an index of 74.2%. While public sector R&D expenditure has seen some growth (+13.1% since 2017), venture capital expenditures remain low at 45.6% of the EU average. The low levels of venture capital investment highlight a critical bottleneck in Slovenia's innovation ecosystem. This lack of financial support, particularly from the private sector, could hinder the growth of start-ups and innovative enterprises, limiting the country's potential to scale innovative ideas into commercial successes.

Firm Investments: Firm investments are weak, with a score of 59.5% relative to the EU average. Notably, non-R&D innovation expenditures are critically low at 27.2%, and R&D expenditure in the business sector has declined by 14.3% since 2017. The significant drop in both R&D and non-R&D innovation expenditures by firms indicates a lack of confidence or capability among businesses to invest in innovation. This trend is worrying as it suggests that Slovenian firms may struggle to compete in increasingly innovation-driven markets, potentially leading to a decline in economic competitiveness.

Innovators: Slovenia performs well in this area, scoring 120.2% of the EU average. SMEs introducing product innovations are particularly strong at 151.7%, and there has been notable growth in job-to-job mobility of human resources in science and technology (HRST) at 110.4%. The robust performance of SMEs in introducing innovations indicates a dynamic and active innovation environment within smaller enterprises. This is a positive sign of adaptability and creativity within Slovenia's business sector, potentially driving future growth if supported by adequate financial and policy frameworks.

Intellectual Assets and Portfolio of Patents: Slovenia lags in intellectual assets, with a score of 88.3%. Both PCT patent applications and design applications are particularly low at 76% and 74.5% of the EU average, respectively. The low output in patenting and design suggests that while Slovenia may be generating innovations, it struggles to formalize and protect these innovations through intellectual property mechanisms. This could limit the country's ability to capitalize on its innovations, reducing potential returns on investment in R&D.

Spinoff Creation: Although specific data on spinoff creation is not directly provided in the report, the low venture capital expenditures and weak performance in intellectual assets suggest that spinoff activity may be limited. The challenges in securing funding and protecting intellectual property likely constrain the development of spinoffs, which are crucial for translating academic research into commercial ventures. The creation of spinoffs is essential for transferring knowledge from research

institutions to the market. Slovenia's struggles in related areas imply that the country may not be fully exploiting its research potential, which could hinder overall innovation-driven economic growth.

Relative Strengths and Weaknesses: Slovenia excels in public-private co-publications, population involved in lifelong learning, and international scientific co-publications. These strengths suggest a collaborative and well-educated environment, conducive to knowledge sharing and innovation. The country is weak in non-R&D innovation expenditures, knowledge-intensive services exports, and venture capital expenditures. These weaknesses indicate structural challenges in translating innovation into economic outputs and scaling up innovative activities.

2.4 Legislative Frameworks

Slovenian legislative. The Republic of Slovenia has established universities and public research institutes, jointly named Public Research Organizations (PROs), with Institutes Act (1991) and The Higher Education Act (1993). Financing of research work at PROs is implemented with the assistance of the Slovenian Research and Innovation Agency.

The researchers compete for the financing of their research plans. They do so in regular time intervals (every year for projects, every four to six years for programmes). Evaluation of the proposals is done on the basis of certain criteria. Thus, it is possible to claim that the financing of research from the public budget is project and programme organised. To a certain degree, such a frequent selection and unavailability of stable long-term financing should support positive selection in the research sphere and enable researchers to work creatively in a relatively secure environment.

With the Act on inventions arising from employment (ZPILDR, 1995) (5), the Republic of Slovenia has introduced an arrangement similar to the Bayh-Dole Act of the USA. The inventions arise from PROs. All the inventions resulting from the state budget financing, are owned and managed by the PROs. Certain conditions regulate the management of the mentioned inventions. These conditions need to be met, for the PROs to become the owner of the actual invention. These conditions are described in Article 21 and 22 of the Act on inventions arising from employment and are related to the Industrial Property Act (6).

All EU member states (except Italy and Sweden) – manage their inventions in the way the Republic of Slovenia does, with respect to the responsible PROs. The state renounces the right of ownership of the inventions in favour of the PROs. Consequently, these PROs, as legal entities, are also responsible for commercialization of inventions. Researchers are not personally responsible for the commercialization of inventions, but are entitled to shared rewards from the commercialization of inventions (in Slovenia minimum is in the amount of 20 % of the gross related PRO income) in case of successful commercialization takes place. The researchers are thus incentivized to participate, and practically all PROs in Slovenia nowadays have internal PRO Acts distributing the benefits defined by the law.

With the Act on Supportive Environment for Entrepreneurship (ZPOP-1, 2007) (7) and the accompanying Record on Keeping Rules on the Innovative Environment (2005) (8) a legal base for a supportive environment for innovation was created in Slovenia.

Entrepreneurship incubators, university incubators and technology parks were explicitly mentioned in Article 2 of the Record on Keeping Rules on the Innovative Environment (8). Each of those supportive organizations was supposed to, in a manner described in the Record, support

development and cooperation of the start-up and young enterprises. Technology transfer offices were mentioned by the Record on Keeping Rules on the Innovative Environment (8) but were not financed through being part of the listed entities by the same Record.

Last but not least, based on the Industrial Property Act (2001) (6), see Article 5, the Slovenian Intellectual Property Office (SIPO) was founded, with the main function to accept patent and other IPR applications, manage the related procedure, related registers of rights, provide information services and represent the Republic of Slovenia at WIPO, EPO and other international organizations.

Intellectual property is an independent legal field, as legislation determines the type and scope of rights of intellectual property, the method of their acquisition, the method of exercising rights in the event of their violation and the like. The field of intellectual property in the Republic of Slovenia is defined by the following laws for which Slovenian Intellectual Property Office (SIPO) is responsible: Industrial Property Act (6), Copyright and Related Rights Act (9), Collective Management of Copyright and Related Rights Act (10), Act on the Protection of Topographies of Integrated Circuits (11), Act on inventions arising from employment (5). Individual areas of IP are also governed by other regulations, e.g., Trade Secrets Act (12), Companies Act (13), Agriculture Act (14) and Act on the Protection of New Varieties of Plants (15), as well as the Code of Obligations (16), The Criminal Code (17) and Liability of Legal Persons for Criminal Offences Act (18).

As a member of the European Union, the Republic of Slovenia is also bound by the adopted **European legislation (regulations and directives)**, which is quite extensive in the field of intellectual property. In this context, the Republic of Slovenia also cooperates intensively with the European Union Intellectual Property Office (EUIPO) - an agency of the European Union (established in 1994 as the Office for Harmonization in the Internal Market) (trademarks and designs), which is responsible for the registration of trademarks of the European Union (EU) and Community models, which apply as uniform rights in all EU member states. The EUIPO also has a European Observatory on Infringements of Intellectual Property Rights. Nevertheless, the transposition of directives also allows the member states some flexibility or exceptions.

There is a lot to it important coordination of the protection of IP rights and the public interest, or allowing exceptions and limitations of copyright and related rights (e.g., in the field of science, education). This is particularly evident in the concept of **open science**: namely, according to the European Data Strategy (2020), data is at the heart of the digital transformations, as their openness will enable many innovations, which in turn will lead to the improvement of citizens' lives. Data is important for economic growth, competitiveness, innovation, the creation of new jobs and the progress of the entire society. Therefore, the European Commission wants to establish a single market for data, which would ensure Europe's global competitiveness and data sovereignty. Here, the issue of open access to the results of scientific research activity (open science) is important. Open science is an important part of the scientific research policy of the EU and also of Slovenia. Open science primarily includes open access to research results, evaluation of the quality and impact of scientific research work using responsible metrics, and connecting and involving the interested public in the research process. More detailed requirements for the implementation of scientific research work according to the principles of open science are determined by the government, considering the Slovenian Scientific Research and Innovation Strategy and the recommendations of European research policies. Open science measures are defined in an action plan adopted by the government. Thus, in the month of May 2023, the Government of the Republic of Slovenia adopted two important documents in the field of scientific research as part of the National Reform Programme 2023. It concerns the Decree on the implementation of scientific research work in accordance with the

principles of open science (Official Gazette of the Republic of Slovenia, No. 59/23) and the Action Plan for Open Science for the implementation of Objective 6.2: Open Science to improve the research quality, efficiency, and responsiveness. In terms of content, the Action Plan for Open Science is linked to the Action Plan for the implementation of the National Strategy of Open Access to Scientific Publications and Research Data in Slovenia 2015–2020. Exceptions to the open availability of research results in publicly funded research (co-financed by public resources at least in the amount of 50%) are possible in justified cases, when fully open access prevents the protection of IP, the protection of personal data, the security of persons or the state or other legal restrictions. This can also include trade secrets. Information about which data will not be openly accessible must be adequately explained and substantiated to the funder in the research data handling plan. Contracts on research activity between a research organization and a private law entity, where no public resources are involved or less than 50%, are not subject to this regulation. Any openness of research data in this case is carried out as agreed in such a contract (for example, in the part where the business interest is.

There are occasional delays in the transposition of EU acts into national legislation, which are primarily the result of long-term interdepartmental coordination and coordination of the interests of various groups. It was done after an urgent procedure and with a delay new legislation on copyright and related rights was adopted in September 2022, which implemented Directive (EU) 2019/790 (19) on copyright and related rights in the digital market. Despite the adoption of the amendments, the public debate in this area is still open, as it is necessary to find a balance between different interests, identify the public interest of Slovenia and clearly represent it already during the preparation of changes to the copyright regulation at the EU level. At the time of the preparation of this analysis, Slovenia was also late in transposing the provisions of Directive (EU) 2015/2436 (20) regarding brands (the deadline expired on 14 January 2023), which was remedied by the adoption of an amendment to the Industrial Property Act on 28 June 2023.

The field of intellectual property is also regulated by many **international treaties** binding Republic of Slovenia, in particular: Agreement on Trade-Related Aspects of IP Rights, Paris Convention for the Protection of Industrial Property, Berne Convention for the Protection of Literary and Artistic Works, Universal Copyright Convention, Convention relating to the Distribution of Programme-Carrying Signals Transmitted by Satellite, International Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organisations, Convention for the Protection of Producers of Phonograms Against Unauthorized Duplication of Their Phonograms, WIPO Copyright Treaty, WIPO Performances and Phonograms Treaty, Marrakesh Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired or Otherwise Print Disabled, Patent Cooperation Treaty, Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure, Strasbourg Agreement Concerning the International Patent Classification, Patent Law Treaty, European Patent Convention, Agreement on a Unified Patent Court, Trademark Law Treaty, Madrid Agreement Concerning the International Registration of Marks and Protocol Relating to the Madrid Agreement Concerning the International Registration of Marks, Nice Agreement Concerning the International Classification of Goods and Services for the Purposes of the Registration of Marks, Vienna Agreement Establishing an International Classification of the Figurative Elements of Marks, Nairobi Treaty on the Protection of the Olympic Symbol, Hague Agreement Concerning the International Registration of Industrial Designs, Geneva Act of the Hague Agreement Concerning the International Registration of Industrial Designs, Locarno Agreement Establishing an International Classification for Industrial Designs and Geneva Act of the Lisbon Agreement on Appellations of Origin and Geographical Indications.

The field of intellectual property is well regulated under international law and rights are mostly unified. International treaties in the field of IP define common rules and procedures for the registration, protection and/or enforcement of IP in different countries. These agreements make it easier for companies to exercise their rights at the international level, simplify procedures and reduce administrative barriers.

Development of new and emerging technologies such as distributed ledger technologies (such as blockchain technology), artificial intelligence, metaverse-related technologies (augmented reality (AR), virtual reality (VR), extended reality (XR) and digital twins), will represent a great challenge for IP protection. This applies both from the point of view of resources (e.g., databases, copyrights...), results (e.g., copyright protection of a product created by artificial intelligence), as well as the general regulation of individual areas, such as e.g., Artificial Intelligence Act, although it does not specifically address the rights of IP (21). Potential violations of IP rights in connection with new and emerging technologies have been pointed out by numerous studies and articles published in recent years. Hupont et al. (22) analysed a new generation of virtual worlds; EUIPO (23) analysed the potential infringements of trademark and design rights due to the use of artificial intelligence, the International Trademark Association (24) study analysed trademark challenges in the metaverse, Mendis, et al. (25) analysed the potential impacts of industrial 3D printing on IP rights, Bogataj Jančič (26) examines whether artificial intelligence can be the author of copyright work, similarly Appel, et al. (27) analysed the relationships between generative models of artificial intelligence and IP rights and more. Solving the aforementioned challenges will require international cooperation, which could be made difficult due to rapid technological development and geopolitical competition (new and emerging technologies as a source of economic and military power of superpowers).

The vast majority of respondent institutions have internal regulations for TT, however these are often not adapted according to the changes in legislation of the "Horizon Europe 2021-2027 plan".

3 Strategy for TT

National Intellectual Property Strategy 2030 (28)

This document outlines Slovenia’s intellectual property strategy through 2030. It aims to harness IP to promote innovation, creativity, and knowledge-sharing, which are crucial for national development and economic growth.

The vision of the Strategy is to establish a top-tier IP system that fosters innovation and creativity, thereby supporting Slovenia's sustainable development goals and enhancing the country’s competitiveness in global markets. Its mission focuses on maximising the potential of IP for economic development and improving the quality of life for its citizens.

To achieve this vision, the strategy sets out three primary strategic goals: strengthening the environment for effective IP creation, protection, and management; increasing public awareness and knowledge of IP; and enhancing the role of IP in the private, public, and broader societal sectors. Key measures include improving IP legislation to make it more business-friendly, enhancing judicial protection for IP rights, and offering greater support to small and medium-sized enterprises (SMEs) in utilizing and managing their IP assets. Furthermore, there is a strong emphasis on promoting IP education and awareness at all levels of society, including schools and the broader public.

In terms of implementation, the Ministry of Economy, Tourism, and Sports will oversee the execution of the strategy in collaboration with other relevant stakeholders. The strategy also includes a robust monitoring and evaluation framework, with key performance indicators such as the extent of IP use in research and innovation, and the level of public understanding of IP. These metrics will help track progress and ensure that the strategy effectively contributes to Slovenia's long-term innovation and economic goals.

Slovenian Development Strategy 2030 (29)

The document Slovenian Development Strategy 2030 was adopted by the Government of the Republic of Slovenia at the end of 2017. The strategy sets out twelve development goals for the Republic of Slovenia, all of which are also linked to the sustainable development goals of the 2030 Agenda. The most important goal for the area of intellectual property is 'Goal 6: Competitive and socially responsible entrepreneurial and research sector', where one of the three performance indicators is expressed in the value of the European Innovation Index, namely its target value in 2030 is the ranking of the Republic of Slovenia in the group of leading EU innovator countries. Intellectual property, with an emphasis on industrial property, creates added value for the economy, and its protection and enforcement contribute to the promotion of innovation and economic growth.

Resolution on the Slovenian Scientific Research and Innovation Strategy 2030 (30)

In the Resolution on the Slovenian Scientific Research and Innovation Strategy 2030, which was adopted by the National Assembly of the Republic of Slovenia in 2022, it is stated, among other things, that the Republic of Slovenia will develop into a successful society based on knowledge and innovation by 2030 and will be included in the group of leading innovator countries on the scale of the EIS. The Republic of Slovenia will achieve the expected development effects and results with five overarching goals, horizontal goals and key measures (we do not list all of them here), which will contribute to approaching the set goal of ranking among the ten most successful EU countries, as measured by the EIS. The field of intellectual property is addressed within the framework of 'objective 5: Accelerated cooperation between science and business, transfer of knowledge and innovation', for which an action plan is also being prepared. The field of intellectual property is also affected by the horizontal goal stated in the resolution: '6.2. Open science to improve the quality, efficiency and responsiveness of research'.

Individual indicators of the EIS will be used to monitor the effectiveness of the national policy for the implementation and promotion of scientific research and innovation activity. For the field of intellectual property, the relevant indicators are in the innovation dimension '3.c Intellectual assets', these monitoring indicators are:

- an application for the grant of a patent under the PCT,
- application for trademark registration,
- application for design registration.

Slovenian Industrial Strategy 2021–2030 (31)

The Government of the Republic of Slovenia in 2021 adopted the document Slovenian Industrial Strategy 2021– 2023. The strategy is based on the Development Strategy of Slovenia 2030, while also

considering other strategic documents at the national and European level. It presents a vision of the development of Slovenian industry as green, creative and smart.

The document defines indicators that represent value goals with target values in 2030. In addition to the overarching indicator (labour productivity) and general indicators of financial operations, the document also defines sub-indicators for the field of green, creative and smart development.

For the field of intellectual property, the following sub-indicators and their target values are important in 2030:

- the number of patent applications filed by Slovenian applicants at the European Patent Office; target in 2030: 150;
- innovation index (according to the development of the EU); target in 2030: 110%;
- number of valid national trademarks; target in 2030: 26,000.

An Overarching Strategy for Slovenia's Digital Transformation by 2030 (32)

The Government of the Republic of Slovenia adopted the Digital Slovenia 2030 Strategy document in 2023. The field of IT is mentioned in several chapters in the document. In 'Chapter 2 - Digital competences and inclusion' is stated that also intellectual property questions are included among the digital competences. 'Chapter 4 - The Road to Smart Society 5.0' addresses intellectual property in the context of data use and following the principle of intellectual property protection while otherwise advocating open by default. However, Chapter 6, which addresses cyber security, includes security against intellectual property theft.

National Programme to Promote the Development and Use of Artificial Intelligence in the Republic of Slovenia by 2025 (33)

The national program touches on the issue of intellectual property only when mentioning the need to provide an appropriate legal framework that will enable the management of non-personal data (e.g., collection, access, sharing, use, modification or addition, also from the point of view of ownership, responsibility, copyright, etc.).

3.1 Global strategy of HEIs in TT

At all three Slovenian public universities, KTT is considered an important activity, with one university showing stronger commitment than the others. However, only one university has a clearly defined strategy for supporting technology transfer, while the others do not have such clarity. Notably, at the university with a defined strategy, governance teams have been actively involved in its development, highlighting the crucial role of institutional involvement in fostering a strong technology transfer culture. This involvement likely enhances the effectiveness and success of technology transfer activities within the organization.

3.2 Map of Stakeholders

3.2.1 Knowledge and technology transfer ecosystem (KTTE)

Slovenian KTTE is an integral part the national innovation system in Slovenia. The key entities of Slovenian national innovation system are presented in Figure 2.

Figure 2: Slovenian National Innovation System (list of institutions is non-exhaustive). Note: MGTŠ - Ministry of the Economy, Tourism and Sport; MVZI - Ministry of Higher Education, Science and Innovation; MKRR - Ministry of Cohesion and Regional Development; MDP - Ministry of Cohesion and Regional Development; PSDDMF - Public Scholarship, Development, Disability and Maintenance Fund of the Republic of Slovenia; NCP – national contact point; EEN – Enterprise Europe Network. (34)

The most active entities which are involved in Slovenian KTTE are listed below.

1. Higher Education Institutions (HEIs) and their respective KTOs

University of Ljubljana: Largest and most prominent university in Slovenia with strong research output in various fields and active involvement in technology transfer.

University of Maribor: Known for research in engineering, natural sciences, and technology transfer activities.

University of Primorska: Emerging in the national research scene, with growing interest in innovation and TT.

In 2024 all three public universities established a consortium of KTOs, which has been granted with a 5-year governmental project and financial support, to strengthen competences in knowledge and technology transfers ecosystem in Slovenia at national level.

Faculty of Information Studies in Novo Mesto (FIŠ): the first pillar of public higher education in the Southeast region of Slovenia, covering topics Computer Science, Web Technologies, Informatics in Contemporary Society, Information Society

All four entities have active Knowledge and Technology Transfer Offices (KTOs), aiming to manage IPR and transfer of inventions to the industry, train in the commercialisation of knowledge and the protection of intellectual property, advice on business plans for innovation, network with companies interested in knowledge and technology transfer and other research organisations and external consultants, promote scientific research and the transfer of knowledge into practice, respond to industry demand for knowledge in the research areas covered by institutions.

2. Research Centres and Institutes and their respective KTOs

Jožef Stefan Institute (JSI): The largest public research institute in Slovenia, playing a pivotal role in innovation, TT, and collaboration with industry

National Institute of Chemistry (KI): Focuses on chemical, pharmaceutical, and material research with potential for TT

National Institute of Biology (NIB): The main research institution for life sciences in Slovenia. In autumn 2023, they completed big investment and Biology (NIB) to the Biotechnology Hub (BTH-NIB) was completed

Rudolfovo - Science and Technology Center Novo mesto (Rudolfovo): the public research institute aims to support the technological development and innovation of South-Eastern Slovenia, focused in Industry 4.0 and 5.0, digitization and digital transformation of the economy and the entire society, circular economy

Institute of Civil Engineering of Slovenia (ZAG): the leading institute in the field of construction in Slovenia

Agricultural Institute of Slovenia (KIS): the leading research institute in the field of agriculture in Slovenia, expanding into the fields of environmental protection and ecology

Geological Survey of Slovenia (GeoZS): the primary geological research institute of Slovenia

Institute of Metals and Technology (IMT): Active in research related to material science and metallurgy with TT potential

Science and Research Centre Koper (ZRS KP): interdisciplinary basis, involving humanities, social and natural sciences, with special emphasis given to the research in the specific environments of the Mediterranean and the upper Adriatic region

In 2024 all those 9 entities and FIŠ as public independent HEI established a consortium of KTOs, which has been granted with a 5-year governmental project and financial support, to strengthen competences in knowledge and technology transfers ecosystem in Slovenia at national level.

3. Government and Policy Makers

Actors in the political system are seen on two levels, i.e., the Government with its ministries and the other bodies implementing the national policies.

Ministry of the Economy, Tourism and Sport focuses on economic policies that support technological advancement and innovation.

Ministry of Higher Education, Science and Innovation focuses on the quality development of higher education, the transfer of knowledge into practice for the development of society as a whole, and the creation of a stimulating environment for research and innovation.

Ministry of Cohesion and Regional Development is responsible for the implementation of the European cohesion policy and regional development. It handles the absorption of funding provided by the European Structural Funds and the Cohesion Fund, as defined by the applicable legislation of the European Union. Ministries, government offices and other stakeholders are included in this process as the national managing authorities; it is also active in the area of entrepreneurship.

Slovenian Research and Innovation Agency (ARIS) is an independent public funding organization that performs tasks related to the National Research and Development Programme and the creation of the European Research Area. ARIS provides a framework for scientific research within the national budget and other sources, promotes high-quality scientific research in Slovenia and its application, fosters internationally comparable evaluation standards, ensures transparency in organizing the research community, promotes international research cooperation, analyzes R&D activities, and provides science policy expertise. Additionally, ARIS implements programs to encourage technological development and innovation, promotes knowledge transfer among various stakeholders, monitors and evaluates innovation policies, and ensures public reporting on the effectiveness of innovation initiatives.

Slovenian Intellectual Property Office (SIPO) governs intellectual property rights in Slovenia, an essential aspect of the TT process.

SPIRIT Slovenia acts as the public agency for entrepreneurship, internationalization, foreign investments, and technology, facilitating business development and innovation.

Slovene Enterprise Fund (SEF, slov. **SPS)** is a governmental institution established to support the growth and development of micro, small, and medium-sized enterprises (SMEs) in Slovenia. It provides financial assistance through grants, loans, guarantees, and equity investments to foster entrepreneurship, boost innovation and competitiveness by enabling easier access to funding for start-ups and SMEs, particularly in their early stages or during growth phases. Additionally, it offers support for internationalization, technological advancement, and scaling of businesses, contributing significantly to the Slovenian economy.

4. Intermediary institutions

Technology Park Ljubljana (LUI): Major innovation hub for start-ups, spinoffs, and high-tech companies, offering support for technology transfer and commercialization.

Slovenian Chamber of Commerce and Industry (GZS) works with businesses across Slovenia to promote innovation and TT, providing a link between research institutions and industry.

The Chamber of Craft and Small Business of Slovenia (OZS) is a national organization representing the interests of craftsmen, entrepreneurs, and small businesses in Slovenia. It provides support, advocacy, and services to its members, including legal and financial advice, training, and assistance

with regulatory compliance. The OZS also promotes the development of small businesses, fosters entrepreneurship, and works to improve the business environment in Slovenia. Through its regional chambers, it ensures representation and support at the local level while engaging with national and international institutions to protect the interests of its members.

Slovenian Association of Technology Transfer Professionals (**SI-TT)** is a national association dedicated to fostering an effective knowledge and technology transfer system. Its goals include defining operational tasks for KTOs in line with the strategic objectives of research organizations (JROs); establishing key performance indicators (KPIs) and methods to measure success in knowledge and technology transfer activities at both JRO and TTO levels; identifying essential skills for technology transfer specialists, proposing a training system, and setting professional standards aligned with international best practices (e.g., ASTP PROTON); advocating for systematic funding of KTT activities.

5. Development banks and Venture capital

SID Bank[6] is a promotional development and export bank 100% owned by the Republic of Slovenia. Its banking and insurance services promote sustainable development and improve the competitiveness of the Slovene economy.

Vesna Deeptech Fund[7] aims to advance earliest tech deal flow with disruptive market potential. The fund invests into breakthrough technologies in the fields of Climate & Environment Tech, Advanced Materials & Enabling Tech and Artificial Intelligence & ICT that will solve world's biggest problems.

6. Support services and conferences

Start-up Slovenia is an integral part of the P2 funding program by the Slovenian Enterprise Fund (SEF) designed to support innovative start-ups in their early stages of development. It provides non-refundable grants to help start-ups cover initial costs, including product development, market entry, and commercialization.

PODIM is one of the leading start-up and innovation conferences in Central and Eastern Europe, held annually in Slovenia. It serves as a meeting point for start-ups, investors, corporates, and thought leaders, fostering collaboration and showcasing innovative solutions. With a mix of inspirational talks, networking opportunities, and tailored business matchmaking, PODIM is a hub for entrepreneurial growth and innovation exchange.

International Technology Transfer Conference (ITTC) is an annual event in Slovenia that brings together researchers, technology transfer professionals, start-ups, and industry leaders. It focuses on fostering collaboration and knowledge exchange in the field of technology transfer, highlighting innovative projects and best practices. The conference serves as a platform for networking, exploring commercialization opportunities, and promoting the translation of research into impactful technological solutions.

3.2.2 The main sectors of research and innovation

Slovenia's research and innovation landscape is diverse, but is particularly strong in ICT, biotechnology, energy, and advanced manufacturing, which align with both national priorities and

[6] https://sid.si/en
[7] https://vesnavc.com/

European Union goals for research and innovation. The country's research institutions, universities, and industry collaborate across multiple fields, particularly in areas where Slovenia has developed competitive advantages.

1. **Information and Communication Technology (ICT)**: one of the most prominent sectors in Slovenia's research landscape, contributing significantly to digital transformation and innovation across industries:

Artificial intelligence (AI): Development of AI applications in various sectors, including industry, healthcare, and logistics.

Big Data and cybersecurity: Research on data analytics, machine learning, and data security is critical, especially in industries like finance and telecommunications.

5G and telecommunications: Research in telecommunications infrastructure, including the implementation of 5G networks, is an important priority.

2. **Biotechnology and Life Sciences**: medical research, pharmaceuticals, and biotechnology applications with key research areas:

Biopharmaceuticals: Research and development of innovative drugs and therapies, including biosimilars and biopharmaceutical products.

Genomics and personalized medicine: Advancing genomic research and developing personalized medical solutions.

Biotechnology for agriculture and food: Developing biotechnological applications for sustainable agriculture and food production.

3. **Energy and Sustainability**: Slovenia places a strong emphasis on research in energy and sustainability, particularly in line with EU green transition goals with key focus areas:

Renewable energy: Research in solar, wind, and hydropower, as well as innovations in energy storage and grid technologies.

Energy efficiency: Innovations aimed at reducing energy consumption in industry, transport, and buildings.

Circular economy: Research supporting the transition to a circular economy, focusing on recycling, waste management, and sustainable materials.

Sustainable mobility: Research in electric vehicles, smart transport systems, and reducing carbon emissions.

4. **Advanced Manufacturing and Industry 4.0**: Slovenia has a strong industrial base, and research in advanced manufacturing and Industry 4.0 plays a key role in its competitiveness. Key areas:

Robotics and automation: Research in industrial robotics, autonomous systems, and manufacturing automation.

Additive manufacturing: Innovations in 3D printing and additive manufacturing technologies.

Smart factories: Integration of digital technologies, sensors, and AI into manufacturing processes to create smart, flexible production systems.

5. **Nanotechnology and Materials Science**: Nanotechnology and materials science research is critical for applications in various industries, including healthcare, energy, and manufacturing. Key research areas include:

Nanomaterials: Development of advanced materials with nanoscale properties for use in electronics, energy storage, and medical devices.

Smart materials: Research into materials that can respond to external stimuli, such as temperature, light, or pressure, with applications in various industries.

Advanced polymers and composites: Development of new materials for use in aerospace, automotive, and construction industries.

6. **Healthcare and Biomedical Sciences**: Healthcare research in Slovenia spans multiple disciplines, from basic biomedical research to applied medical technologies. Key research areas include:

Medical devices and diagnostics: Innovation in the design and production of medical devices, including diagnostics and therapeutic equipment.

Public health and epidemiology: Research on public health issues, including epidemiological studies and disease prevention.

Aging and geriatrics: Slovenia's research also addresses the challenges posed by its aging population, focusing on aging-related diseases and healthcare systems.

7. **Agriculture and Food Science**: Slovenia's agriculture and food sectors are also innovation-driven, with research focused on improving food security, sustainability, and the development of new food technologies. Key research areas include:

Precision agriculture: Use of ICT, sensors, and data analytics to optimize agricultural productivity and sustainability.

Sustainable food production: Research on reducing the environmental impact of agriculture, improving crop yields, and promoting organic farming practices.

Food safety and quality: Development of new methods to ensure food safety, traceability, and quality control.

8. **Environmental Science and Ecology**: Environmental research is a major priority in Slovenia, given the country's commitment to sustainable development and biodiversity preservation. Key research areas include:

Biodiversity conservation: Research on protecting Slovenia's diverse ecosystems, including forests, rivers, and wildlife.

Climate change adaptation: Research into strategies for mitigating and adapting to climate change impacts, particularly in agriculture, water management, and disaster resilience.

Water management: Research on sustainable water management practices and technologies, crucial for both agricultural and urban needs.

9. **Automotive and Mobility**: The automotive industry is one of Slovenia's most important industrial sectors, and research here focuses on developing next-generation mobility solutions. Key areas include:

Electric vehicles (EVs): Research and development of EV components, including batteries and electric drivetrains.

Autonomous vehicles: Innovation in autonomous driving technologies and smart transport systems.

Lightweight materials: Research into new materials that can improve vehicle efficiency by reducing weight.

10. **Cultural and Creative Industries**: Slovenia also supports research and innovation in cultural and creative industries, focusing on the intersection of digital technologies and the arts. Areas include:

Digital humanities: Research using digital tools and methods to study cultural heritage and human history.

Creative technologies: Innovations that blend design, arts, and technology, with applications in gaming, media, and entertainment industries.

Conclusion

Slovenia's research and innovation ecosystem is driven by strong public-private partnerships, EU funding (such as Horizon Europe), and collaboration between universities, research institutes like the Jožef Stefan Institute, and industries across a range of sectors. The country is particularly strong in ICT, biotechnology, energy, and advanced manufacturing, which align with both national priorities and European Union goals for research and innovation.

4 TT Structures

In Slovenia, 13 Knowledge and Technology Transfer Offices (KTOs) operate within public research organizations (PROs). Most offices employ one to two people, while only the largest PROs, such as the Jožef Stefan Institute (IJS), the University of Ljubljana (UL), the University of Maribor (UM), and the University of Primorska (UP), have more staff members.

Technology transfer can be categorized into the following key activities or areas:

1. Creating networks, platforms, and events; networking and event organization
2. Publishing and presenting
3. Contract research
4. Contractual research collaboration
5. Establishing spin-off companies
6. Licensing
7. Continuous professional development
8. Teaching, motivating, and fostering entrepreneurial and innovation mindsets
9. Consulting

Knowledge and technology transfer activities require expertise and specialized staff in various fields, e.g. science and engineering, business and economy, finance, law, intellectual property. The scope of these activities varies across PROs and is carried out in different organizational forms. In some cases, the services occur outside KTOs, within other departments or support units of PROs. However, due to a lack of experience, knowledge, and established processes, certain activities are either not

performed or are carried out on a reduced scale, especially in smaller PROs. For example, the establishment of spin-off companies is actively supported primarily in larger PROs.

All the surveyed organisations have a single technology transfer office that provides comprehensive support services. The highest number of respondents indicated that their offices perform administrative functions to support IP protection and technology transfer activities. Many also assist in finding industrial partners, commercializing innovations, and advising on the creation and management of spin-offs. A significant number of offices help teachers and researchers identify results with commercial value, determine the appropriate type of IP rights protection, and negotiate license agreements. Slightly fewer offices are involved in evaluating the commercial potential of disclosed innovations. Additional services mentioned include education and awareness-raising, contract preparation, student engagement, promotion, and international collaboration.

Some organizations have well-defined teams involving researchers, a head of the technology transfer office, and specialized staff such as legal advisors, financial administrators, and experts in innovation. Others involve committees, such as invention and innovation committees or intellectual property commissions, to oversee the process. In some cases, the structure includes a multidisciplinary team of scientists, economists, and legal experts, while others rely on a single person handling all TT functions. Additionally, certain offices have dedicated personnel for intellectual property marketing, spinoff support, and business development. A few organizations mentioned external collaborators for industry connections. Overall, the structures vary from small, single-person operations to larger, multi-functional teams.

To improve the technology transfer structures within organizations, several key aspects were identified in the survey that need to be addressed. Staffing and expertise are major concerns, with many organizations being understaffed and lacking specialized skills, such as market analysis and commercialization. Finding industry partners is another significant challenge, as are overly bureaucratic procedures that often reflect in slow TT processes.

Many TT offices are heavily dependent on project-based funding, which limits their ability to operate sustainably. Moreover, there is a need to increase commercialization efforts and improve the identification of innovations with market potential. Enhancing the marketing orientation of TT offices and building stronger links with commercialization experts would lead to better success rates in technology transfer

Finally, addressing the low innovation culture in some institutions is crucial. In many cases, patenting and knowledge transfer are not sufficiently prioritized or rewarded in academic settings which results in low researcher motivation and engagement.

4.1 TT System Scheme

In the Slovenian innovation ecosystem, various operators carry out various operations, the carriers of which are ministries, public agencies and public funds (Figure 3). In general, operations can be divided into those that are mainly engaged in advisory activities for companies, namely the Slovenian Enterprise Points (SPOT), Innovative Environment Entities (SIO) and Digital Innovation Centres (DIH), and those that are mainly engaged in technology transfer from Public Research Organisations (PROs) to companies, namely the Consortium for Technology Transfer from PROs to Companies (KTT) and Strategic Research and Innovation Partnerships (SRIP). The European Commission's Enterprise Europe Network (EEN) is involved in both advisory and mediation in technology transfer at the

international level, but its activities are more of a connecting rather than operational nature, similar to the National Contact Points (NCPs), which mainly provide information related to Horizon Europe projects.

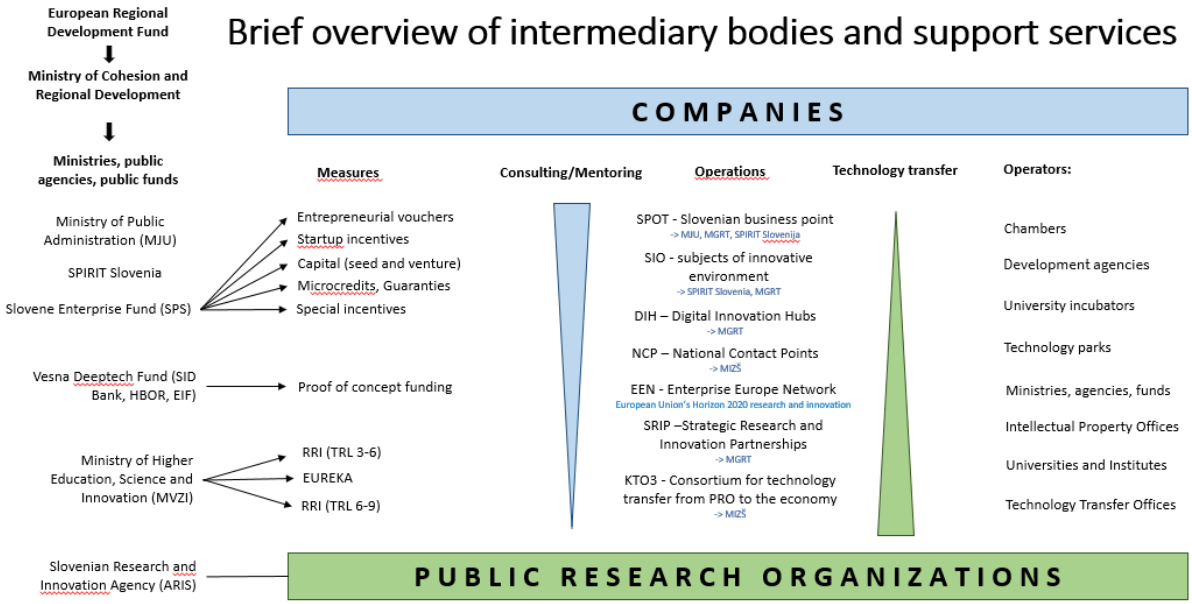

Figure 3: Overview of intermediary bodies and support services of Slovenian innovation ecosystem.

4.2 TT Procedures

The Industrial Property Act (ZIL-1) (6) defines various industrial property rights, such as patents, designs, trademarks, and geographical indications, along with the procedures for their acquisition, registration, and protection. The ZIL-1 establishes the Slovenian Intellectual Property Office (SIPO) and outlines its responsibilities in the realm of industrial property rights. According to Article 5 of ZIL-1, SIPO's primary duties include:

- Receiving Applications: Accepting submissions for the acquisition of industrial property rights.
- Conducting Procedures: Independently managing processes for granting patents and registering designs, trademarks, and geographical indications.
- Maintaining Registers: Keeping official records of industrial property rights and other related registries as specified by the law.
- Handling Revocations and Nullifications: Managing procedures related to the revocation and nullification of trademarks.
- Providing Information Services: Offering information services concerning industrial property rights.
- International Representation: Representing Slovenia in foreign and international organizations operating in the field of industrial property, based on the positions, instructions, and authorizations of the Government of the Republic of Slovenia.
- Other Duties: Performing additional tasks within its jurisdiction.

These provisions ensure that SIPO operates as the central authority for the protection and management of industrial property rights in Slovenia, facilitating the acquisition, registration, and safeguarding of such rights.

Additionally, Article 49 of the Scientific Research and Innovation Activities Act (ZZrID) (1) stipulates that PROs and researchers should promote the utilization, protection, and transfer of knowledge, ensuring that the outcomes of publicly funded research are disseminated to society and the economy.

However, it does not specifically address the management of intellectual property (IP) within public research organizations (PROs). This aspect is governed by the internal regulations of individual PROs, which outline the processes for identifying, protecting, and commercializing IP generated through their research activities.

The Act on inventions arising from employment (ZPILDR) (5) governs the rights and obligations of employers and employees concerning inventions created within employment relationships. In the context of public research organizations (PROs) in Slovenia, the Act provides the following framework:

- Classification of Inventions:

  Service Inventions: Inventions developed by employees during the execution of their work duties or through the use of the employer's resources.

  Free Inventions: Inventions created independently of the employee's work assignments and without utilizing the employer's resources.
- Employee Obligations: Employees are required to promptly notify their employer in writing upon the creation of a service invention.
- Employer Rights: Employers have the right to claim ownership of service inventions, including the authority to file for patents and manage the commercialization process.
- Inventor Compensation: The Act mandates that employers provide fair compensation to inventors of service inventions, considering the economic value of the invention and the employer's contribution.

PROs are tasked with establishing internal regulations that detail procedures for managing intellectual property (IP), encompassing the identification, protection, commercialization, and revenue sharing of inventions. These internal policies must align with the provisions of the ZPILDR (5) and other pertinent legislation.

Additionally, the Scientific Research and Innovation Activities Act (ZZrID) (1) emphasizes the importance of knowledge transfer. Article 49 specifies that revenues generated from knowledge transfer activities can be utilized to fund the core operations of PROs or to reward inventors, in accordance with the ZPILDR.

Collectively, these legislative measures underscore the significance of effective IP management within PROs, promoting the transfer of knowledge and technologies to the industry while ensuring that inventors receive equitable recognition and compensation for their contributions.

Furthermore, the Act on Supportive Environment for Entrepreneurship (ZPOP-1) (7) establishes measures to promote entrepreneurship in Slovenia, defining the organization and procedures for allocating resources to create a supportive environment. The Act identifies key entities that provide

services to encourage entrepreneurship and innovation, ensuring entrepreneurs and companies have access to information, knowledge, and funding.

The Regulation on Maintaining the Register of Innovative Environment Entities outlines the process and criteria for registering entities that foster innovation, as well as the procedures for their removal from the register. It specifies general, infrastructural, and staffing conditions required for inclusion.

Entities within the innovative environment include:

- University Incubators which facilitate the commercialization of research and innovation from public research organizations (PROs),
- Technology Parks which support the development of technology-based companies, often in collaboration with PROs,
- Business Accelerators which provide mentorship and resources to rapidly scale start-ups,
- Other Related Organizations, engaged in activities that promote entrepreneurship and innovation.

Specifically, university incubators and technology parks are closely linked to innovations from PROs, aiding in the transfer of technology and knowledge into the entrepreneurial sector. They support the establishment and growth of companies based on research outcomes and innovations developed within PROs, thereby promoting the commercialization of research and strengthening connections between science and industry.

Slovenia's technology transfer (TT) ecosystem is designed to facilitate the movement of research outcomes from higher education institutions (HEIs) and public research organizations (PROs) to industry and society. This system is characterized by dedicated offices, legal frameworks, and various procedures to manage and commercialize intellectual property (IP).

Responsibilities of HEIs in Technology Transfer. HEIs and PROs in Slovenia are mandated to manage and transfer the intellectual property they generate. This responsibility is typically executed through Technology Transfer Offices (TTOs) established within these institutions. The legal framework supporting this includes the Act on Inventions Arising from Employment, which outlines the obligations of these entities in IP management.

The Technology Transfer (TT) procedures in Slovenia encompass various mechanisms, including:

- Patent Licensing: Granting rights to third parties to use patented technologies under defined conditions.
- Creation of Spin-off Companies: Establishing new enterprises to commercialize research findings.
- Contractual Research and Development: Engaging in research projects funded by industry partners.
- Consultancy Services: Providing expert advice to external organizations based on academic expertise.

These procedures are designed to cover different aspects of technology transfer, ensuring a comprehensive approach to commercialization.

Definition of Procedures for Various Transfer Types. While general frameworks exist, the specificity of procedures for different types of technology transfer—such as patents, spin-offs, and contracts—can vary among institutions. Some HEIs have detailed protocols for each transfer type, while others may operate under broader guidelines. The development and implementation of these procedures are influenced by institutional policies and the maturity of their TTOs.

Terms and Forms of Service Delivery. Service delivery in technology transfer is typically formalized through agreements that outline the roles, responsibilities, and expectations of all parties involved. Common forms include:

- Licensing Agreements: Detailing the terms under which IP is licensed to external entities.
- Collaboration Contracts: Defining the scope and terms of joint research projects.
- Consultancy Agreements: Specifying the services to be provided and compensation arrangements.

These documents ensure clarity and legal compliance in technology transfer activities.

Definition of Service-Related Costs. The Scientific Research and Innovation Activities Act (ZZrID) (1) establishes the framework for funding scientific research and innovation in Slovenia, which encompasses the financing of Knowledge Transfer Offices (KTOs). According to Article 2 of the Act, the system is financed partly or fully from the state budget and other sources, including European programmes and funds, local communities, and the economy.

The Act does not explicitly detail the funding mechanisms for KTOs or the costs associated with delivering their services. However, it emphasizes the importance of knowledge transfer and the commercialization of research outcomes. Article 49 highlights that public research organizations (PROs) and researchers are responsible for promoting the use, protection, and transfer of knowledge, ensuring that publicly funded research results are disseminated to society and the economy.

In practice, the funding of KTOs often involves a combination of public funding, including state budget allocations and European Union funds, as well as private sector contributions. For instance, in December 2023, the Ministry of Higher Education, Science and Innovation announced the establishment of new KTOs and the upgrading of existing ones within Slovenian public research organizations, with over €2.5 million allocated from the European Regional Development Fund.

Technology Transfer Offices (TTOs) within public research organisations are integral components of their organisational structures. These offices are primarily funded through the research organisations' system funding sources and, in part, through European projects. TTOs do not internally charge researchers or research units for their services. When TTO staff participate in projects, their labour costs are covered by each project's budget, adhering to the specific programme's funding rules. Services provided directly to external entities, such as companies, are typically considered market services and are charged according to market rates.

In summary, all thirteen Slovenian Technology Transfer Offices (TTOs) are essential components of public research organizations, primarily funded through institutional budgets, national and European projects. They provide services to internal researchers without additional charges, integrating support into the organization's framework. When TTO staff engage in specific projects, their labor costs are allocated from the respective project's budget, following the funding guidelines of the specific funding program. Services offered to external entities, such as companies, are considered market services and are billed at standard market rates.

In summary, while Slovenian HEIs are responsible for technology transfer procedures, the specificity and clarity of these processes, including service delivery terms and cost definitions, can differ among institutions. Ongoing efforts aim to standardize and enhance these procedures to strengthen the national technology transfer ecosystem.

4.3 Strengths and Weaknesses of TT Units/Offices

Based on extensive survey distributed to 37 Slovene organizations, encompassing higher education institutions (HEIs), public research organizations (PROs), incubators, and technology parks, the strengths and the weaknesses of TT Units/Offices in Slovenian TT ecosystem have been identified, see table below.

Strengths	Weaknesses
Responsive, flexible and skilled staff	Too much bureaucracy
Established contacts with researchers and companies	Excessive attachment to project funds to finance office activities
Legal knowledge	Lack of specific skills/expertise
Integration into international networks	Insufficient commercialization
Independence	Understaffed, too many cases per employee
Staff's research experience	Lack of innovation culture (patenting in violation of organisation's regulations)
Good connections with the local innovation ecosystem	Insufficient interest and motivation of researchers
Staff's willingness to learn	Time-consuming internal procedures
Comprehensive support	Lack of industry partners
The possibility of an accelerated procedure for the takeover of work-related inventions	Organisation's habilitation rules do not take into consideration KTT or impact

Slovenian Technology Transfer Offices (TTOs) exhibit a range of strengths and face several challenges in their operations:

Strengths:

1. Responsive, Flexible, and Skilled Staff:

Strength: TTO personnel adeptly navigate the complexities of technology transfer, providing tailored support to researchers and industry partners.

Weakness: Maintaining such adaptability can lead to staff burnout if not managed properly.

2. Established Contacts with Researchers and Companies:

Strength: Strong networks facilitate effective collaboration and knowledge exchange between academia and industry.

Weakness: Over-reliance on existing contacts may limit outreach to new partners, potentially stifling diversity and innovation.

3. Legal Knowledge:

Strength: Expertise in intellectual property law ensures proper management and protection of innovations.

Weakness: Focusing heavily on legal aspects might slow down processes due to complex legal procedures and could potentially hinder flexibility in negotiations.

4. Integration into International Networks:

Strength: Participation in global collaborations enhances access to diverse resources and best practices.

Weakness: Managing international relationships can be resource-intensive and may divert attention from local priorities.

5. Independence:

Strength: Operational autonomy allows TTOs to make unbiased decisions, fostering trust among stakeholders.

Weakness: Independence might lead to isolation if not balanced with collaboration, potentially resulting in missed opportunities for synergy with other departments or organizations.

6. Staff's Research Experience:

Strength: A background in research enables staff to better understand and support the needs of academic innovators.

Weakness: A strong research focus might overshadow business and market considerations, which are crucial for successful technology transfer.

7. Good Connections with the Local Innovation Ecosystem:

Strength: Engagement with regional partners strengthens the innovation landscape.

Weakness: Concentrating primarily on local networks may limit exposure to broader, potentially more lucrative opportunities.

8. Staff's Willingness to Learn:

Strength: A commitment to continuous improvement keeps TTOs adaptable to emerging trends.

Weakness: Without proper direction, continuous learning efforts might lack focus, leading to inefficiencies.

9. Comprehensive Support:

Strength: Offering end-to-end services ensures thorough assistance throughout the technology transfer process.

Weakness: Providing comprehensive support can strain resources and may lead to overextension if not managed properly.

10. Possibility of Accelerated Procedures for Work-Related Inventions:

Strength: Streamlined processes expedite the commercialization of research outcomes.

Weakness: Accelerated procedures might compromise thoroughness, potentially overlooking critical details that could affect the success of technology transfer.

Weaknesses:

1. Excessive Bureaucracy:

Complex administrative procedures can hinder efficiency and slow down operations.

2. Dependence on Project-Based Funding:

Reliance on specific project funds may lead to financial instability and limit long-term planning.

3. Lack of Specific Expertise:

Gaps in specialized knowledge can impede the effective commercialization of certain technologies.

4. Insufficient Commercialization:

Challenges in bringing innovations to market result in underutilized research outputs.

5. Understaffing:

High caseloads per employee can lead to burnout and reduced service quality.

6. Weak Innovation Culture:

Inadequate emphasis on patenting and commercialization within organizations hampers innovation efforts.

7. Low Researcher Engagement:

Limited interest and motivation among researchers to participate in technology transfer activities.

8. Time-Consuming Internal Procedures:

Lengthy internal processes delay the progression of projects.

9. Scarcity of Industry Partners:

A limited number of collaborations with industry restricts opportunities for technology transfer.

10. Academic Evaluation Constraints:

Institutional criteria that overlook knowledge and technology transfer activities diminish incentives for engagement.

4.4 TT Structure Best Practises

Consortium for Knowledge and Technology Transfer (KTO)

In 2024, the third Knowledge Transfer Office Project (KTO-3) was initiated, funded by the Ministry of Higher Education, Science, and Innovation (MVZI) and the European Union through the European Regional Development Fund, with a total budget of €2.15 million. The project, running from April 12, 2024, to February 28, 2029, aims to enhance the infrastructure and effectiveness of knowledge transfer in Slovenia. It brings together ten public research organizations (PROs) into the "Consortium for Knowledge Transfer - KTO," including the Jožef Stefan Institute (IJS), Faculty of Information Studies in Novo Mesto (FIŠ), Geological Survey of Slovenia (GeoZS), Institute of Metals and Technology (IMT), National Institute of Chemistry (KI), Agricultural Institute of Slovenia (KIS), Rudolfovo - Science and Technology Center Novo Mesto, Slovenian National Building and Civil Engineering Institute (ZAG), and the Science and Research Centre Koper (ZRS KP).

The consortium aims to synergistically connect competencies and best practices in the commercialization of scientific solutions and knowledge transfer among its members and with the KTOs of Slovenia's three public universities, which are united in another consortium. The project's objectives include strengthening and upgrading existing KTOs, establishing new KTOs in institutions beginning to engage professionally in knowledge and technology transfer, and improving collaboration and knowledge exchange among various stakeholders in the innovation ecosystem. This approach is expected to promote strategic patenting, effective commercialization, and economic utilization of inventions, as well as the development of mechanisms for knowledge valorization.

A significant goal of the project is to unify approaches to contractual relationships arising in knowledge valorization processes. This includes developing common contract templates, negotiation

guidelines, valuation methods, regulations, and other documents to streamline procedures within PROs and in collaboration with economic entities. By achieving key performance indicators—such as filing 25 patent applications with full examination and establishing 28 new collaborations with companies—the project aims to contribute to the specific objective of developing and enhancing research and innovation capacities and implementing advanced technologies. This aligns with the strategic goals outlined in the European Cohesion Policy Program 2021-2027, ultimately enhancing the innovation capacity of Slovenian society and accelerating the process of innovative and smart economic transformation.

International Technology Transfer Conference (ITTC)

Organized by partners from two national consortia of knowledge and technology transfer offices, the ITTC promotes knowledge exchange between academia and industry. It facilitates cooperation and the commercialization of innovations from research labs to industrial applications. The International Technology Transfer Conference (ITTC) has been traditionally organized by the Jožef Stefan Institute, and has been a pivotal platform for promoting collaboration between academia and industry for over 15 years. A hallmark of the conference is the "Best Innovation with Commercial Potential" pitch competition, where researchers present their technologies to an international expert panel. This competition encourages the commercialization of inventive technologies developed at public research organizations, often leading to the establishment of spin-off companies or the licensing of technologies. Winners receive recognition and financial support, such as the €2,500 prize awarded in recent years. The ITTC also features keynote speeches, roundtable discussions, and paper presentations on technology transfer and intellectual property, fostering knowledge exchange and strengthening the innovation ecosystem. By integrating these elements, the ITTC effectively bridges the gap between research and market application, contributing significantly to technological advancement and economic growth.

Proof-of-Concept Support

The Vesna Deep Tech Venture Fund exemplifies effective practices in Knowledge Transfer Office (KTO) activities within Slovenia. Established with a €49 million investment, including €40 million from the European Investment Fund (EIF) and contributions from national development banks SID Banka (Slovenia) and HBOR (Croatia), this fund is the first of its kind in Slovenia and Croatia.

The fund focuses on technology transfer, intellectual property protection, and the commercialization of research projects from universities and research institutions. It aims to invest in up to 80 projects, particularly at the proof-of-concept stage, facilitating the transformation of research into viable businesses.

Managed by Vesna Venture Capital, the fund supports scientific institutions in aligning their research commercialization efforts with Western European standards, thereby enhancing cohesion, sustainability, and competitiveness within the European Union.

A notable example of the fund's impact is its seed investment in Mysteria Colorum (MyCol), a spin-out from Slovenia's National Institute of Chemistry. This investment enabled MyCol to advance its innovative temperature-sensitive labelling technology, demonstrating the fund's role in bridging the gap between research and market application.

By providing financial resources and expertise, the Vesna Deep Tech Venture Fund strengthens the innovation ecosystem in Slovenia, serving as a model for effective KTO activities that facilitate the successful transfer of knowledge and technology from public research.

Program of company visits to bridge the gap between research and industry

The Knowledge Transfer Office (KTO) at the Jožef Stefan Institute (JSI) in Slovenia has developed a structured program of company visits to bridge the gap between research and industry. These visits are organized in three phases to foster trust and collaboration between researchers and businesses.

The program structure:

1. Initial Engagement: KTO representatives initiate contact with companies to arrange meetings aimed at identifying potential areas for cooperation. Annually, the KTO conducts approximately 40 to 50 of these initial visits, typically involving experts in both company collaboration and technology/intellectual property. citeturn0search3
2. Solution Development: Following the initial meeting, the KTO collaborates with JSI researchers to identify suitable technologies and expertise that address the company's specific challenges defined in the first phase. This stage may include further meetings and detailed discussions to propose the value of the JSI's project or technology to the company and to specify concrete approaches, milestones, and deliverables in the development of tailored solutions. citeturn0search3
3. Formalizing Collaboration: The KTO assists in defining the terms of cooperation, which may involve negotiating collaboration terms, service pricing or project budgeting, intellectual property rights, drafting non-disclosure agreements, and securing appropriate funding. Support is provided through various co-funding sources, including EU projects and national schemes. citeturn0search3

Achievements. By 2021, the KTO had conducted over 300 initial company visits, leading to numerous collaborative projects and the successful transfer of technologies to the market.

Key takeaways:

- Proactive Engagement: Initiating contact with companies is crucial for uncovering potential collaborations.
- Tailored Solutions: Aligning research capabilities with industry needs ensures effective technology transfer.
- Comprehensive Support: Providing assistance in legal, financial, and technical aspects facilitates smoother partnerships.

The KTO's company visit program exemplifies a proactive approach to technology transfer, effectively connecting scientific research with industry applications.

5 TT Instruments

- collaborative research agreements with industry
- patents and licences
- creation of spin out companies and their revenue
- research service agreements
- impact on society, environment and economy

5.1 Exchange of Research Staff with Companies

Before 2012 a program called 'Young researchers in industry' was a type of exchange of research staff with companies. Unfortunately, this program stopped and in 2024 it is planned to be restarted. Some problems were related to the situations where these young researchers were doing regular company tasks instead of R&D. Also, some issues related to IP were present. We assume this was related to poor understanding of IP rules related to state aid rules.

At the Jožef Stefan Institute (JSI) there was a rule that during the postdoc period, postdocs were obliged to make a secondment abroad for a few months if they wished to promote in their career. This was recently adjusted with a rule that secondment in industry is also possible. We believe this will promote further staff exchange between JSI and industry and will present this as a good practice to other RTOs in Slovenia.

Another staff exchange takes place in spin out companies of Slovenian RTOs. Researchers employ fully or partly in a spin out company and thus gain experience in industry. As statistically most start-up companies are doomed to failure, RTOs should have a policy to accept these researchers back as people with experience and not as incapable people. We believe this culture should be improved.

Other tools such as Marie Curie Sklodowska Actions are important in intersectorial staff exchange. Slovenia has already two large MSCA Cofund actions (SMASH and SQUASH, each 40 postdocs) which accelerate staff exchange between RTOs and industry.

5.2 Internationalization of Knowledge Transfer

The results of the survey revealed that the most commonly used instrument for internationalisation of technology transfer is leveraging existing international contacts of researchers, with the highest number of respondents indicating this approach. Other frequently mentioned instruments include working through international companies and utilizing networks of companies and international higher education and research institutions. A smaller number of respondents rely on national companies with foreign headquarters. Additionally, some participants mentioned using specific networks and platforms such as the Enterprise Europe Network (EEN), specialized portals, and university networks like T4EU and Enihei.

For example, Jožef Stefan Institute is member of the following international entities which are enabling internationalization of KTT.

EEN (Enterprise Europe Network) is the world's largest support network for small and medium-sized enterprises (SMEs) with international ambitions. It helps businesses innovate and grow by providing services such as market intelligence, business matchmaking, funding opportunities, and access to international partnerships. EEN operates through a global network of experts, connecting companies with partners and resources across over 60 countries. The **Slovenian EEN consortium** is part of the global Enterprise Europe Network and is dedicated to supporting small and medium-sized enterprises (SMEs) in Slovenia. The consortium includes key organizations such as the Chamber of Commerce and Industry of Slovenia (GZS), the Jožef Stefan Institute (IJS), and SPIRIT Slovenia, among others. It provides services like business

matchmaking, access to international markets, innovation support, and guidance on EU funding opportunities, helping Slovenian businesses expand and compete globally.

JRC TTO Circle is an initiative by the European Commission's Joint Research Centre (JRC) that connects KTOs from public research organizations across Europe. It aims to foster collaboration, share best practices, and enhance the capacity of KTOs to commercialize research outputs effectively. By building a network of KTOs, the JRC TTO Circle supports innovation, knowledge transfer, and the creation of impact-driven partnerships between research institutions and industry.

EARMA (European Association of Research Managers and Administrators) is a professional organization that supports individuals involved in the management and administration of research. It provides training, networking opportunities, and best practices to enhance the skills and expertise of research managers and administrators across Europe. EARMA plays a key role in shaping the research management profession, fostering collaboration, and contributing to the development of research policy at national and European levels.

ASTP-Proton is a leading European association dedicated to knowledge transfer professionals working in research, industry, and technology transfer. It provides a platform for training, networking, and sharing best practices to enhance the commercialization of research and innovation. Through conferences, workshops, and policy advocacy, ASTP-Proton supports the professional development of its members and strengthens the link between research institutions and the marketplace.

EARTO (European Association of Research and Technology Organisations) is a Brussels-based association representing the interests of research and technology organizations (RTOs) across Europe. It advocates for policies that promote research, innovation, and technological development to address societal and industrial challenges. EARTO provides a platform for its members to collaborate, share best practices, and influence European research and innovation agendas, strengthening the impact of RTOs on economic growth and competitiveness.

EIT Manufacturing is a Knowledge and Innovation Community (KIC) under the European Institute of Innovation and Technology (EIT) focused on strengthening Europe's manufacturing sector. It brings together leading businesses, universities, and research centers to drive innovation, sustainability, and digital transformation in manufacturing. Through education, innovation projects, and support for start-ups, EIT Manufacturing aims to foster collaboration, enhance competitiveness, and contribute to a more sustainable and resilient manufacturing ecosystem in Europe.

5.3 Tools Used to Publicize the Generated Knowledge

- scientific articles
- scientific conferences and industrial fairs
- patents
- technology offers
- webpages and social networks
- media articles
- brochures and catalogues
- list of spin out companies

- innovation events (International Technology Transfer Conference, Slovenian Research and Innovation Agency day, Technology Park day, Uniminds)
- RTOs doors open day

5.4 Barriers to the Commercialization of Knowledge Generated in HEIs

- not enough funding for TRL3-6 and venture creation
- absorption capacity of the Slovenian industry
- bureaucracy at Slovenian RTOs
- mindset and evaluation of researchers - researchers overloaded with research and the way of financing, there are no incentives for market activity, there are not enough salary stimulation for innovative researchers
- lack of IP and business creation knowledge
- lack or TTO support staff

5.5 TT Instruments Best Practices

The Technology Transfer Office at the Jožef Stefan Institute (JSI) has established an internal Proof of Concept fund in 2020 for development and commercialization of JSI technologies above TRL3. In the period 2020-2023 this fund comprised around 50.000 EUR while in 2024 it was increased to 250.000 EUR due to involvement of structural financing reform. Projects last for 1 year and an industrial partner or spin out creation plan is needed. We believe this financial instrument helps to fill the TRL3-6 gap that is currently missing in Slovenia.

Another best practice partly initiated by TTO JSI is Vesna deep tech venture fund. This fund financed by European Investment Bank, Slovenian and Croatian investment banks, started in 2024 and will support spin out creation projects already at RTO level (50 kEUR) and later when companies are already created (400 kEUR).

6 Economic Indicators and Funding

In Slovenia, the financial framework supporting technology transfer (TT) is multifaceted, involving various funding instruments, budget allocations from higher education institutions (HEIs) and public administration, as well as policies encouraging teaching and research staff to engage in TT activities.

Financing Instruments for Technology Transfer

Slovenia offers a range of financing instruments aimed at facilitating TT. Notably, the Vesna Deeptech Fund, established in 2024, is the first regional deeptech fund dedicated to fostering scientific and technological innovations in areas such as artificial intelligence, robotics, energy, healthcare, biomaterials, and cybersecurity. The fund invests in early-stage innovations (TRL 3-4) and supports companies entering the market, thereby bridging the gap between research and commercialization.

Additionally, the Slovenian government, in collaboration with the European Union, has initiated programs to support Knowledge Transfer Offices (KTOs). In December 2023, a call for proposals was

launched to establish new KTOs and upgrade existing ones within Slovenian public research organisations. This initiative allocated €4.3 million, with over €2.5 million sourced from the European Regional Development Fund (ERDF), aiming to promote collaboration and enhance the skills of KTO employees.

Budget Allocations by Higher Education Institutions and Public Administration

HEIs in Slovenia allocate portions of their budgets to support TT activities, including the operational costs of KTOs, staffing, legal services, and promotional efforts. The extent of these allocations varies among institutions, reflecting their strategic priorities and research output.

Public administration also plays a significant role in funding TT. The Slovenian government provides substantial support through competitive funding programs and direct institutional funding. For instance, the "Resolution on the Slovenian Scientific Research and Innovation Strategy 2030" outlines the country's commitment to enhancing research and innovation, including the establishment and support of KTOs. This strategy emphasises effective knowledge transfer between research institutions and industry to foster innovation and economic growth.

Researcher's Access to Funding

Researchers in Slovenia have access to various funding opportunities to advance their innovations from concept to market. Programs like Horizon Europe, the Slovenian Research and Innovation Agency (ARIS) grants, and national TT initiatives provide funding for patenting, prototyping, and commercialization activities. Additionally, dedicated schemes such as industrial PhDs and postdoctoral fellowships promote collaboration with industry and accelerate the application of research.

Policies Encouraging Teaching and Research Staff

Slovenia has implemented several policies to encourage and support teaching and research staff in HEIs to engage in TT activities. These include professional development opportunities, such as sabbaticals dedicated to scientific research and study, and participation in international mobility programs like Erasmus+. Financial incentives, strategic support for research and entrepreneurial teaching, and a supportive policy framework further motivate academic staff to contribute to the TT ecosystem.

Collectively, these financial instruments, budget allocations, and supportive policies create a conducive environment for technology transfer in Slovenia, facilitating the commercialization of research outputs and fostering innovation-driven economic growth.

6.1 Distribution of the Budget Among the Involved Agents

In Slovenia, the distribution of financial outcomes derived from technology transfer (TT) activities is governed by legislative frameworks, institutional policies, and agreements between researchers, institutions, and technology transfer offices (TTOs). This structure ensures equitable sharing of profits from the commercialization of research results, such as patents, licences, and know-how.

The Employment-Related Inventions Act (ZPILDR) (5) specifies that inventions created within the employment relationship, defined as service inventions, belong to the employer (institution). However, employees who create such inventions are entitled to a reasonable reward. The reward amount is based on factors such as the economic utility of the invention, the role of the employee,

and the employer's contribution to the invention. This ensures that researchers benefit directly from the financial success of their intellectual contributions.

At the University of Ljubljana, the biggest and the most important HSE in Slovenia, detailed guidelines for the management and distribution of revenues from industrial property are established. Once commercialization proceeds are generated, costs incurred for intellectual property protection (e.g., patent application and maintenance) are deducted. The remaining royalties are then distributed as follows:

- 40% to the inventor(s),
- 30% to the university faculty or member institution where the inventor is employed,
- 30% to the central university body if the costs were covered by the university.

If the costs were covered by the faculty or member institution, their share increases accordingly. These policies emphasise fair compensation while also incentivizing the development and protection of intellectual property.

Similarly, the Jožef Stefan Institute (JSI), Slovenia's largest research institute, adopts a clear structure for distributing revenues derived from licensing or selling intellectual property and technologies. The proceeds are divided as follows:

- One-third to the inventors,
- One-third to the Proof of Concept (PoC) fund, which supports further development and validation of technologies,
- One-third to the department where the invention originated.

This distribution model ensures a balance between rewarding inventors, reinvesting in innovation, and supporting the operational needs of the originating research unit. Such frameworks promote sustained engagement in technology transfer activities while aligning institutional and individual interests.

When revenues are derived from licensing or the sale of inventions, profits are distributed among the university, the researcher(s), and the TTO according to predefined policies. These policies often include a provision guaranteeing researchers a minimum share of the gross revenue, ensuring their active participation in the TT process.

This distribution framework balances institutional interests with individual rewards, fostering a collaborative environment for innovation and knowledge transfer while promoting transparency and accountability across all stakeholders.

7 Human Resources and Training

In Slovenia, the landscape of human resources dedicated to Technology Transfer (TT) is characterised by a mix of strengths and challenges. While larger public research organisations (PROs) maintain more substantial Technology Transfer Offices (TTOs), smaller institutions often operate with limited personnel and financial resources.

Availability of Human Resources for Technology Transfer

Larger PROs, such as the Jožef Stefan Institute and the University of Ljubljana, have established TTOs with dedicated teams to manage TT activities. For instance, the Jožef Stefan Institute's Office for Project and Innovation Support employs experts from various professional and scientific fields to facilitate the transfer of technologies and innovations developed at the institute into business.

In contrast, smaller public institutions typically have only one or two staff members handling TT responsibilities, which can limit their capacity to effectively manage and promote technology commercialization.

Professional Profiles of Technology Transfer Personnel

Staff within TTOs in Slovenia possess diverse educational backgrounds, including technical and natural sciences, law, and economics. This multidisciplinary expertise is crucial for addressing the complex aspects of TT, such as intellectual property (IP) management, market analysis, and legal negotiations. For example, the Technology Transfer Offices of the main Slovenian PROs assist researchers in transferring their knowledge to the market and ensures the protection of their intellectual property.

Training and Professional Development

Beyond formal education, TTO personnel have opportunities for additional training and certification in TT. Programs like the Certified Licensing Professional (CLP) and courses offered by the Centre for International Intellectual Property Studies (CEIPI) provide specialised knowledge in IP and licensing. Moreover, organisations such as the Slovenian Intellectual Property Office (SIPO), the European Patent Office (EPO), the World Intellectual Property Organization (WIPO), and the Association of European Science and Technology Transfer Professionals (ASTP) offer workshops, seminars, and courses to enhance the skills of TT professionals. For instance, ASTP provides training courses across Europe, delivering professional development services to knowledge transfer professionals.

Training for Researchers on Technology Transfer Systems

Researchers in Slovenia have access to training programs that enhance their understanding of TT processes. Universities and research institutions organise workshops and seminars focusing on IP rights, commercialization strategies, and collaboration with industry. For example, the University of Ljubljana's Knowledge Transfer Office acts as a bridge between research and business, supporting and connecting students, researchers, and companies in innovation.

These initiatives aim to equip researchers with the necessary skills to navigate the commercialization pathway effectively.

Training for Industry Professionals on Technology Transfer

Training programs offered by organizations such as SIPO, EPO, and WIPO occasionally include sessions tailored for industry professionals. These programs focus on intellectual property management and licensing, aiming to foster better collaboration between research institutions and companies.

Challenges and Opportunities

Despite the availability of training and the presence of skilled professionals, TTOs in Slovenia often face challenges related to limited human and financial resources. Smaller institutions, in particular, may struggle to provide comprehensive TT services due to staffing constraints. Addressing these challenges requires strategic investments in capacity building, enhanced funding mechanisms, and fostering a culture that values and supports TT activities across all levels of research and industry.

In summary, while Slovenia boasts a dedicated and skilled workforce in the TT domain, there is a need for continued support and development to ensure that both researchers and industry professionals are well-equipped to engage in effective technology transfer, thereby driving innovation and economic growth.

8 Relationships Between the Agents of the Ecosystem

In Slovenia, the technology transfer (TT) ecosystem is composed of various agents, including technology transfer offices (TTOs), higher education institutions (HEIs), and companies. These agents collaborate through platforms and programs designed to promote innovation and economic growth.

Modes of Collaboration Among Ecosystem Agents

Collaboration between TTOs, HEIs, and companies occurs through forums, meetings, and open innovation programs. For instance, the **KTO3 Consortium** promotes intellectual property protection and commercialization, while the **Enterprise Europe Network (EEN)** facilitates international partnerships and technology transfer opportunities. Additionally, organisations such as **ASTP-Proton**, **EARMA**, and **EARTO** provide professional development, networking opportunities, and advocacy for innovation policies, indirectly supporting Slovenian TTOs and HEIs in their TT efforts.

Evolution of Private Sector Involvement

The private sector's engagement in the TT ecosystem has significantly increased in recent years, with companies recognizing the value of collaborating with research institutions. Initiatives such as the **CEETT Platform**, a regional collaboration between the European Investment Fund (EIF), SID Banka, and HBOR, play a vital role in this evolution. The platform provides funding to support technology transfer and the commercialization of research outputs in Slovenia and Croatia.

A key development under the CEETT Platform is the establishment of the **Vesna Deep Tech Venture Fund**, which focuses on investing in early-stage projects with commercialization potential. By addressing the funding gap between academic research and market application, this initiative strengthens private sector involvement and boosts innovation in the region.

Collaboration and Knowledge Transfer Between HEIs

HEIs in Slovenia collaborate through joint projects, networks, and platforms that enhance the commercialization of research outcomes. The **SI-TT national platform** connects professionals employed in TTOs across various institutions, fostering knowledge exchange, skill development, and collaboration among technology transfer experts.

Two key **KTO consortia** further support collaboration in the TT ecosystem. One consortium unites the TTOs of Slovenia's three public universities, while the other brings together TTOs from ten public research institutes. These consortia work independently within their respective domains but also collaborate to share best practices, pool resources, and strengthen technology transfer across the country.

Additionally, Slovenia benefits from participation in the **Enterprise Europe Network (EEN)**, which facilitates international partnerships and provides valuable support for TT professionals and institutions, helping them connect with industry and research partners across Europe.

Involvement of External Entities and International Collaboration

External entities such as innovation hubs and clusters play a critical role in connecting different actors within the TT ecosystem. The **Competence Centre on Technology Transfer (CC TT)** of the **Joint Research Centre (JRC)** provides expertise and facilitates partnerships between academia and

industry. Slovenian institutions also actively engage in the **European Technology Transfer Offices (TTO) Circle**, sharing best practices and fostering cross-border innovation networks.

9 Public Administration

Public administration in Slovenia plays a pivotal role in shaping the technology transfer (TT) ecosystem through strategic policies, funding initiatives, and direct engagement with higher education institutions (HEIs) and research organisations. Recent legislative developments and funding programs have significantly influenced the promotion of knowledge and technology transfer (KTT).

Policies and Incentives for Promotion

The enactment of the **Scientific Research and Innovation Activities Act** has established a robust framework for advancing KTT. This act introduced key measures, including the establishment of the **Public Agency for Scientific Research and Innovation (ARIS)**, which facilitates the transfer of academic knowledge into practical applications, strengthening links between research institutions and industry. The act also emphasises the role of Knowledge Transfer Offices (KTOs) by providing a legal framework and support mechanisms to enhance their effectiveness in managing intellectual property and bridging the gap between research and industry.

In addition, the government has initiated funding programs and policies to stimulate TT activities. For instance, the **KTO Call for Proposals** has provided €4.3 million in 2023 to support the establishment and upgrading of KTOs across Slovenian public research organisations, with a significant portion sourced from the European Regional Development Fund (ERDF). This initiative aims to enhance the skills of KTO employees and promote collaboration among research institutions.

Allocation of Grants and Subsidies

Public administration in Slovenia allocates substantial grants and subsidies to support innovation and technology transfer. These investments align with the country's strategic goals of fostering innovation and economic development. A key initiative is the government's commitment to increase public investment in research and innovation to 1.25% of GDP by 2030, a significant step toward bolstering KTT activities and driving innovation across the country.

Programs such as the **KTO Call for Proposals** have already allocated millions to establish and enhance Knowledge Transfer Offices (KTOs), ensuring they have the resources needed to manage intellectual property and facilitate technology transfer effectively. Other funding mechanisms also support specific activities, including intellectual property management and compliance with state aid regulations, contributing to the broader innovation ecosystem.

Notable National Aid Programs

Key funding sources include the **Slovene Enterprise Fund**, which offers grants and repayable assistance to innovative start-ups and scaleups, and the **P2 Start-up Incentive**, which provides €54,000 to support new ventures. Additionally, the government has prioritised the digital transformation of public administration and education systems, which indirectly supports the broader TT ecosystem.

Level of Involvement and Approach to HEI Activity

Public administration actively engages with HEIs to modernise higher education and integrate it with research and innovation. The **Resolution on the National Programme of Higher Education 2030** emphasises collaboration between HEIs, research organisations, and industry, fostering an environment conducive to innovation and knowledge transfer.

Specialized Public Personnel Integrated into Technology Transfer

In Slovenia, technology transfer (TT) is primarily facilitated by specialised staff within public research organisations (PROs) and higher education institutions (HEIs). These professionals, often part of Knowledge Transfer Offices (KTOs), manage intellectual property and foster industry collaborations. The **Scientific Research and Innovation Activities Act** aims to enhance TT by strengthening institutional capacities and supporting agencies like the **Public Agency for Scientific Research and Innovation (ARIS)**, which coordinates research and innovation efforts nationwide. This legislative framework provides resources and structures to improve TT processes and engagement with both national and international partners.

10 Conclusions

Today, Slovenia has a well-established, though still developing, knowledge and technology transfer ecosystem (KTTE), mainly characterised by a solid research infrastructure, active participation in international collaborations, and supportive government policies. The key research institutions and HEIs have Knowledge Technology Transfer Offices (KTOs) dedicated to managing IP, licensing technologies, facilitating collaborations between researchers and businesses, spreading awareness and knowledge about IP and its commercial potential among researchers, and offering support in establishing spin-offs and spin-outs. These offices are crucial for bridging the gap between research outputs and market needs. The governmental efforts in the last decade to foster networking of TTOs by financial support of KTO consortia at PROs aim to strengthen Slovenia's knowledge transfer ecosystem.

However, Slovenian KTTE faces challenges in scaling innovations to the global marketplace. Barriers include a lack of venture capital, limited access to global markets for small businesses, and sometimes a gap between academia and industry needs in terms of applied innovation.

Despite of governmental efforts to support the work of KTOs at PROs in the last decade there is still lack of permanent funding mechanisms which would enable stable and progressive development of efficient KTTE in Slovenia. Smaller institutions, in particular, may struggle to provide comprehensive TT services due to staffing constraints. Addressing these challenges requires strategic investments in capacity building, enhanced funding mechanisms, and fostering a culture that values and supports TT activities across all levels of research and industry.

Additional challenge is that the intellectual property in Slovenia, as in the entire European Union, is usually not recognized as corporate assets that could be used as collateral (e.g.to obtain a loan), the exceptions are examples of some in the market already well-established trademarks. One of the reasons is the absence of generally accepted standards for the evaluation of IP. Proper valuation of IP would encourage both debt and equity financing.

There is also still low level of awareness in the society regarding different aspects of intellectual property and its value and impact on the prosperity of the society: what is intellectually property, why and how one should protect it, how to market and commercialize it, etc.

According to the analysis of the situation in the field of intellectual property in Slovenia, reported in September 2023 by Institute for Economic Research in Ljubljana (35), there is a lack of content in the field of IP at all levels of education (for the purpose of raising awareness) and also in higher education (professional skills). There are already some IP contents in the curriculum for primary and secondary schools, but it would make sense to place them more systematically, and only some faculties have compulsory courses that include the field of IP (e.g. European Faculty of Law, Faculty of Pharmacy), while some faculties have elective courses (e.g. the Faculty of Law in Ljubljana and Maribor; Catholic Institute, Faculty of Law and Business Studies; MLC Faculty of Management and Law, Ljubljana). There is also a lack of professional education in the field of IP in the Slovenian language.

Based on these observations we may conclude there is a significant need for development of Technology Transfer Curriculum for HEIs, Capacity Building Modules for Current TT Professionals, and Development of Capacity Building Modules for Newcomer TT Professionals in order to fill the gap in education and training towards improving awareness and competences in the field of knowledge and technology transfer in Slovenia.

11 Bibliographic References

Bibliography

1. *Zakon o znanstvenoraziskovalni in inovacijski dejavnosti (ZZrID), Uradni list RS, št. 186/21, 40/23, 102/24.* Ljubljana : Ministrstvo za izobraževanje, znanost in šport, 2021.

2. *A decade of Knowledge Transfer in Slovenia.* Špela Stres, Levin Pal. Proceedings of the 13th International Technology Transfer Conference, Jožef Stefan Institute, Ljubljana, 2020.
https://ittc.ijs.si/13ittc/wp-content/uploads/2020/10/A-decade-of-knowledge-transfer-in-Slovenia_StresPal_final_PDF.pdf

3. *The future of European competitiveness: Report by Mario Draghi.* European Commission, 2024.
https://commission.europa.eu/topics/strengthening-european-competitiveness/eu-competitiveness-looking-ahead_en

4. European Commission. *European Innovation Scoreboard 2024 – Country profile Slovenia.* Brussels : European Commission, Directorate-General for Research and Innovation, 2024.

5. *Zakon o izumih iz delovnega razmerja (ZPILDR).* Ljubljana : Slovenian Intellectual Property Office, 1995.

6. *Zakon o industrijski lastnini (ZIL-1).* Ljubljana : Slovenian Intellectual Property Office, 2021.

7. *Zakon o podpornem okolju za podjetništvo (ZPOP-1).* Ljubljana : Ministrstvo za gospodarstvo, 2007.

8. *Pravilnik o načinu vodenja in vsebini evidence subjektov inovativnega okolja, Uradni list RS, št. 119.* Ljubljana : Ministrstvo za gospodarstvo, 2005.

9. *Related Rights Act.* Ljubljana : Slovenian Intellectual Property Office, 1995.

10. *Collective Management of Copyright and Related Rights Act.* Ljubljana : Slovenian Intellectual Property Office, 2016.

11. *Act on the Protection of Topographies of Integrated Circuits.* Ljubljana : Ministry of the Economy, 1995.

12. *Trade Secrets Act.* Ljubljana : Ministry of Economic Development and Technology, 2019.

13. *Companies Act.* Ljubljana : Ministry od Economic Development and Technology, 2006.

14. *Agriculture act.* Ljubljana : Ministry of Agriculture, Forestry and Food, 1996.

15. *Act on the Protection of New Varieties of Plants.* Ljubljana : Ministry of Agriculture, Forestry and Food, 1998.

16. *Code of Obligations.* Ljubljana : Ministry of Finance, 2021.

17. *Criminal Code.* Ljubljana : Ministry Of Justice, 2008.

18. *Liability of Legal Persons for Criminal Offences Act.* Ljubljana : Ministry of Justice, 1999.

19. *Directive (EU) 2019/790 of the European Parliament and of the Council of 17 April 2019 on copyright and related rights in the Digital Single Market.* n.a. : European Union, 2019. s. 92-125.

20. *Directive (EU) 2015/2436 of the European Parliament and of the Council of 16 December 2015 to approximate the laws of the Member States relating to trade marks.* n.a. : Europen Union, 2015. s. 1-26.

21. *AI and IP: Theory to Policy and Back Again – Policy and Research Recommendations at the Intersection of Artificial Intelligence and Intellectual Property.* Picht, P. G. ve Thouvenin, A. 2023, ICC, Cilt 54, s. 916-940.

22. Hupont Torres, I., ve diğerleri. *Next Generation Virtual Worlds: Societal, Technological, Economic and Policy Challenges for the EU.* v : Publications Office of the European Union, 2023.

23. *Study on the impact of Artificial Intelligence on the infringement and.* EUIPO. Luxemburg : Publications Office of the European Union, 2022.

24. International Trademark Association. *Trademarks in the Metaverse White Paper.* 2023.

25. Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs. *The intellectual property implications of the development of industrial 3D printing.* Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs. basım yeri bilinmiyor : Publications Office of the European Union, 2020.

26. Bogataj Jančič, M. Ali je lahko umetna inteligenca avtor avtorskega dela? [dü.] Aleš Završnik ve Katja Simončič. *Pravo in umetna inteligenca: vprašanja etike, človekovih pravic in družbene škode.* Ljubljana : Inštitut za kriminologijo pri Pravni fakulteti v Ljubljani, 2021, s. 161-191.

27. Appel, G., Neelbauer, J. ve Schweidel, D. A. Generative AI Has an Intellectual Property Problem. *Harvard Business Review.* [Çevrimiçi] 07. April 2023. [Alıntı Tarihi: 12. August 2024.] https://hbr.org/2023/04/generative-ai-has-an-intellectual-property-problem.

28. *National Intellectual Property Strategy 2030.* Slovenian Intellectual Property Office, 2024. https://www.gov.si/assets/organi-v-sestavi/URSIL/Dokumenti/NACIONALNA-STRATEGIJA_IL_EN_ebook.pdf

29. *Slovenian development strategy 2030.* Ljubljana : Government Office for Development and European Cohesion Policy, 2017.

30. *Resolucija o znanstvenoraziskovalni in inovacijski strategiji Slovenije 2030 (ReZrIS30).* Ljubljana : Ministry of Education, Science and Sport, 2022.

https://www.gov.si/assets/ministrstva/MIZS/Dokumenti/ZNANOST/Nacionalni-dokumenti/ZRISS-2030

31. *Slovenian industrial strategy 2021–2030.* Ljubljana : Ministry of Economic Development and Technology of the Republic of Slovenia, 2021. s. 111-216.

32. *An Overarching Strategy for Slovenia's Digital Transformation - Digital Slovenia 2030.* Ljubljana : Ministry of Digital Transformation, 2023.

33. *National Programme to Promote the Development and Use of Artificial Intelligence in the Republic of Slovenia by 2025.* Ljubljana : Government of the Republic of Slovenia, 2021.

34. *Strengthening the Innovation Ecosystem in Slovenia: Current state of play of the Slovenian national innovation ecosystem.* Ljubljana : SPIRIT Slovenia, 2021.

https://www.podjetniski-portal.si/uploads/gradiva/krepitev_inovacijskega_ekosistema/srss161_slovenia_ecosystem_d2_state_of_play_report.pdf?utm_source=chatgpt.com

35. Damjan Kavaš, Nika Murovec, Klemen Koman, Analiza stanja na področju intelektualne lastnine v Sloveniji, Inštitut za ekonomska raziskovanja, Ljubljana, september 2023.

https://www.ier.si/wp-content/uploads/2024/03/Analiza_IL_Slovenija_2023_final.pdf