Strengthening the Innovation Ecosystem in Slovenia

REPUBLIC OF SLOVENIA
MINISTRY OF ECONOMIC DEVELOPMENT AND TECHNOLOGY

SPIRIT SLOVENIA

Report: Benchmarking Slovenia Against Advanced Practices

Contract REFORM/SC2020/100 implementing framework contract No SRSS/2018/01/FWC/002

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Executive summary

This document constitutes the report for Activity 3: Benchmarking Slovenia Against Advanced Practices, undertaken for contract REFORM/SC2020/100 – Strengthening the Innovation Ecosystem in Slovenia. The aim of this report is to compare and evaluate Slovenia and its innovation ecosystem against trends and characteristics of the innovation ecosystems of innovation leaders at European Union (EU) and global level.

The comparison countries

The analysis of the Austrian, Estonian, Flemish (Belgium) and Israeli systems covers the main strategies and policy documents governing the innovation systems in each of the comparison countries. It also looks at how are policy priorities formed and implemented in each country, what works and what does not work. Each country has been mapped in terms of the key actors in the system, partnerships, collaborations, and networks and how well-developed the governance, monitoring and evaluation frameworks are. The major programmes and instruments have also been looked at, as well as finance options and loans available for innovation activities, including venture capital.

Overall, this benchmarking identified 6 advanced practices for Austria, 5 for Estonia, 5 for Flanders and 8 for Israel. Of these 25 total practices, a shortlist of 11 practices have been selected and may feature in the study visits, recommendations, and implementation plan.

Benchmarking

The benchmarking revealed several key differences that exist when compared to Slovenia. For example, Slovenia does not have a central innovation, research, and development coordination and instead has two key coordination verticals. This is in contrast to Estonia and Austria, which both have one coordination vertical. In terms of the instruments, each benchmark country displayed a widely different set up, although all were deemed to comprehensively cover TRL levels. In particular, Estonia focuses mostly on competitive calls, Flanders has a system dominated by continuously open calls and Austria has a more mixed system, with one key characteristic being lower efficiency of instruments. What is clear is that consistent application year-on-year is key. In this way, the system of continuously open calls in Flanders provides some implementable practices for Slovenia. Financial instruments have also emerged as a key priority area for Slovenia and examples of publicly owned holding companies in Flanders and Austria, as well as the role of the European Investment Bank in Estonia, hold crucial insights.

Overall, the benchmarking revealed that sustainability of networks is a challenge for Estonia and Austria, as well as Slovenia. It also revealed that Flanders exhibits the most successful approach to collaboration networks. The focus on strategic research centres and spearhead clusters is a gradual specialisation strategy that will feature in the recommendations and implementation plan. The analysis further revealed that the monitoring and evaluation of innovation instruments was the most advanced in Austria in terms of actors and institutions, with lessons on monitoring culture in Estonia also having relevance for Slovenia.

Overall, the SWOT analysis enabled several benchmarking profiles to be drawn out, in comparison to the barriers and drivers identified in Slovenia by the State of Play report. Austria was deemed to be a system with strong behavioural incentives and long-term commitment. Estonia was a closely related system with an accessible and reasonably efficient set up. Flanders has strong networks and client-orientated and commercially focused orientation. Israel was overall deemed to be a unique system and not easily replicated.

Outcomes and conclusions

In conjunction with the outcomes of the co-construction roundtable and gap analysis workshops, which took place in April 2021, the analysis drew out some tentative priority areas and early recommendations for further exploration. The priority areas focused on are **venture capital**, **collaboration,** and **support systems**. The preliminary recommendations touch on, *inter alia,* the following areas:

- A financing scheme for early stage/TRL5 pre-commercial equity investment.
- An Equity scheme for Post-TRL9 innovation (scale-up) to fill in for growth venture capital (deployment).
- Equipping existing institutions (e.g., SID Banka) with a Venture Capital arm.
- The possible transition of the Slovenian Enterprise Fund from a public entity to a publicly owned entity.
- Reform of the tax system to encourage venture capital and Foreign Direct Investment (FDI).
- Re-design a set of evaluation methods for existing collaboration funding.
- Embarking on a trust-building initiative between collaborators for projects.
- Industrial PhDs.
- Open pilot and demonstration schemes, especially for TRL 4-6.
- Larger value innovation vouchers from SPIRIT, with additional areas of application.
- More targeted messaging and information, including training for SMEs to use infrastructure.
- A dedicated platform for Technology Transfer Office/ Strategic Research and Innovation Partnership (SRIP) cooperation.

In terms of next steps, these preliminary recommendation areas will be further refined and approved via targeted interviews, an implementation plan and workshop with stakeholders during Activity 4 of the project. They will then be supplemented with study visits and workshops with ministry and agency staff during Activity 5. Crucially, these stages will take account of developments regarding the newly approved Recovery and Resilience Plan (RRP) for Slovenia and new parameters regarding budgets and staffing for key innovation activities.

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Abbreviations

ABA - Austrian Business Agency

ACR - Austrian Cooperative Research

AIT - Austrian Institute of Technology

ARRS - Slovenian Research Agency

AWS - Austrian Promotional Bank

BDI - Federation of German Industries

BFV - Biotech Funds Flanders

BMBWF - Federal Ministry of Education, Science and Research

BMK – Austrian Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology

CDG - Christian Doppler Gesellschaft

CIS - Community Innovation Survey

COMET – Austrian Competence Centres for Excellent Technologies

EC - European Commission

ECOOM – Flemish Centre for R&D Monitoring

EEN - Enterprise Europe Network

EIB - European Investment Bank

EIF - European Investment Fund

EIS - European Innovation Scoreboard

EIT - European Institute of Innovation and Technology

EPO - European Patent Office

ERA - European Research Area

ERDF - European Regional Development Fund

ESIF – European Structural and Investment Funds

EU – European Union

EWI - The Flemish department of economy, science and innovation

FDI – Foreign Direct Investment

FFG - Austrian Research Promotion Agency

FI - Financial Instruments

FIT - Flanders Investment and trade

FWF - Austrian Science Fund

GDP - gross domestic product

GII - Global Innovation Index

GIMV - Flanders Investment Company

GODECP - Government Office for Development and European Cohesion Policy

HEI - Higher Education Institutions

IIA - Israel Innovation Authority

IMEC - Interuniversity Microelectronics Centre Flanders

IPR - Intellectual Property Rights

IST - Institute of Science and Technology

IT - Information Technology

KPI - key performance indicator

LBG - Ludwig Boltzmann Society

MEAC – Estonian Ministry of Economic Affairs and Communications

MEDT – Slovenian Ministry of Economic Development and Technology

MER – Estonian Ministry of Education and Research

MESS – Slovenian Ministry of Education, Science and Sport

MNC - Multinational corporation

MoU - Memoranda of Understanding

ÖAW - Austrian Academy of Sciences

OCS – Israeli Office of the Chief Scientist

OECD - Organisation for Economic cooperation and Development

PISA - Programme for International Student Assessment

PMV - Flanders Holding Company

R&D - Research and development

RI - Research infrastructure

RIS - Regional Innovation Scoreboard

RTDI - Research, technology development and innovation

RTO – Research and Technology Organisation

SAL - Silicon Austria Labs

SID - Slovenian Export and Development Bank

SMBA – Israeli Small and Medium Business Agency

SME - Small and Medium Enterprise

SRIP – Strategic Research and Innovation Partnership

STEM – Science Technology, engineering and maths

SWOT – Strengths, weaknesses, opportunities and threats

TRL – Technology Readiness Level

TTO – Technology Transfer Office

UHASSELT - University of Hasselt

UK – United Kingdom

US - United States

USSR – Union of Soviet Socialist Republics

VARIO – The Flemish Advisory Council for Innovation and Enterprise

VITO - Flemish Institute for Technological Research

VLAIO – Flemish innovation agency

VMH - Flemish Environmental Holding

VRWI – Former Flemish Science and Innovation Council

VUB - Vrije Universiteit Brussel

ZEW - Leibniz Centre for European Economic Research

1. Introduction

This document constitutes the report for Activity 3: Benchmarking Slovenia Against Advanced Practices for contract REFORM/SC2020/100 – Strengthening the Innovation Ecosystem in Slovenia.

This report is intended to be used in conjunction with the preceding Activity 2 report, which documented the innovation ecosystem state of play in Slovenia. Following this report, these subsequent stages of the project are:

- Activity 4: The production of a set of recommendations and tailor-made measures for improving the efficiency of Slovenian innovation policy.
- Activity 5: Capacity building for MEDT & SPIRIT employees for effective implementation of tailor-made measures to improve the innovation ecosystem.

1.1 Aim and objectives

The aim of this report is to compare and evaluate Slovenia and its innovation ecosystem against trends and characteristics of the innovation ecosystems of innovation leaders at EU and global level. Within this aim are several objectives:

- To understand which of the four benchmarked countries may have best practices to fill the gaps identified in the Slovenian innovation ecosystem.
- To analyse these best practices from these benchmarked countries and assess the extent to which their lessons can be tailored to the Slovenian context.
- To outline three priority areas and preliminary recommendations, which will form the basis of activity 4 of the project (the building of a recommendation and implementation plan).
- To set the scene for the selection of 2-4 specific country practices required for Activity 5, which includes study visits (or online equivalents in the context of the ongoing Covid-19 pandemic).

This report is therefore intended to be a working document, bridging the state of play analysis of the Slovenian innovation ecosystem, to the more functional structural reform elements at the later stage of the project.

1.2 Methodology

The objective of this activity is to perform a benchmark analysis comparing Slovenia and its innovation ecosystem against the advanced practices from trends and characteristics of the innovation ecosystems of innovation leaders from other Member States and, where relevant, third countries. This analysis was implemented with 5 associated tasks:

a) Analysis of existing studies, analyses, and publications on relevant advanced practices. The Study Team conducted an in-depth literature review and a limited round of interviews. The analysis made use of existing studies, analyses, publications

and data sources while selecting the most applicable and relevant advanced practices for Slovenia.

b) A benchmark analysis to select advanced practices that work in the Slovenian context. The goal of this analysis was to draw conclusions on which practices are implementable in Slovenia. The methodology used for this task produced a SWOT-analysis covering Strengths, Weaknesses, Opportunities and Threats of each possible relevant practice. This SWOT is outlined in section 3.3.

c) A gap analysis to select possible solutions. This methodology directly compares the state-of-play (from Activity 2) with the advanced practices analysed in this activity. This was operationalised through a gap analysis workshop with 24 stakeholders, a summary of which has been annexed to this report.

d) A co-construction roundtable, to support the creation of priority areas. The roundtable was organised as horizontal sessions to gather all participants in a plenary setting for validation purposes. The attendees were composed of representatives from across the innovation ecosystem, totalling 40 attendees. The roundtables were supported with a note from the research team, which was circulated to participants beforehand to allow them to prepare and gather complementary inputs. A summary of the roundtable can be found in the annex.

e) The development of preliminary recommendations to implement advanced practices within Slovenian context. These recommendations have been grouped into three priority areas and allow for further refinement and detailed implementation planning in the next activity of the project.

Within these tasks, six interviews were conducted with stakeholders in each of the benchmarked countries, according to a set of research questions. The research questions for the whole activity were refined within the project Steering Committee.

1.1.1 Country selection criteria

The countries selected for this benchmarking were selected in discussion with members of the project Steering Committee, itself composed of representatives from the Slovenian Ministry for Economic Development and Technology (MEDT), SPIRIT Slovenia - Public Agency for Entrepreneurship, Internationalization, Fore-ign Investments and Technology (SPIRIT), Ministry of Education, Science and Sport (MESS), and Government Office for Development and European Cohesion Policy (GODECP).

These discussions took account of, *inter alia,* the following factors:

- Regional importance and geography.
- History, culture, and 'transition'.
- Population and relative size.
- International reputation and level of advancement along innovation scale.
- Performance in competitive European funding.

Discussions within the project Steering Committee, including the ministries involved in the project, have led to an understanding of advanced practices as emanating from 'innovation leaders.'

1.1.2 Definition of advanced practices

This report understands 'advanced practices' broadly and recognises that there are both stand-alone and relative advanced practices. The advanced practices therefore are, first and foremost, seen as a type of international best-practice, which includes how well an individual country uses its resources (economic, human, natural etc.).

The report has selected the countries based on different levels of comparability, ultimately underpinned by a recognition that the countries selected are highly advanced innovation ecosystems. Implicit in this definition is the recognition that there may be some country best practices that are found to be impractical to implement in Slovenia due to divergences between the two systems. This could be perhaps because the framework conditions are too different, or the practices are too advanced. In many ways these conclusions are also crucial findings as they can help to target the direction of future efforts and policy recommendations.

Within this context, advanced practices should also be viewed through:

- The objectives of key Slovenian strategic and policy documents.
- The current status of the actors who may be involved in implementing best practices activities (e.g., policymakers, universities, Research and Technology Organisations (RTOs) etc).
- The outcomes of the state of play report, submitted under Activity 2 of this project.

Timing must also be taken into consideration. Advanced practices may either be at an early stage of development, fully mature, or somewhere in-between. In this context, practices can be classified against an evolutionary scale, as seen in Figure 1, below.

Figure 1 - Developmental Categorisation of Advanced Practices

Developing practices – a programme, activity or strategy that is in concept or development and shows potential to become a best practice. Its relevancy, effectiveness and potential for replication among other organisations or other RTDI systems is not yet proven.

Promising practices - A programme, activity or strategy that has worked within one organisation and shows promise during its early stages for becoming a best practice with long term sustainable impact. A promising practice must have some objective basis for claiming effectiveness and must have the potential for replication among other organisations or RTDI systems/

Good practices – A programme, activity or strategy that meets most of the following criteria: leads to an actual change, has an impact on the policy environment, demonstrates an innovative or replicable approach, and demonstrates sustainability.

Best practices – those methods or techniques that have consistently shown results superior to those achieved with other means in a given situation and that could be adapted for other situations. This must be shown to work effectively and produce

successful outcomes by the evidence provided by subjective and objective data sources. In general, this necessitates rigorous evaluation, demonstrated success and impact and capacity for replication.

Overall, this analysis looks to find one 'best practice' or 'good practice' from each benchmarked country system that has elements which could be replicated in Slovenia. Depending on the outcome of the analysis, 'developing practices' or 'promising practices' may also be considered for selection. It is important to note that the definition of advanced practice can be one activity (e.g., an instrument) or a group of activities working towards an identifiable goal (e.g., digitisation).

2. The comparison countries

This section of the report outlines the selection rationale, state of play in each system and identifies some advanced practices that may be relevant to the Slovenian case. The research and analysis in this section covers the main strategies and policy documents governing the innovation systems in each of the comparison countries. It also looks at how are policy priorities formed and implemented in the country, what works and what does not work.

Each country has been mapped in terms of the key actors in the system and their relative importance, including the key intermediaries and which cluster and innovation networks exist. One crucial element of the country analysis focuses on how well-developed the governance, monitoring and evaluation frameworks are for each country and how strategic intelligence is organised, for example whether there is an evaluation unit.

This framework is explored in the wider context of the major programmes and instruments used and how concrete programmes and instruments cover the TRL scale, what types of call procurement processes feature in the country and examples are there of the types of support post-project. Additionally, in light of the outcomes of the stakeholder consultation, finance options and loans available for innovation activities have been analysed, including venture capital. Finally, and highly relevant to the Slovenian context, the analysis looks at partnerships, collaborations and networks, their maintenance and the underlying factors affecting sustainability.

2.1 Austria

2.1.1 Selection rationale

Austria's research, technology development and innovation (RTDI) system has experienced a remarkable catch-up process in the past two decades and many important successes were achieved. Notably, expenditures on research and development (R&D) reached 3.2% of gross domestic product (GDP) in 2019 and Austria is now ranked number two in the EU for its R&D intensity. Within this, private sector spending represents 54.7%, a rise of 18% since 2015.[1] Its efforts are currently aimed at moving from 'Strong Innovator' to 'innovation leader' on the European Innovation Scoreboard.

However, although the Austrian Council's innovation monitoring shows that the performance of the Austrian RTDI system has definitely improved since 2010, the extent of these improvements is not sufficient to move in any significant way towards the level of the innovation leaders. The Organisation for Economic Cooperation and Development (OECD) review confirmed the assessment by discussing the challenge to transform its sizable investment in RTDI into more decisive economic and social impacts. Austria today still lags behind innovation leaders such as Denmark, the Netherlands, Sweden, and Switzerland.

Despite this, three key points stand out for the country and are useful to explore further in the context of Slovenia:

[1] Federal Ministry of Education, Science and Research, Research in Austria. Accessed via: https://www.bmbwf.gv.at/en/Topics/Research/Research-in-Austria.html

- Austria succeeded in joining the group of countries with the highest R&D intensity by mobilising resources and maintaining a high level of government support.
- The strong government support of the past (by 6 ministers) is pursued for the next decade showing stability and vision (see the 2030 strategy).
- The 2030 strategy[2] and its implementation and operationalisation through an inter-ministerial pact.

2.1.2 The innovation system

The strategy for research, technology, and innovation (FTI) is at the centre of the Austrian current competitive position. With the first RTI Strategy[3] adopted in 2011, the Austrian Government set itself the goal of making Austria an innovation leader by 2020. As a result, the Austrian RTI system has definitely improved since 2010. However, the extent of these improvements is not sufficient (see below). The 2030 strategy aims at achieving the goals of the 2011 strategy by pursuing three objectives:

1. Open up to the top international fields and strengthen Austria as an FTI location;
2. Focus on effectiveness and excellence;
3. Rely on knowledge, talents and skills.

Concerning the first objective, this includes: expanding research and technology infrastructure and ensure accessibility; Increasing participation in EU missions, EU partnerships and Important Projects of Common European Interest (IPCEIs); and Promoting internationalization and strategically aligning it.

Concerning the second objective, this includes: Promoting excellent basic research; Supporting applied research and its impact on the economy and society; and FTI to achieve the climate goals.

Concerning the third objective, this includes: Developing and promoting human resources; Supporting international perspectives of researchers and students.

The strategy is supported by 6 ministers and is operationalised through an inter-ministerial pact, the FTI Pact. The 2021-2023 FTI Pact has been adopted. It contains strategic priorities and measures to achieve the goals. Priorities are subsequently made by the ministries in the service and financing agreements with the central institutions, in accordance with their respective legal requirements.

In addition, Austrian coherence across all ministries was ensured during the process of developing the 2030 strategy through a Task Force. The Task Force concentrated particularly on output, impact, excellence and openness. This task force also had a 'drafting group', which contained key stakeholders of the innovation ecosystem.

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[2] Austrian Ministry for Education, Science and Research, 2020, *RTI Strategy 2030 - the Federal Government's strategy for research, technology and innovation*. Accessed via https://www.bmbwf.gv.at/Themen/Forschung/Forschung-in-%C3%96sterreich/Strategische-Ausrichtung-und-beratende-Gremien/Strategien/FTI-Strategie-der-Bundesregierung-.html

[3] *Becoming an innovation leader*. Accessed via https://www.bmk.gv.at/en/topics/innovation/policy/rti_strategy.html

2.2.1.1 Key players

In Austria, there are a wide variety of tertiary education institutions. In addition to public universities, the Austrian tertiary sector includes universities of applied sciences (UAS, Fachhoch-schulen, since 1993), private universities (since 1999) and university colleges of teacher education. There are currently 22 state universities in Austria (including six universities of the Arts and three technical universities), 21 universities of applied sciences (which may be established as either public or private entities) and 13 accredited private universities - with a total of around 380,000 students in 2019.

The common language of instruction is German but around 16% of the degree programmes at public universities were offered in English in 2019.

The main Research and Technology Organisations (RTOs) are:

- The **Austrian Academy of Sciences**[4] (ÖAW) has more than 1,100 employees. Its main focus is on space research, basic biomedical research, as well as topics in the fields of history, socioeconomics and cultural science.
- The **Austrian Institute of Technology**[5] (AIT) is Austria's largest non-university research facility with 1,400 employees, and is dedicated to topics of the future, such as energy, mobility, the security of critical infrastructure, health and the environment as well as innovation and sustainability research.
- **Joanneum Research**[6], with over 450 employees, is also an important provider of innovation and technology with a focus on applied research in the areas of materials analysis, health, information and communication technologies, resources, as well as economic and innovation research.
- The **Christian Doppler Gesellschaft**[7] (CDG) promotes cooperation between science and business. This takes place in specially established research units with fixed terms, in which application-orientated basic research is pursued. As of 2020, there are 91 Christian Doppler Laboratories at universities and non-university research institutions, and 17 Josef Ressel Centres at universities of applied sciences.
- Other RTOs are: the Institute of Science and Technology (IST), the Silicon Austria Labs GmbH (SAL), the Ludwig Boltzmann Society (LBG).

Companies: There is a particularly high proportion of innovative companies not only in the classical technology industries of electronic data processing and electrotechnology/optics, but also in the chemical and pharmaceutical industry, in mechanical engineering and in the vehicle industry. In the service sector, which has a slightly lower overall proportion of innovative companies, the Information Technology (IT) and telecommunications industry is of special importance. The leading companies play a key role as drivers of innovation in Austria. Small and Medium Sized Enterprises (SMEs) also take a huge share in the innovation landscape.

[4] See website of the Austrian Academy of Sciences. Accessed via https://www.oeaw.ac.at/en/austrian-academy-of-sciences/
[5] See website of the Austrian Institute of Technology. Accessed via https://www.ait.ac.at/en/ .
[6] Website of the JOANNEUM RESEARCH Institution. Accessed via https://www.joanneum.at .
[7] Website of Christian Doppler Research Association. Accessed via https://www.cdg.ac.at .

The public authorities overseeing RDTI in Austria include the **Federal Ministry for Digital and Economic Affairs**, the **Federal Ministry of Education, Science and Research**, the **Federal Ministry for Transport**, **Innovation and Technology**, the **Federal Ministry of Finance**, and the **Austrian Business Agency** (ABA – more information in Figure 2). The main institutions are:

- The **Austrian Council for Research and Technology Development**[8]. Established on 11 July 2000 by the Parliament, the new and independent Council for Research and Technology Development became a legal entity under public law on 1st September 2004. The Council's work covers the entire national innovation system. It may be consulted by both federal and regional institutions. Its equivalent for science is the **Austrian Science Council**[9].
- The **Austrian Research Promotion Agency**[10] (FFG) is the national funding agency for industrial research and development in Austria. FFG funding schemes play an important role in generating new knowledge, developing new products and services, and enhancing competitiveness in the global marketplace. They make it easier, or possible, to finance research and innovation projects, and help to absorb the risks involved in research. The FFG supports international networking and encourages careers in science.
- The **Austrian Cooperative Research**[11] (ACR) is a network of private research institutes offering applied R&D for companies. The services are tailored to meet the needs of SMEs. ACR-institutes offer testing, inspection and certification as well as technology and knowledge transfer. They perform more than two-thirds of their services for SMEs. In 2019 the networks had EUR 65 million Turnover, 715 employees, and 11,300 customers (76% of which were SMEs). There are 17 ACR institutes focusing on: sustainable building; renewable energy; product, processes, and materials; food quality and safety; innovation and competitiveness; and digitalisation.
- The **Austrian Promotional Bank**[12] (AWS) is the promotional bank for business-related economic development. It supports companies with low-interest loans, grants, guarantees as well as consulting and other services.
- The **Austrian Science Fund**[13] (FWF) is Austria's central funding organization for basic research. The purpose of the FWF is to support the ongoing development of Austrian science and basic research at a high international level. The FWF's funding activities focus on research efforts devoted to generating new knowledge.

[8] See website of the Austrian Council for Research and Technology Development. Accessed via https://www.rat-fte.at/home-en.html
[9] See website of the Austria Science Council. Accessed via https://www.wissenschaftsrat.ac.at/en/
[10] See website of the Austrian Research Promotion Agency. Accessed via https://www.ffg.at/en
[11] See website of the Austrian Cooperative Research Network. Accessed via https://www.acr.ac.at/english/
[12] See website of the Austrian promotional bank. Accessed via www.aws.at/en
[13] See website of the Austrian Science Fund. Accessed via www.fwf.ac.at/en

Figure 2 - The Austrian Business Agency[14]

The Austrian Business Agency is the national business promotion company of Austria. It is formed of different departments and provides free consultancy services. The parent department is ABA – Work in Austria, which contains ABA – Invest in Austria and the nationwide film commission Location Austria. Among the services offered are Immigration and Residence Services for high-skilled employees. It acts as the first point of contact for foreign companies who want to establish their own business in Austria. The company is owned and operated by the Republic of Austria and reports directly to the Federal Ministry for Digital and Economic Affairs.

Monitoring is conducted through the annual Austrian Research and Technology report[15] by the Austrian Council. The monitoring shows that the performance of the Austrian RTI system has definitely improved since 2010. The extent of these improvements is however not sufficient to move in any significant way towards the level of the 'innovation leaders'.

2.1.2.2 Programmes and instruments

Austria supports research-oriented companies with direct and indirect research funding:

- **Direct[16]** research funding is provided through **grants**, **loans** and **guarantees,** including **vouchers for SMEs.**
- **Indirect** research funding is provided through **tax credits[17]** for research expenditure (14% of the research project expenditures).

The prerequisites for research funding depend on the type and eligibility of the research project as well as on the size and type of company.

The aim was to achieve, by 2020, a distribution of public and private financing in which one-third is public and the other two-thirds are private. The contribution of the public sector should, after the necessary phase of consolidation resulting from the financial crisis and budget consolidation, be stabilised on a path where it can support the desired research intensity with such ratio of private and public research financing.

The Austrian R&D **tax credit** is available for companies that have project-related R&D expenses. Its evaluation is carried out by the FFG (Austrian Research Promotion Agency), based on the project proposal. The credit is being acknowledged as a high incentive to undertake R&D activities by Austrian companies as this grant is treated as an immediate cash credit on a company's tax account (14% of the tax base since 01/2018). Tax incentives account for 48% of total public support for business R&D in Austria.[18]

[14] See website of the Austrian Business Agency for reference: https://investinaustria.at/en/

[15] Austrian Research and Technology Reports, 2010-2020. Accessed via https://www.bmk.gv.at/themen/innovation/publikationen/evaluierungen/forschungsfoerderung.html

[16] Austrian Research Promotion Agency, 2020, *Current Funding Opportunities*. Accessed via www.ffg.at/en/content/funding

[17] Austrian Research Promotion Agency, *Expert opinion for the research premium: The seal of approval for innovative companies.* Accessed via www.ffg.at/forschungspraemie .

[18] OECD, *Measuring Tax Support for R&D and Innovation: Country Profile Austria*. Accessed via https://www.oecd.org/sti/rd-tax-stats.htm

More regarding the tax credit is outlined below in Figure 3.

Figure 3 - Outline of the Functioning of the Tax Credit System in Austria[19]

The application for the research premium (tax credit) for in-house R&D as well as for contract research can be submitted to the responsible tax office. The research premium amounts to 14 percent of the total research expenditure of a financial year. The research premium is credited by the tax office and also benefits companies that have no profit. In order to be able to claim a research premium for in-house research and experimental development, the tax office then reports to the FFG on the business claiming the credit. The annual reports of the FFG can be requested and are free of charge.

The procedure for applying for a research premium is as follows:

The application is sent to the responsible tax office, which assesses the nature of the research the meaning of Section 108c of the Income Tax Act and the Research Premium Ordinance. When making the assessment of the report, the FFG also uses the OECD Frascati Manual (2015) to assess whether the content requirements for the research award are met.

Once the report has been prepared, it is automatically sent to the responsible tax office and can be viewed in the electronic tax file for the company. The company will be notified of the completion by email.

The federal expenditure for research and research promotion amounted to nearly 3.3 billion EUR in 2020[20]. The expenditures by main institutions are:

- FFG funding volume: EUR 685 million in 2018 (including EUR 123 million for broad band infrastructure)[21].
- FWF approved funding volume: EUR 230.8 million in 2018.
- AWS funding for corporate business development: EUR 1,145.4 million in 2017.
- Competence Centres for Excellent Technologies are funded by the initiative **COMET** to promote cooperation between companies and scientific facilities within the context of a jointly defined but high-level research program. So far 5 COMET Centres (K2), 24 COMET Centres (K1) and 63 COMET Projects for a total volume of about 2.24 billion EUR have been funded.

RTDI infrastructures in Austria are located in 4 major regional hubs: Innsbruck, Graz, Linz and predominately Vienna. This pattern is mainly driven by the location of major Universities with an emphasis on Science Technology, Engineering and Maths (STEM) fields or Digital Services, e.g. **TU Vienna,** University of natural resources and life science, **WU**

[19] FFG, Expert opinion for the research premium, https://www.ffg.at/forschungspraemie

[20] Statistics Austria, 2020, *Government R&D Budget Analysis*. Accessed via https://www.statistik.at/web_en/statistics/EnergyEnvironmentInnovationMobility/research_and_development_r_d_innovation/government_r_d_budget_analysis/index.html

[21] Invest In Austria, 2020, *Research Funding in Austria » R&D*. accessed via https://investinaustria.at/en/research-development/investment-incentives.php .

Vienna, **University of Innsbruck, Johannes-Kepler-University**, etc. Due to the demographic structure of Austria, most universities and research institutions cluster in the regional capitals as seen above and mingle with the private and government sector there. Therefore, most of the universities not only have internal research facilities and programs, but also Hubs or specified centres to support the entrepreneurial spirit of students and facilitate innovation. Almost half of RTDI infrastructures in Austria are in the field of natural sciences, with technical science and medicine & health sciences as runner ups. Especially in Vienna, there is a major trend towards a RTDI specialisation in life sciences. Infrastructures like the Vienna Bio Center Core Facilities, a Life-Sciences-Technology Center and the founding of a centre for precision medicine as well as one for translational medicine within the medical university were important milestones for that strategy.

The evidence to show **cost-effective measures** is provided by the European Innovation Scoreboard (EIS) as only one prominent example among other international rankings. Austria is ranked **8th** among the group of **strong innovators** together with Estonia, France, Germany, Ireland, Luxemburg, and the Netherlands. Although the country performs better in 2021 than in 2014[22] with a strong increase (11%-points), due to a strong performance increase in 2017, some of the underlying indicators have underperformed. For example, use of information technologies decreased in Austria (-41.5%) while the EU average increased (+15.5%) between 2014 and 2021. It must be noted that Austria's strengths are intellectual assets, attractive research system, and linkages which is looking at the collaboration efforts between innovating firms, research collaboration between the private and public sector, and the extent to which the private sector finances public R&D activities.

However, over the last ten years, even if upward trends are seen in individual rankings, the overall development is clearly downward[23]. These findings are confirmed in the annual Monitoring Report of the Austrian Economic Chamber[24], which summarizes Austria's performance in more than 150 international rankings. Regardless of the respective survey methods and the indicators used, on the whole these rankings only show, that Austria is "average, for a high-income country, with low rankings and deterioration in many places." The lead places on the other hand are mostly occupied by the innovation leaders, which are also chosen as reference countries for the Austrian Council's innovation monitoring.

Especially responsible here is the fact that the Austrian RTDI system has clearly not been able to convert its high research inputs into corresponding innovation outputs. Austria invests an above-average high amount in its R&D system. At the same time, however, this only generates comparatively **moderate innovation output**[25]. The high R&D expenditure therefore does not result in performance that is appropriate for Austria's advanced scientific and innovation level. Austria is stagnating compared with the leading European countries. The **imbalance between innovation input and output** is an indication of perhaps the greatest challenge Austria must overcome in the decade ahead. The Austrian Council proposes a number of recommendations, such as decreased administrative complexity for

[22] See page 59 of the European Innovation Scoreboard 2021, accessed via https://ec.europa.eu/docsroom/documents/46013

[23] Tamara Elisa Schranz, 2020, *Report on Austria's Scientific and Technological Capability 2020*, Austrian Chamber of Commerce. Accessed via https://www.wko.at/Content.Node/kampagnen/monitoringreport/start.html

[24] *ibid*

[25] *ibid*

Start-ups, but also on research funding, and rebalance direct funding to research institutions towards more competitive allocation of resources.

An OECD Country Review entitled "Supporting Entrepreneurship and Innovation in Austria"[26] was Commissioned by the Federal Ministry of Education, Science and Research (BMBWF). The results were presented in November 2019. It discusses the challenge to transform Austria sizeable investment in RTDI into **more decisive economic and social impacts**. Although Austria has well developed links between industry and science, the capacity to address societal challenges needs deeper collaboration between basic research and industry. The national debate on mission is an occasion to build those links. The same across funding agencies supporting basic research and applied research. A single council (instead of two) for science, research and innovation could strengthen coordination and advance innovation relevant issues. The share of competitive funding toward research institutions would also need to increase.

Most of the funds allocated by the **Austrian Research Promotion Agency,** the innovation agency, are competitive calls[27]. The FFG supports:

- Single firm projects: from Individual Projects of Experimental Development, to start-ups. Submission can be made anytime, and the funding decision is fast;
- Collaborative projects on specific topics: energy, cities and the environment, mobility, materials and production, information and communication technologies, safety and security, and space. Many of these projects are undertaken by companies working together with research institutes or universities;
- Structures and infrastructures: establishing new research priorities by creating major competence centres, as well as laboratories and special research infrastructures. This includes the COMET competence centres;
- Innovation and open innovation: to involve new groups such as users, suppliers, important stakeholders, applying new methods, and the growing importance of non-technological innovations;
- Qualification and talent: support school projects, internships, the implementation of novel training programmes for businesses, and endowed professorships;
- International networks: support participation to EU programmes (Horizon 2020, EUREKA, Eurostars-2, COST, COSME). Every year, the Austrian businesses and institutes secure around 200 million EUR of EU research funding. FFG also acts as the National Contact Point for a variety of programmes, and is actively involved in a range of European and international initiatives including many ERA-NETs and the Enterprise Europe Network (EEN);
- Other services: free tax incentive assessment, job exchange for research and technology, finding partners both in Austria and abroad, and a whole range of advisory and training measures. The FFG is also a competence centre for innovative public procurement, participates in the European EURAXESS initiative and runs the

[26] OECD, 2018, *OECD Reviews of Innovation Policy: Austria 2018*. Accessed via https://read.oecd-ilibrary.org/science-and-technology/oecd-reviews-of-innovation-policy-austria-2018_9789264309470-en#page13

[27] Austrian Research Promotion Agency, 2018, *FUNDING ADDS VALUE*. Accessed via https://www.ffg.at/sites/default/files/allgemeine_downloads/FFG_Folder_EN.pdf .

Global Incubator Network start-up programme together with the Austrian Promotional Bank (AWS).

Figure 4 - Outline of the Functioning of the Austrian Research Promotion Agency FFG[28]

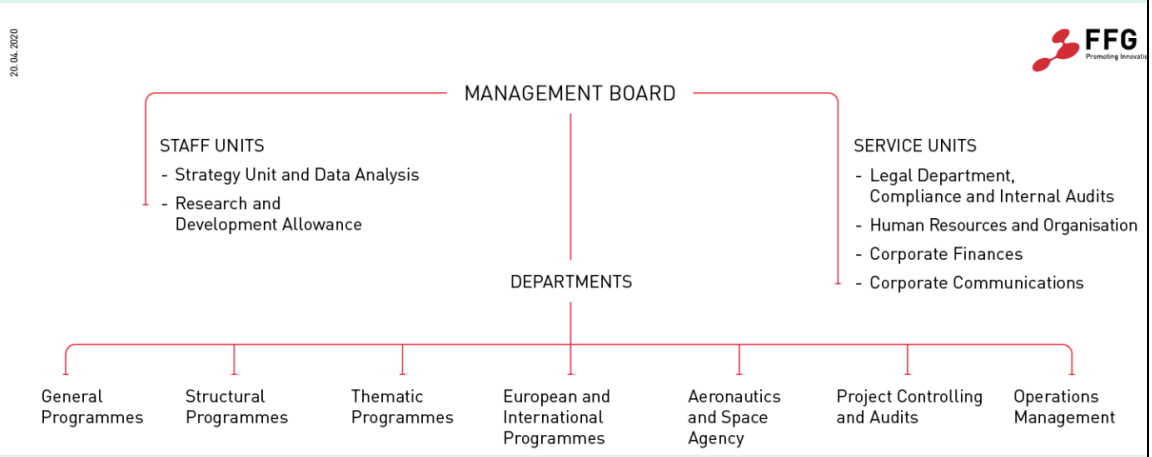
The purpose of the FFG is to promote research, technology, development and innovation for the benefit of Austria." (Sec. 3 of the FFG Act). The tasks of the FFG are the following:

- To manage and finance research projects in the business and science sectors, impulse programmes for the economy and research facilities, and networks fostering cooperation between science and industry.
- To manage cooperative programmes and projects with the EU and other European and international partners.
- To represent Austria's interests at relevant European and international institutions on behalf of the Austrian government.
- To provide consultation and support to intensify Austria's involvement in European programmes, especially in the EU Framework Programme for Research, Technology and Innovation and the Framework Programme for Competitiveness and Innovation.
- To provide support and strategy development services for decision-makers in the Austrian innovation system.
- To improve public awareness of the importance of R&D.

Legal Basis: The FFG was founded on 1 September 2004 (pursuant to the FFG Act on establishing a research promotion agency, Federal Law Gazette I No. 73/2004). The FFG is wholly owned by the Republic of Austria, represented by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) and the Federal Ministry for Digital and Economic Affairs (BMDW). As a provider of funding services, however, the FFG also works for other national and international institutions.

The agency is lead by Henrietta Egerth and Klaus Pseiner who have been the managing directors of the FFG since its founding in September 2004.The graph below provides the organisation:

[28] See for reference: FFG, https://www.ffg.at/en/FFG/objectives-and-mission



Budget: The FFG awards annually well over 400 million euros in federal funding to around 3,000 applied research and innovation projects involving around 5,500 partners[29]. The FFG also offers a comprehensive range of information and services. It is the national contact point for the EU programme Horizon 2020, which provides Austrian organisations with 150 to 200 million euros in funding each year. The agency provides professional expertise on tax incentives for research and innovation ("R&D allowance") and coordinates Austrian activities in space research and technology. It has also been commissioned to manage the programme to extend Austria's broadband infrastructure ("the broadband billion").

In 2020, Austria's companies, universities and research institutions submitted **2,303 patent applications**[30] to the European Patent Office (EPO). That is almost as many as in 2019 when 2,436 patent applications were submitted. The country ranks 8th among European countries and even 7th when ranking the country according to the number of applications per million inhabitants (260 patent applications per million inhabitants). BOREALIS AG was the most active applicant in 2020 with 182 patent applications, followed by TRIDONIC GMBH & CO. KG (70), AMS AG (68), ZKW GROUP GMBH (65), FRONIUS INTERNATIONAL GMBH (54) and JULIUS BLUM GMBH (43).

[29] See for reference: FFG https://www.ffg.at/en/content/results-impacts

[30] European Patent Officer, 2020, *Annual Report: European patent applications per country of origin.* Accessed via https://www.epo.org/about-us/annual-reports-statistics/statistics/2020/statistics/patent-applications.html#tab2 .

Figure 4 - International comparison of patent applications

Country	2020	2019	Change %
Germany	25 954	26 762	-3.0%
France	10 554	10 233	3.1%
Netherlands	6 375	6 942	-8.2%
Italy	4 600	4 469	2.9%
Sweden	4 423	4 395	0.6%
Denmark	2 404	2 415	-0.5%
Belgium	2 400	2 422	-0.9%
Austria	2 303	2 346	-1.8%
Finland	1 895	1 705	11.1%
Spain	1 791	1 885	-5.0%

< Prev 1 2 3 Next >

Source: EPO.
Status: 1.2.2021.

In addition to the patent applications (ranked 7th or 8th) and the Innovation scoreboards (ranked 8th), the **innovation performance** of the region can be seen through various indicators. The key point is to highlight strengths and weaknesses related to the innovation system.

The **Global Competitiveness Index** (GCI) is based on indicators that reflect economic productivity and growth. These indicators are grouped into twelve overarching dimensions representing the corresponding composite indices: 1) Institutions, 2) Infra- structure, 3) Macroeconomic stability, 4) ICT adoption, 5) Health, 6) Skills, 7) Product market, 8) Labour market, 9) Financial system, 10) Market size, 11) Business dynamism, and 12) Innovation capability. With a GCI score of 76.6 in 2019, Austria came **21st**, up by one position compared to previous year. Austria's performance in the "Macroeconomic stability" sub-index achieved the highest score (100 out of 100) and thus claimed first place. The country also enjoys a very good position in the areas of "Infrastructure" (89, 10th) and "Innovation capability" (74, 14th). Other areas, however, require significant improvement, such as "ICT adoption" – comprising the sub-indices "Mobile-cellular telephone subscriptions per 100 population", "Mobile-broadband subscriptions per 100 population", "Fixed-broadband internet subscriptions per 100 population", "Fibre internet subscriptions per 100 population", and "Internet users as a percentage of the adult population" – in which Austria is placed 50th in an international comparison.

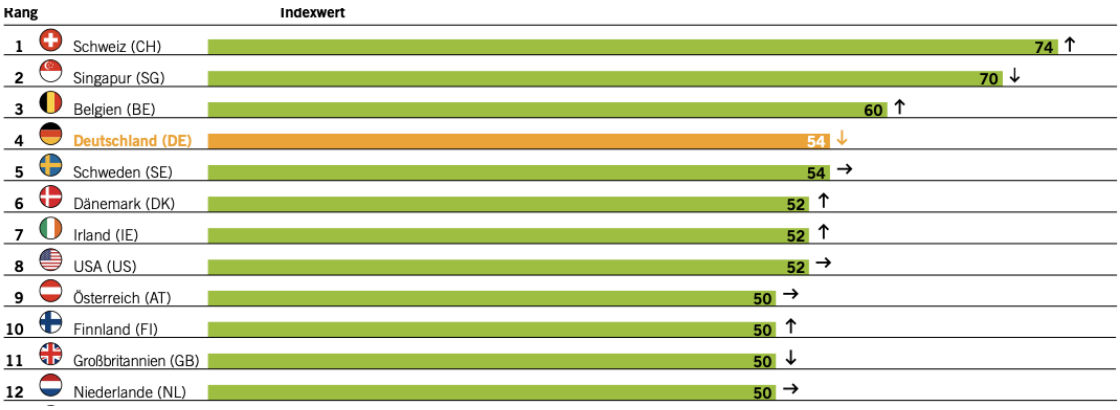
Table 1 - A selection of innovation indicators for Austria

Austria's position	Global Competitiveness Index 2019	Global Innovation Index 2019	European Innovation Scoreboard 2019	Innovation Indicator 2020
Value	**76.6** (scale 0 to 100) vs. 2018 (value 76.3)	**50.94** (scale 0 to 100) vs. 2018 (value 51.32)	2018: **125** (Scale 0 to 180) vs. 2017 (value 122)	**50** (out of 100)
Ranking	**21** (out of 141) vs. 2018 22 (out of 140)	**21** (out of 129) vs. 2018 21 (out of 126)	2018: **9** (out of 28) vs. 2017 10 (out of 28)	**9** (out of 35) vs. 2018 11 (out of 35)
EU-28 comparison	7 (out of 28)	13 (out of 28)	2018: 9 (out of 28) vs. 2017 10 (out of 28)	6 (out of 17)
Number of countries	141	129	28	35
Number of individual indicators	103	80	27	38

Source: Austrian Research and Technology Report 2020, based on data from World Economic Forum (2019); Cornell University, INSEAD and WIPO (2019); European Commission (2019); Federation of German Industries (BDI) et al. (2020).

The **Global Innovation Index** (GII) comprises indicators such as infrastructure, market and entrepreneurial development, knowledge and technology output, and creativity output. Austria retained **21st** place between 2018 and 2019 with only a minimal change to its overall score (51.32 in 2018; 50.94 in 2019). Austria's performance in this index was very strong in the area of "Tertiary Education" (3rd), "Research & Development (R&D)" (18th) and "Knowledge Workers" (17th). The country also came 25th in the two lower-level sub-indicators of knowledge and technology output and creativity output, putting it on the fringes of the leading group of countries. Austria's performance was much poorer in the areas of "Investment" and "Knowledge Diffusion" – which are based on information on market capitalisation, on venture capital finance and exports of ICT services and on foreign direct investment – as it came in 81st and 40th respectively in an international comparison.

Table 2 - BDI innovation rankings



Source: Innovation Indicators 2020

In the "**Innovation Indicator**" [31], an international comparison published by the Federation of German Industries (BDI) together with the Fraunhofer ISI and the Leibniz Centre for European Economic Research (ZEW), Austria is currently in **ninth** place (out of a total of 35 countries) demonstrating excellent innovation foundations (see Table *2*). This puts it ahead of strong innovators such as South Korea and Finland. Austria has gone up two places in the country rankings, although its indicator score of 50 points (out of a possible 100) is unchanged.

Similarly, at 63 %, the share of **innovative companies**[32] is also far above the European average**.** Austria scores well on the European Innovation score for Public-private co-publications, Innovative SMEs collaborating with others, International scientific co-publications, and Foreign doctorate students. **For example, Austria ranks 2nd** in the European Innovation scoreboard for linkage indicators relating to public private-co

[31] Innovations Indicator, 2020, *Innovations Indicator 2020*. Accessed via http://www.innovationsindikator.de/2020/

[32] Statistics Austria, 2018, *Innovation Survey (CIS) 2018. Accessed via http://www.statistik.at/wcm/idc/idcplg?IdcService=GET_PDF_FILE&RevisionSelectionMethod=LatestReleased&dDocName=124918* .

publications in the EU in 2021.[33] Innovative firms are an important policy issue as most jobs are created by a limited number of high-growth firms. . Austria is less strong on Innovation-Friendly Environment, employment impact, and Sales impacts. Low-scoring indicators also include Employment in fast-growing enterprises of innovative sectors, Venture capital expenditures, Exports of knowledge-intensive services, and Non- R&D innovation expenditures.

2.1.2.3 Financial instruments

The **Austrian Promotional Bank**[34] (AWS – or Austrian Wirtschaftsservices) is the promotional bank for business-related economic development. It supports companies with low-interest loans, grants, guarantees as well as consulting and other services. Following simplifications, the bank focus on four activities:

- Developing ideas: is for the first steps of an entrepreneur (from deeptech, to creative impact, and first incubator)
- Setting up a business: supports new enterprises with loans, guarantees, equity, grants and coaching.
- Sustainable expansion: supports established firms in developing new products and production methods, scaling business models and internationalising technologies.
- Connecting services: acts as a neutral intermediary to offer companies a number of networking services where solutions may be lacking on the market.

Table 3 - AWS key figures

Key figures 2018 and 2019		
	2018	2019
Projects[1]	3,700	4,770
Total funding [in € millions]	1,100	1,120
Present value (in € millions)	189	135
1 All data exclude any employment bonus.		
Employees	**2018**	**2019**
Headcount	278	255
Full time equivalents, rounded	245	227
Source: Austria Wirtschaftsservice (aws).		

The bank monitors indicators such as Internationalisation (including membership of international networks), knowledge and technology transfer, output, innovation and excellence, or quality assurance and its evaluation.

The bank also operates several funds on behalf of the government:

[33] European Innovation Scoreboard (2021). Accessed via: https://ec.europa.eu/docsroom/documents/46013
[34] Website of the Austrian promotional bank. Accessed via www.aws.at/en

- The AWS Mid Cap Fund[35], to invest in medium-sized companies. Established in 2009, the Fund offers follow-on funding for companies enjoying strong growth or co-invests in medium-sized acquisitions or company successions. The purpose of the AWS Mid Cap Fund is to form partnerships of equals with enterprises and offer them the best possible support in pursuing and achieving sustainable growth. The fund is endowed with EUR 70 million.
- The AWS Founders Fund[36] provides venture capital for company founders. Established in 2013, the fund is set to run until 2026. The fund is endowed with EUR 65 million and provides venture capital for young enterprises with significant growth potential that are unable to raise the necessary capital through bank loans, for example, in addition to investing in the founding and initial growth phases of commercial businesses headquartered in Austria.
- The ERP Fund provides ERP loans with low interest rates and long term perspectives. Established in 1962 and using funds from the US Marshall Plan aid programme, the yearly funding is between EUR 500 million and EUR 600 million. The ERP Fund supports the investment activities of Austrian enterprises and thereby promotes investment in innovation, technology, modernisation, expansion measures and the development/expansion of services and business fields.

However, the OECD noted in 2018[37] that **a key barrier to boosting the level of high-growth companies in Austria is the shortage of risk capital.** VC investments in Austria are around 12% of that in Denmark and 11% of that in Sweden. Tax incentives for individuals and pensions fund are missing in comparison to Sweden for example.

2.1.2.4 Partnerships

International co-operation is essential to address complex challenges and achieve critical mass. The country plays an active part in the European Research Area (ERA) as it can be seen in the ERA roadmap[38]. Investments in research and development have been steadily increased in recent years in order to further strengthen Austria's position as a knowledge society and to foster innovation and work towards the goal of becoming one of Europe's most innovative countries. Austria also strives to adopt EU policies, for example by providing favourable conditions and adequate support for researchers. Austria was among the first to adopt the EU Code and Charter for researchers[39] or the Human Resource Strategy for Researchers[40] (HRS4R).

In December 2019, the Austrian Research Promotion Agency (FFG) published a "Thematic Dossier", on the performance of Austrian companies in Horizon 2020[41]. It shows the success

[35] Mittelstandsfonds Austria, 2020, *Creating value together: Growth capital as an accelerator for SMEs*. Accessed via https://www.mittelstands-fonds.at/en/

[36] Founders Fund Austria, 2020, *Venture capital for ideas & innovations*. Accessed via https://www.gruenderfonds.at/en/

[37] OECD (2018): OECD Reviews of Innovation Policy: Austria 2018. OECD Publishing, Paris,

[38] Austrian Competitiveness Council, 2015, *Austrian ERA Roadmap*. Accessed via https://era.gv.at/era/era-roadmap/austrian-era-roadmap/

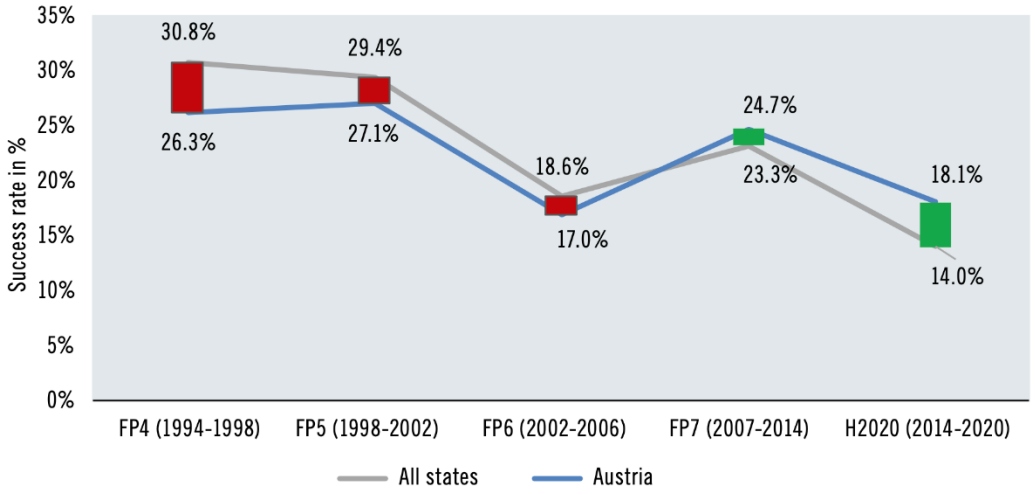
[39] Euraxess Austria, The European Charter & Code for Researchers Accesssed via: https://www.euraxess.at/jobs/charter-code-researchers

[40] Euraxess Austria, Human Resources Strategy for Researchers (HRS4R). Accessed via: https://www.euraxess.at/jobs/hrs4r

[41] FFG, December 2019, ERA thematic dossier on performance of Austrian enterprises in horizon 2020. See page 14 for reference: https://www.ffg.at/sites/default/files/downloads/Themendossier_Wirtschaft_Update_Dec2019.pdf

rates of Austrian companies ahead of the average for all countries by four percentage points. This success rate of 18.1% for Austria's companies in Horizon 2020 is the highest amongst all EU member states (just ahead of France and Belgium). Austrian SMEs are also achieving above-average success. Their success rate is 15%, placing them in second position.

Figure 5 - Performance of Austrian companies in H2020



Source: FFG 2019

2.1.3 Identified advanced practices

Five advanced practices identified in the Austrian case that can be classified as: 'developing', 'promising', 'good' or 'best' practices are presented below (see definition in Section 1.3)

Advanced Practice 1 (best). Long-term commitment of Austrian authorities toward R&D. Austria's RTDI has experienced a remarkable catch-up process in the past two decades. Important successes were achieved such as the high number of patent application. Certainly, maintaining a high level of expenditures on R&D, reaching 3.2% of gross domestic product in 2019 helped. Austria is now ranked number two in the European Union for its R&D intensity. Possibly transferable to Slovenia in the middle term.

Advanced Practice 2 (good). Strong political commitment. The strong government support of the past (by 6 ministers) is pursued for the next decade showing stability and vision (see the 2030 strategy). Possibly transferable to Slovenia in the middle term.

Advanced Practice 3 (best). Long-term strategy. The 2030 strategy is operationalised through the pact showing interesting reform points such as concentration, cross-departmental collaborations (to finance research, and to coordinate), clarification of the instrument portfolio, and more open topics for basic research. The use of societal challenges as an instrument to deepen collaboration between basic research and industry is also key. Two avenues are explored: 1) the share of competitive funding will increase with the aim to increase and deepen collaboration between basic research and industry, and; 2) a single agency for funding research is also envisaged instead of two funding agencies

supporting basic research and applied research. Possibly transferable to Slovenia in the middle term.

Advanced Practice 4 (best). An independent monitoring entity and evaluations. The Austrian Council for Research and Technology Development is an independent entity that monitors the entire national innovation system. It may be consulted by both federal and regional institutions. Its main task is to make recommendations to the Austrian Government on all issues relating to research, technology, and innovation policy. Annual monitoring is conducted through the annual Austrian Research and Technology report by the Austrian Council. These are supported by sub-contracted monitoring reports, for example in 2008. Highly transferable to Slovenia in the short term and recommended.

Advanced Practice 5 (good). International co-operation. The country plays an active part in the European Research Area (ERA) as it can be seen in the ERA roadmap. Austria also strives to adopt EU policies, for example by providing favourable conditions and adequate support for researchers. Transferable to Slovenia.

Advanced Practice 6 (best). Nurturing good researchers. Researchers are one of the priorities of the Austrian Government 2030 strategy. Doctorate researchers are nurtured in doctoral schools fully compliant with the principle of the Human Resources Excellence in Research Principles[42] including being prepared to work in collaboration with industry. Transferable to Slovenia.

2.2 Estonia

Section 2.2 presents the findings of the desk research for Estonia as a comparator country. Interviews with two stakeholders, the Estonian Research Councill and Enterprise Estonia, have also been carried out.

2.2.1 Selection rationale

Estonia is a small and centralised country with a generally well reputed RTDI system. The country's innovation and digitisation policies have for some time received international attention and been the subject of a good body of literature.

Estonia has consistently pursued policies to strengthen its innovation system in the last decades, in particular since joining the EU in 2004. However, Estonia also has a longer history of technology and R&D. Estonia was one of the wealthiest parts of the Soviet Union. In the 1980s, Soviet Estonia became the Union's centre for technological advancement and software development. Estonia was also at the forefront of education policy in the USSR. When the Soviet Union collapsed in the early 1990s, Estonia was in a strong position to take advantage of its existing technological knowhow. The country pursued policies conducive with this competitive advantage, including the introduction of Europe's first flat tax.[43]

[42] Euraxess, 2019, *The Human Resources Strategy for Researchers,* European Commission. Accessed via https://euraxess.ec.europa.eu/jobs/hrs4r .

[43] The Economist, Oct 13th 2005, *When small is beautifully successful.* Accessed via https://www.economist.com/europe/2005/10/13/when-small-is-beautifully-successful

Since regaining independence in the 1990s, Estonia has been proactive in promoting innovation as part of a political grand strategy. In addition to building on its past technological knowhow and in building an effective innovation system, the country has created an entire political culture centred on innovation highlighted by the "e-Estonia" model. [44]

Since joining the EU (2004), Estonia has continued to invest in RTDI. The 2021 European Innovation Scoreboard (EIS) listed Estonia as a 'Strong Innovator' along with Austria, France, Germany, Ireland Luxembourg, and the Netherlands, which means that the country's performance is above or close to the EU average (the definition of the group). In comparison, Slovenia is classified as a Moderate Innovator.[45]

Although the Estonian RTDI system displays innovative practices which can be applied to a country with a small population and many strengths, the country is also facing its fair share of challenges.

The 2017 EU Semester analysis suggests that "despite progress in implementing R&D and enterprise growth strategies, Estonia's research and innovation ecosystem remains fragile."[46] It identifies the following key challenges: low private investment in R&D, insufficient cooperation between businesses and academia, low efficiency of public R&D spending, shortage of skills, insufficient prioritisation of research and innovation investment, and lack of entrepreneurial discovery process.

2.2.2 The innovation system

Design and evaluation of RTDI policy is predominantly the responsibility of the Ministry of Education and Research (MER). MER is in charge of research and education policy. The Ministry of Economic Affairs and Communications (MEAC) oversees technological development and innovation policy. Each ministry is supported by an advisory committee. Other ministries are also responsible for organising and financing R&D activities, drafting and implementing R&D programmes in their remit. At the operational level, both MEAC and MER have implementing agencies and intermediaries. The Research and Development Council is an expert advisory body for the Government on R&D and innovation – all policy documents have to pass the R&D Council prior to being approved by Government.

One central piece of legislation, the Organisation of Research and Development Act, provides the framework for the Estonian RTDI system. According to this law, the Estonian Government is tasked with preparing national R&D development plans, which are submitted to the Riigikogu (Parliament) for approval of the national R&D programmes.

Until recently there were three R&I-related strategies in Estonia. These are the Estonian Research and `development and innovation Strategy 2014-2020, the Estonian Entrepreneurship Growth Strategy, 2014-2020 and the Estonian Smart Specialisation

[44] *ibid*

[45] European Commission, 2021, *European Innovation Scoreboard 2021*. Accessed via https://ec.europa.eu/docsroom/documents/46013

[46] European Commission, 2017, *Country Report Estonia 2017,* SWD 72 final.

Strategy. A peer-review of the Estonian RTDI system (2019) suggested that a "lack of clarity about relative priorities and aspects of implementation leave limited space for effective coordination at the thematic level." It welcomed the new single strategy – Estonia 2035 (approved by Government in October 2020), which is an opportunity to develop more consistent and systemic coordination of policy and to take a position on how Estonia should tackle 'societal challenges' such as climate change and ageing of the population.

Indeed, Estonia 2035 is a holistic development strategy and not an innovation strategy. The main focus of the strategy is on the health of citizens, preparedness for change, and Estonia's relationship with the living environment. It will act as a basis for planning the European funding for the next period. The focus is also on security and on innovation, and in ensuring that Estonia is "trustworthy, and people-centred".[47]

The "Estonia 2035" strategy is primarily implemented through development plans and programmes in each field. This includes local government units and organisations from the public sector, the voluntary sector, and the private sector. The strategy is to become the base document for planning European funding for the next period, and it is closely linked with the national budgeting processes. The compilation, implementation, and coordination of changes of the strategy is the responsibility of the Government Office in cooperation with the Ministry of Finance.[48]

The policymaking process for innovation is also coordinated in central government, by the Prime Minister's Office, and it aims to ensure that innovation is linked with other relevant strategies, notably the recently approved Estonia 2035.

Figure 6 - Estonia's RTDI governance model summarised

The legal basis for the organisation and functioning of the Estonian research system is the Organisation of Research and Development Act.

The different parts of the Estonian research system have the following functions.

- The government together with the parliament shape the policies; the parliament approves the research, development and innovation strategy and state budget for research; once a year the Prime Minister provides the parliament with an overview on the execution of the strategy.'
- The Research and Development Council, which consists of four ministers and eight members appointed by the government, directs the state's research and innovation policy and advises the government in such matters.
- Different ministries prepare and implement sectoral policies. The Research Policy Committee is an advisory body to the Estonian Ministry of Education and Research. The

[47] Estonian Government, 08.10.2020, *The Government approved the national long-term development strategy "Estonia 2035"*. Accessed via https://www.valitsus.ee/en/news/government-approved-national-long-term-development-strategy-estonia-2035 .

[48] *ibid*

respective advisory body to the Estonian Ministry of Economic Affairs and Communications is the Innovation Policy Committee.

- State foundations, the Estonian Research Council and the Archimedes Foundation, are the principal institutions organising research within the area of responsibility of the Estonian Ministry of Education and Research, and Enterprise Estonia, which operates under the supervision of the Estonian Ministry of Economic Affairs and Communications, is the principal institution funding innovation.
- Research and development work is carried out by public sector research institutions (primarily universities) and private sector research institutions. Most of Estonia's research personnel are employed by universities, where most of the research is conducted.
- The Estonian Academy of Sciences acts under a separate law. It is an independent association of top-level scientists and scholars, with commitment and responsibility to advance scientific research and represent science nationally and internationally.

Source: Estonian Research Council (2019) Estonian Research 2019[49]

MER and MEAC (responsible for innovation and industry) have also created a combined strategy. This is also aligned with the new ESIF priorities. This (new) strategic collaboration between the ministries is a conscious decision to encourage cooperation over competition (for funding and political priorities) and in order to avoid an overlap of activities.

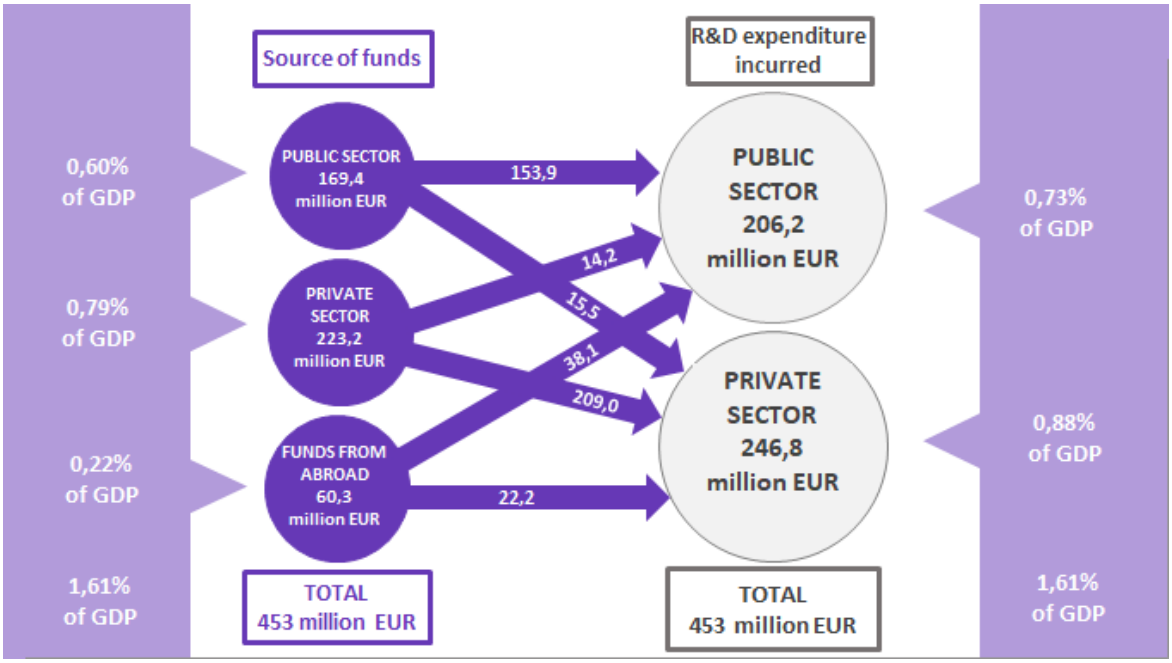
With regards to infrastructure, Estonia has a national Roadmap for key research infrastructure in place. This is managed by the Estonian Research Council. Although the national roadmap is up-to-date and provides an overview of existing research infrastructure, helping to avoid duplication, funding of research infrastructure is not sustainable, as the resources have come from the Structural Funds and may end in 2020.

New research infrastructure is proposed by the universities and other public research organisations through a competitive process. The proposals are peer reviewed using criteria such as 1) potential for world-class research, scientific breakthroughs and potential to introduce new cutting-edge technologies, 2) accessibility to a wide community of public and private researchers, 3) sustainability in the form of a long-term plan for scientific goals, maintenance, finance and utilisation of the research infrastructures, and 4) feasibility of access to and preservation of data and/or materials collected.

The below figure summarises R&D expenditure and the main sources of funding – public and private in Estonia for 2019.

[49] Estonian Research Council, 2019, *Estonian Research 2019*, annual report. Accessed via https://www.etag.ee/wp-content/uploads/2019/04/Estonian_Research_2019_veeb.pdf .

Figure 7 - Flows of funding and expenditure on R&D between sectors in Estonia in 2019 (million EUR)



Source: Statistics Estonia (last updated 02.12.2020). Calculations by Estonian Research Council.

2.2.2.1 Key players

The main actors of the Estonian research system are the **six public universities**. Out of these universities, Tartu University and Tallinn University of Technology dominate in terms of student numbers, research output and public funding received. An important aspect of the Estonian system is its reliance on competitive project-based policy measures, both in funding public universities and private companies.

With regards to **education**, Estonia outperforms most other OECD countries in overall Programme for International Student Assessment (PISA) performance despite relatively low expenditure on education. In PISA 2018, Estonia was among the top performers in all three domains assessed (maths, reading and science). Students' socio-economic status also had the lowest impact on reading performance in the OECD. Estonia has also made significant efforts to strengthen digital skills and inclusive education among teachers, as well as increasing their wages in recent years. Estonia has comprehensive procedures for system-level evaluation, drawing on data from external and internal evaluations at different levels of the system.[50]

With regards to **research**, the universities in Estonia are quite independent and autonomous. HEI funding has also been linked to key performance indicators (KPIs). Currently, public funding and competitive funding for HEIs each constitute a 50-50 share

[50] OECD, 2020, *Education Policy Outlook Estonia*, OECD Education Policy Perspectives. Accessed via https://www.oecd-ilibrary.org/education/education-policy-outlook-in-estonia_9d472195-en .

of HEI budgets, however in previous years competitive funding constituted a much larger share – up to 90%. This (former) extremely competitive situation has helped to shape the research community in Estonia – they are used to competition and in seeking funding, e.g., from European funds, in order to survive. Interviewees consulted for this study, believe that competition for funding has concentrated the Estonian HEIs in terms of research since only excellent research groups survived in this environment. Base funding is linked to KPIs covering, for example, outputs, citations, and PhDs. More recently base funding has also become linked to industry related KPIs.

With regards to university cooperation with industry, business funding of university activities (e.g. contract research) is increasing but is still overall low. This is an area of the RTDI system that Estonia is trying to improve. There are different measures in place, e.g. innovation vouchers, support for businesses to hire researchers/scientists, and digitalisation support. There are also measures in place for R&D institutions to collaborate with businesses. One such initiative aims to help R&D institutions put economic and societal value on their activities, to encourage them to focus support on research where there is a wider societal need.

One key characteristic that policymakers are attempting to tackle is that the Estonian economy is dominated by low-tech SMEs whose need for research and development is limited and therefore only a few of them are cooperating with universities. Private sector R&D is performed mostly in larger companies. Business suffers from chronic skill shortages with all three main economic sectors (industry, construction, services) suffering higher shortages than the EU average.

There are **three main funding agencies**:

1. **Estonian Research Council** is a governmental foundation that was established to concentrate the funding of R&D and guarantee the better functioning of financing systems. The Council supports researchers, awards research grants, and facilitates applied research in the fields of smart specialisation.

The Council represents Estonia at international organisations, coordinates participation in international cooperation programmes and supports international cooperation by means of counselling and funding.

Th Council allocates 51.2m euros per year in research grants, and 1.4m euros of annual support for international research cooperation.

The Council also manages the Estonian Research Information System (ETIS) that contains information on R&D institutions, researchers, research projects and research outputs. [51]

2. **Archimedes foundation** is an independent body established by the Estonian government in 1997 with the objective to coordinate and implement different international and national programmes and projects in the field of training, education, research, technological development and innovation.

[51] Estonian Research Council, 2020, *OUR TARGET GROUPS AND PARTNERS*. Accessed via https://www.etag.ee/en/introduction/#partners

It is the implementing body of Erasmus+ and administer several national and international scholarship schemes for improving mobility, marketing Estonian higher education and research abroad. It is/was also the managing agency for the ESIF 2014-2020 in the field of R&D.

3. **Enterprise Estonia** is also a national foundation. It aims to develop Estonian economy through three principal areas of activity: i) developing Estonian enterprises and boosting export capacity, ii) increasing tourism revenue, iii) bringing high value-added foreign investments to Estonia.

Enterprise Estonia works to address two major market failures, which are limited product development of enterprises and concentrated exports to a few specific markets. Exporting enterprises serve as the main basis of the Estonian economy, as exports account for 80% of the total output thereof.[52]

In addition to these, some innovation funding can be sought from the **Ministry of Defence** (for innovation linked to military application). There is also funding available for environmental/green innovation projects as well as for innovation projects in the agricultural sector. This funding is provided by government agencies.

The **Estonian Development Fund** is a state-run public institution tasked with investing in young and growth-oriented technology companies (together with the private sector). For example, the Fund might invest into SMEs registered in Estonia, which are elaborating or planning innovative and creative products, services, etc, while having a considerable growth and export or internationalisation potential. The Fund also helps to identify and motivate risk capitalists and business angels to co-invest into knowledge-based company start-ups.[53]

The main innovation funding is concentrated to Enterprise Estonia and to some extent the Research Council. Although overall, the portfolios are fairly well structured – there is stability with regards to the types of funding/instruments available – the research agencies are still seeking to improve their support. There is a recent new instrument promoting intersectoral mobility, for example.

With regards to innovation, Enterprise Estonia is working to create a one-shop-stop where any entrepreneur who approaches the agency is either supported by Enterprise Estonia or put in contact with another agency (i.e. nobody is turned away without a response).

Governance, monitoring and evaluation framework

There are a lot of activities in terms of monitoring and evaluation in the RTDI system.

The research funders and ministries support multiple studies. Over the years these studies have become more relevant and effective in supporting the policy process as policymakers have developed more precise needs around the study designs and research questions to be addressed.

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[52] Enterprise Estonia, 2020, *About Us: Enterprise Estonia*. Accessed via https://www.eas.ee/eas/?lang=en .

[53] Research and Innovation Observatory, *Estonian Development Fund*, European Commission Joint Research Centre. Accessed via https://rio.jrc.ec.europa.eu/country-analysis/organisations/estonian-development-fund and Website of the Estonian Development Fund, http://www.arengufond.ee

Enterprise Estonia regularly surveys and monitors entrepreneurs and businesses to understand their needs and behaviour. For example, surveys that ask about why a business is not investing in R&D consistently show the same conclusions, where the top reasons are the following: 1. The company has no previous history of R&D investment and has no habit to innovate. 2. The company lacks the knowhow (lack of R&D personnel). 3. The company is concerned about intellectual property. 4. The company does not know with whom to cooperate. According to these surveys, financial concerns only arise as the number 5 or 6 reason. Hence, the reasons for a lack of R&D activities in many Estonian firms are due to behavioural reasons rather than financial ones.

Many studies on R&I are also impact assessments of current initiatives. Although the monitoring and evaluation system is rather advanced, improvements are still being made in particular to improve the consistency between monitoring and evaluation. For example, one particular challenge is to ensure that the ex-post assessments of programmes are carried out in time to feed into the next round of the policy cycle – the design of the follow up programme.

There is a scientific advisor in each ministry, who together make up a network of advisors. They are aware of what the main current research topics are and, consequently, what questions to address when commissioning studies.

This network of scientific advisors has been an effective forum, which the government is also working to improve further, through, among other things, ensuring that the advisors have access to the ministry budgets and can influence spending priorities.

In 2020, an equivalent network of advisors was set up among private sector associations, building on the lessons learned from the government network. The private sector associations scientific advisors are currently tasked with developing an action plan.

2.2.2.2 Programmes and instruments

Research in Estonia is primarily financed on the basis of quality competition. Financing comes from the state budget, foreign funds (mostly EU H2020 and other means) and companies. The Estonian Research Council is the principal funding body of R&D in Estonia, consolidating different grants and types of funding and giving research more visibility within society. There are also several mobility grants. As most research is performed in the public universities, most research jobs are also available in public universities. PhD students are regarded as students and receive a monthly scholarship.[54]

The Estonian Research Council's portfolio consists of instruments that cover the current strategy. There are concept papers to provide rationale for funding instruments in advance of their roll out. Instruments are not ad hoc but part of a portfolio. Yet, this portfolio is work in progress. One of the most recent additions was an instrument for intersectoral mobility – this was a new kind of programme for Estonia.

It is an ongoing process for identifying gaps. Identification of gaps is done by a number of central actors, including government's (PM's Office) scientific advisors, the ministries' network of scientific advisors and the funding councils.

[54] Euraxess, 2017, *Euraxess Country in Focus: Estonia.* Accessed via https://cdn1.euraxess.org/sites/default/files/domains/north-america/1_estonia.pdf

Evaluations, including impact assessments are also carried out of the programmes run by the Estonian Research Council and by Enterprise Estonia (described above).

With regards to the application process, this is predominantly internationalised. In response to the specific calls for proposals, all applications are submitted in English. For the Estonian Research Council programmes, the peer review is carried out with the support of international reviewers. The emphasis on international reviewers is partly due to the fact that the Estonian RTDI community is small. Since the main organisations and individuals know each other, the conflict of interest is greater.

For projects involving industry, there is a greater reliance on Estonian researchers, the conflict of interest is lesser in these topics.

All applications developed in response to Calls for Proposals are submitted and stored on the Estonian research information system. Successful proposals are then continuously updated in the system, including recording research outputs like publication etc.

The Research Information system is a central tool for monitoring although the system is currently under development in order to improve the statistical analysis possible.[55]

While the Estonian Research Council offers a portfolio of grants, predominantly for the lower TRLs, but also for collaboration with companies, Enterprise Estonia's support covers both grants and services. For example, through the Enterprise development programme, companies can seek support covering:

1. Identifying the enterprise's ambition and readiness for change
2. Preparing the development plan
3. Implementing the development plan

The portfolio of the Enterprise Estonia aims to look at innovation in a broad sense and to cater for a range of types of clients. Some measures are quite simple, for example innovation vouchers aimed at science and engineering projects.

Other measures are more comprehensive. The Entrepreneurship development programme for example provides a 360-degree advisory service. The agency takes on entrepreneurial clients and examine the idea or business 360 degrees, looking for bottlenecks and how to solve challenges. Regardless of the type of company, the agency then takes on to provide support. This can range from knowhow to equipment – the type of support is not limited. The condition is that the business raises its added value with 10% after the treatment. These types of indicators are used for collecting data which then also monitors staff performance at the agency.

Other key initiatives focus on supporting businesses to digitise. This may include providing a diagnostic for individual companies that contact Enterprise Estonia and developing a roadmap for digitalisation for individual clients. Digitisation grants are also available.

[55] Website of the Estonian Research Information System. Accessed via https://www.etis.ee/Portal/News/Index/?IsLandingPage=true&lang=ENG#.

One of the more recent programmes is focused on support for applied sciences among businesses. There are two parts to this programme – consultation advice and finance. The funding may come from Enterprise Estonia or from other sources (e.g., private foundations).

2.2.2.3 Financial instruments

Financial instruments function overall well in Estonia.[56] Currently, the following financial instruments are being implemented in Estonia through the help of European programmes and the European Investment Fund:

Table 4 - Financial Instruments in Estonia

Fund	Description
EstFund	A 60-million-euro Fund-of-Funds initiative was launched by EIF in March 2016 in close co-operation with KredEx and the Estonian Ministry of Economic Affairs and Communications to stimulate equity investments into innovative and high growth-focussed enterprises in Estonia.
Business Angels Co-Investment Fund	
Krediidikindlustus	
Laenud, käendused	
Kala töötlemisega alustavate või tegelevate ettevõtete pikaajaline investeerimislaen	Enhancing the competitiveness of small and medium-sized enterprises (SMEs) linked to EMFF, implemented by the Estonian Rural Development Foundation.
Kala töötlemisega alustavate või tegelevate mikro- ja väikeettevõtete kasvulaen	
MAK 2014-2020 rahastamisvahend	Rural development (limited information in English)
Vesiviljelustoodete tootmisega alustavate või tegelevate ettevõtete investeerimislaen	

Source: https://www.fi-compass.eu/

Financial instruments are also available through the European Investment Bank. The EIB has been active in Estonia since 1993. In 2020, EIB Group financing for Estonian projects equalled 2.48% of Estonian GDP, the highest percentage of all EU countries.[57]

2.2.2.4 Partnerships

Organisations aimed at supporting networks and linkages between RTDI actors are, according to a recent peer-review of the Estonian system, rather poorly developed. Most

[56] Branten and Purju, 2013, *Innovative Financial Instruments in EU Funding Schemes*, Baltic Journal of European Studies, Tallinn University of Technology, Vol. 3, No. 1 (13) - 10.24.

[57] European Investment Bank, 2020, *EIB Group activity in Estonia in 2020*. Accessed via https://www.eib.org/attachments/country/factsheet_estonia_2020_en.pdf .

were created in late 2000s and early 2010s with the help of European structural funds via cluster, competence centre and similar programmes. Estonia has 22 technology clusters, 6 competence centres, 3 Science and Technology Parks. The Estonian Intellectual Property and Technology Transfer Centre (EIPTTC) also offers a wide variety of intellectual property and technology transfer support services, training and education.

Enterprise Estonia is the funding body responsible for Clusters in Estonia. To date, some clusters have achieved long-term success, although they have been more prone to network rather than carry out research.

There have been around 10 Competence Centres in Estonia, although only six remain in operation. According to stakeholder interviews, some of these have become rather successful, while others are likely not sustainable in terms of becoming self-sufficient. Overall, Competence Centres have struggled to find their role in the RTDI system in Estonia (with some exceptions). They tend to compete with Higher Education Institutions (HEIs) and with industry, which is counterproductive. At the time of writing, it is estimated that there are around six centres left in operation. These are now registered R&D institutions, which means they are part funded by the government and eligible to apply for Calls for Proposals from the research funders.

2.2.3 Identified advanced practices

The following advanced practices have been identified in the Estonian case that can be classified as: 'developing', 'promising', 'good' or 'best' practices are presented below (see definition in Section 1.3)

Advanced Practice 1 (best). Consistent and long-term political commitment to R&I. In the last 20 years, research and innovation has been a priority among political stakeholders in Estonia which has allowed for innovative policies to be implemented. Since regaining independence in the 1990s, Estonia has been proactive in promoting innovation as part of a political grand strategy. This political commitment is a long-term advanced practice example which on the one hand is difficult to replicate but on the other hand is a fundamental building block to have in place in any innovation ecosystem.

Advanced Practice 2 (best/good). Estonia can demonstrate an extensive and evolving involvement of scientific experts in government. There is a scientific advisor in each ministry, who together make up a network of advisors. This advanced practice could be a useful practice in Slovenia in its own right and also support the need to improve the political commitment to R&I more generally (by developing a closer relationship between scientific experts and policymakers).

Advanced Practice 3 (promising). Long-term holistic strategy. Until recently there were three R&I-related strategies in Estonia. A new single strategy – Estonia 2035 (approved by Government in October 2020), is an opportunity to develop more consistent and systemic coordination of policy and to take a position on how Estonia should tackle 'societal challenges' such as climate change and ageing of the population. This advanced practice is not yet evidenced to be 'good' or 'best' practice but could be an interesting example of stakeholder involvement in R&I decision making since the Estonia 2035 strategy saw consultations with over 17,000 stakeholders.

Advanced Practice 4 (best). Extensive evaluation and monitoring culture. There are a lot of activities in terms of monitoring and evaluation in the RTDI system. The research funders and ministries support multiple studies. Over the years these studies have become more relevant and effective in supporting the policy process as policymakers have developed more precise needs around the study designs and research questions to be addressed. This advanced practice example could be replicated in Slovenia and should be additionally valuable since it should support R&I policymakers in Slovenia to improve current design and implementation issues.

Advanced Practice 5 (good). Consolidation of research performing organisations. With regards to research, the universities in Estonia are quite independent and autonomous. HEI funding has also been linked to key performance indicators (KPIs). Currently, public funding and competitive funding for HEIs each constitute a 50-50 share of HEI budgets, however in previous years competitive funding constituted a much larger share – up to 90%. This (former) extremely competitive situation has helped to shape the research community in Estonia – they are used to competition and in seeking funding, e.g. from European funds, in order to survive. Interviewees consulted for this study, believe that competition for funding has concentrated the Estonian HEIs in terms of research since only excellent research groups survived in this environment.

2.3 Flanders (BE)

2.3.1 Selection rationale

The **region of Flanders** has started to elaborate a broad-based strategy for RTDI policy around the mid-1990s. It has since then been developed through a series of initiatives, treaties, parliament acts, decrees, agreements, decisions, Memoranda of Understanding (MoUs) and statements to implement and evaluate policy in the broad field of science, research and innovation. This is underpinned by a substantial public budget for research and innovation. The Flemish Government has confirmed in its 2019-24 governing agreement (as already stated in the 2014-2019) a growth path for the 3% target of R&D intensity, including 1% by public R&D.

The region shows strong commitment both politically and financially into RTDI programs, but also shows the important factor of stability and continuation (see the 2050 vision[58]). Three key point stands out:

- Flanders has established **key institutions** such as Strategic Research Centres and spearhead clusters, or VLAIO, the innovation agency;
- Flanders is **well connected**, for example with Vanguard or TAFTIE to which SPIRIT is also a member. TAFTIE is a great opportunity to learn, get feedback and implement good practices from others;
- Policy is based on **middle to long-term** plan with 5 years' plans and the 2050 vision.

[58] Flemish Government, 2018, *Vision 2050: A long term strategy*. Accessed via https://www.vlaanderen.be/vlaamse-regering/visie-2050

2.3.2 The innovation system

Flanders is an autonomous region located in the northern part of Belgium. The policy RTDI is under the responsibility of EWI, the department of economy, science and innovation. The region of Flanders is responsible for most of the RTDI policies in terms of legislation and budget. In 2017, Flanders spent 7.499 billion euros, or 2.89% of GDP, on R&D [59].

The **federal authority of Belgium** remains responsible for a limited number of research programmes such as in the field of climate and sustainable development, the support of research infrastructures of national interest, several federal scientific institutes, and a small number of exclusively attributed research themes, including the Belgian space policy, 'sustainable' nuclear energy and polar research at the Antarctic station.

To illustrate the process, the 2014-2019 RTDI policy has been developed through several agreements:

- the **government agreement** in which the various political parties that are part of the governing coalition outline their priorities for the five-yearly parliamentary term;
- the **policy paper of the minister** charged with scientific research and innovation priorities for the five-year governing period;
- the **annual policy letter of the minister**, which further elaborates and specifies the initiatives for the general policy framework that is announced in the policy note. The letters state the on-going situation and the implementation of policy for the parliamentary year concerned. For the parliamentary year 2017-2018, the strategic and operational objectives can be found in Table 5.

Table 5 - 2017-2018 Strategic and Operational Objectives of Flanders

Invest in agile employees and companies (1)
Invest in competencies (1.2)
Focus on a grounded education and professional choice - STEM (1.2.1)
Invest in the framework conditions for innovation-driven entrepreneurship (1.3.)
Invest in knowledge building and innovation (1.3.1.)
Elaboration of a programme-wise approach for smart specializations and cluster pacts (1.3.2.)
Evaluations and research (1.3.4.)
Invest into an excellent knowledge base (2)
Strive towards a qualitative elaboration of the 3% target (2.1.)
Research at universities (2.1.1.)
The Strategic Research Centres (2.1.2.)
Invest in state-of-the-art research infrastructure (2.2.)
Flanders develops a policy for open data and open access (2.3.)
Invest in a simplified and tailored delivery of services (3)
An integrated contact point for the entrepreneur (3.1.)
Flanders Innovation and Entrepreneurship (3.1.1.)
Digital desk (3.1.2.)
Invest in European, international and interregional networks (6)
European representation (6.3.)
Activate the innovation potential at SMEs and within large companies (9.)
Innovative public procurement (10)

[59] Flemish Government, 2019, *Policy memorandum 2019-2024. Economy, science policy and innovation.* Accessed via https://www.vlaanderen.be/publicaties/beleidsnota-2019-2024-economie-wetenschapsbeleid-en-innovatie .

Source: STI in Flanders 2017 - Science, Technology & Innovation - Flanders - Policy & Key Figures

Moreover, several multi-annual strategic plans and targets are agreed with a broad-ranging group of stakeholders from government, civil society and industry. These plans set out targets across a range of policy fields, amongst which RTDI is assigned a clear priority. The major plans include the Flemish and the Belgian **National Reform Programme for the EU2020 strategy** (in the framework of the European Semester), and the Transversal Policy Note: **Flanders 2050** (Vision 2050: a long-term strategy for Flanders).

In terms of stability of political priorities, RTDI policy has always been a priority. Since 1980 Flanders is a Belgian region and innovation and valorisation of research by the business sector has always been important. This can be seen in the high commitment for the budget and 5 years plans. For example, the 2014-2019 coalition agreement of the Flemish Government announced a number of priorities, underpinned by a higher focus on **business-oriented innovation and valorisation**, strong knowledge organizations with excellent research and a growth path for the 3% target for R&D, whereby public outlays strive towards 1% by 2020.

Smart specialisation has also featured since 2005 and several governmental actions gradually influenced the current specialisation of the region. This includes the 2014-2019 new governing agreement, which called for a cluster policy. The Flemish Government also approved a Concept Note on a Cluster policy in 2015 and along with a cluster strategy. This strategy elaborated 2 types of clusters: (large-scaled) spearhead clusters on the one hand, and (smaller- scaled) innovative enterprise networks on the other hand.

Today, the landscape is characterised in Flanders by the **strategic research centres** and the **cluster policy** and a combination of bottom-up programmes complemented with 10 focal points (4 strategic research centres and 6 spearhead clusters) in which triple helix collaborations are stimulated. For each of the focal points, the government of Flanders has taken the decision to grant support to a strategic research centre or a spearhead clusters thereby marking the area a priority for Flanders. This choice equals a specialisation strategy with 10 priority domains. The spearhead clusters or strategic research centres are a point of reference to mark a larger domain in which other organisations can also be active. The recent 2019-24 Flanders' smart specialisation strategy[60] pursue 10 priority investment domains:

1. Sustainable chemistry (Catalisti)
2. Advanced materials (SIM)
3. Smart manufacturing (Flanders Make)
4. Health and life sciences (vib)
5. Specialised logistics (VIL)
6. Agro-Food (Flanders Food)
7. Electronic systems, Iot and photonic systems (imec)

[60] Flemish Government, 2019, Policy memorandum 2019-2024. Economy, science policy and innovation. Accessed via https://www.vlaanderen.be/publicaties/beleidsnota-2019-2024-economie-wetenschapsbeleid-en-innovatie .

8. Energy (Flux 50)
9. Environment & cleantech (Vito)
10. Blue economy (Blue Cluster)

The strategy also aims to achieve the 3% target for R&D by 2024 and increases cooperation to achieve higher impact. The above set of acts show strong commitment both political and financial into STI, but also stability and continuation.

2.3.2.1 Key players

Flanders has established **key institutions** such as RTOs or spearhead clusters, some of these, such as KU Leuven, University of Gent, IMEC or VITO, have established subsidiary activities abroad (in the USA and Asia), often involving local counterparts. The role and tasks of the major actors in the RTDI landscape of Flanders is defined in the "Decreet betreffende de organisatie en financiering van het wetenschaps- en innovatiebeleid" (Flemish Parliament Act on the organisation and support of the scientific and innovation policy), which was approved on 30 April 2009 by the Flemish Parliament (and modified thereafter). The key institutions are composed of:

- **Universities**: Flanders' university sector is shaped by 5 university associations: **KU Leuven** (Katholieke Universiteit Leuven), **UGhent** (University of Ghent), **VUB** (Vrije Universiteit Brussel), **UHASSELT** (University of Hasselt), and **Universiteit Antwerpen** (University of Antwerp). They are all consistently featuring in the top 100 of the most-innovative universities (Reuters).
- **Main RTOs**: Flanders has established four Strategic Research Centers (SRC): **IMEC** (1984) in nanoelectronics and digital technologies boosting 4.000 researchers and 12.000 m2 of cleanrooms, **VITO** (1991) in the field of energy, sustainable chemistry, materials, health technology and land use boosting 900 researchers, **VIB** (1995) on life science and biotechnologies boosting 1.700 scientists, and **Flanders Make** (2014) in the field of industry 4.0 with 600 researchers (more information in Figure 8 below).

Figure 8 - Outline main RTOs in Flanders

- **Other RTOs**: a number of other knowledge institutes in specific domains such as **VLIZ** in Marine science, **ITM** in tropical health, **ILVO** in agricultural research, and various other collective research institutes are active in specific fields.
- **Clusters:** the Flemish cluster policy is based on a limited number of large-scale and ambitious clusters with a long-term strategy (called Spearhead clusters) connecting private companies, public organisations, and academic institutes.
- About 16 other **innovative business networks**.
- **Private sector**: shows high innovative capacity according to several indicators (see the innovation performance section).
- **VARIO**[61], the **Flemish Advisory Council for Innovation and Enterprise**. VARIO advises both the Flemish Government and the Flemish Parliament on its science, technology, innovation, industry and entrepreneurship policy. The council does this on its own initiative as well as on request. VARIO works independently from the Flemish Government and the Flemish stakeholders as VARIO council members take part in their personal capacity. For example, during 2012-13, VARIO has defined 7 key priority transition areas, and 9 themes that cover society's needs on economic, ecological and sociocultural levels to be achieved by 2050. For example, by 2020: rank among the top 5 knowledge regions in Europe, and reach R&D expenditure of 3% of GDP. The seven transitional areas for 2025 are: Society (socioeconomic engine), Digital society, Food, Health and well-being, New energy demand and delivery, Urban planning, mobility dynamics and logistics, and Smart resource management.

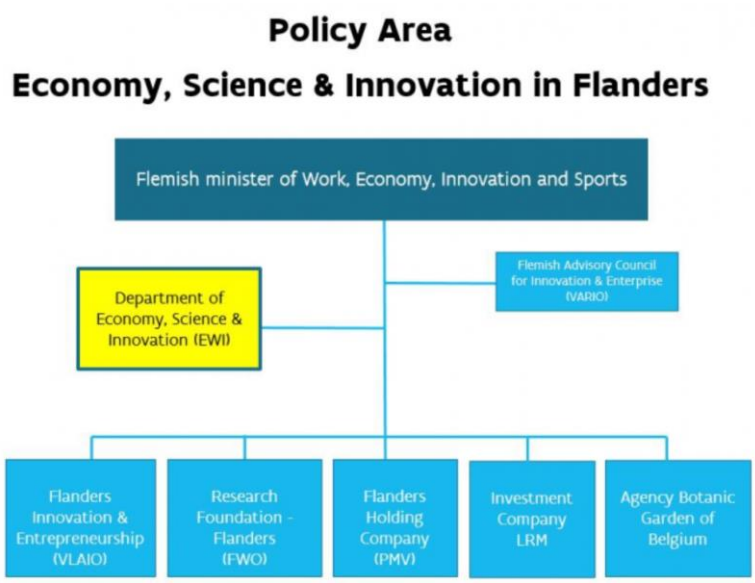
- **VLAIO**[62] is the **innovation agency**. Flanders Innovation & Entrepreneurship is the contact point for entrepreneurs in Flanders. The agency encourages and supports innovation and entrepreneurship and contribute to a favourable business climate. The

[61] Flemish Advisory Council for Innovation and Enterprise, *About Us*. Accessed via https://www.vario.be/en/about-us.
[62] See website of the Flemish Agency for Innovation and Entrepreneurship. Accessed via https://www.vlaio.be/ .

agency is a one-stop-shop providing 4 services: funding for research and innovation through EU networks (fund the Flemish part or integrate in EU networks such as EUROSTAR, Eureka clusters, JTIs, Art 185 or ERA-NET initiatives), information services (Enterprise Europe Network - EEN[63], and National Contact Point for H2020), network with other EU agencies (TAFTIE[64], best practices), and allocate Structural funds (ERDF, Interreg). EEN can help SMEs with partner search for commercial collaboration, or strategic partners for innovation, different aspects of European regulations, and access to European funding for your project. In one word, VLAIO centralise all needs for SMEs. Vlaams Innovatienetwerk (VIN, Flemish Innovation Network), coordinated by VLAIO, is a network of intermediary organizations and knowledge centres that are active in the field of innovation support.

- **FIT**[65] (Flanders Investment and trade) is the government agency tasked with attracting foreign investments and support Flemish companies to export;
- **FWO**[66] is the Research Council providing basic research support;
- **PMV**[67] (Flanders Holding Company), provides funding for companies, from the day they first open their doors, through their various growth stages and even on to operating internationally. Three main pillars: risk capital, loans and mezzanine finance.
- **LRM**[68] is an investment company that stimulates economic growth in Limburg.

Figure 9 - Key policy actors in Flanders



Source: https://www.ewi-vlaanderen.be/en/our-department/policy-area-science-economy-and-innovation

[63] See website of the Flemish enterprise Europe Network. Accessed via https://www.enterpriseeuropevlaanderen.be
[64] See Website of TAFTIE, the European Network of Innovation Agencies. Accessed via https://taftie.eu/ .
[65] Website of Flanders Investment, *Why invest in Flanders?* Accessed via https://www.flandersinvestmentandtrade.com/invest/en .
[66] Website of the Flanders Research Organisation. Accessed via https://www.fwo.be/en/ .
[67] Website of Participation Company Flanders. Accessed via https://www.pmv.eu/en
[68] Website of Limburg Reconversion Company. Accessed via https://www.lrm.be/en/about-lrm .

In addition, several science parks, research parks and incubators offer facilities for research-based young companies and innovative enterprises. Often, these are spin-off companies from a university or an RTO and are located close to the knowledge centre in question. In some cases, an incubator is specifically oriented towards a particular scientific area.

TTO Flanders[69] is a joint initiative by the five Flemish universities that offers a unique portal to the knowledge and technology available within the different Flemish universities and university colleges. This is one of the initiatives undertaken under the umbrella of the Flemish Interuniversity Council (VLIR) who is an autonomous consultation body established in 1976 and financed by the universities[70]. The VLIR working groups focus on the valorisation of research.

The **governance, monitoring and evaluation** is under the responsibility of Department of Economy, Science and Innovation (EWI). The policy initiatives, evolution, whereabouts, available budgets and statistics that describe the Flanders' research and innovation landscape are being monitored and reported on in a structural manner mostly by the EWI Department[71]. However, various EWI agencies also provide information and data about their own specific initiatives and budgets, or conduct studies, as does the advisory body VARIO (studies, advice, benchmarks) or the Centre for R&D Monitoring (ECOOM) (see Figure 9 above).

2.2.3.1 Programmes and instruments

Both public and private funding for R&D have been substantially increased in recent years. There are three main types of support available:

- **Public Financing and investment**. According to the Centre for R&D Monitoring[72] (ECOOM), Belgium – of which Flanders is the northern region – spent 2.89% of its GDP on R&D in 2019[73]. This is significantly higher than the European average of 2.0% and put Flanders as number 5 in Europe for R&D intensity.
- **Private investment:** The main contributors in the research and innovation landscape are businesses and industries. Companies in Flanders (and Belgium) are among the most innovative in the EU. In 2018, 67.8% of all industrial companies and service businesses conduct a form of innovation, according to the bi-annual Community Innovation Survey[74] (CIS). In only Estonia and Cyprus, do companies innovate more than in Flanders (EU-27: 50.3%).
- **Tax incentives**: framework conditions such as Intellectual Property Rights (IPR), normalisation, standardisation, tax credits and scientific visas for researchers are

[69] https://ttoflanders.be/en/

[70] https://vlir.be/over-ons/

[71] Flemish Government, 2017, *Science, Technology and Innovation system in Flanders*. Accessed via https://www.ewi-vlaanderen.be/sites/default/files/bestanden/sti_in_flanders_2017_chapter_1.pdf . and Flemish Government, 2018*, Vision 2050*, strategy. Accessed via https://publicaties.vlaanderen.be/view-file/28831

[72] Flemish Centre for Research & Development Monitoring, *Services from the Government: 3% note.* Accessed via https://www.ecoom.be/en/services/3note .

[73] Eurostat, 10 March 2021, *Research and development expenditure, by sectors of performance,* data browser. Accessed via https://ec.europa.eu/eurostat/databrowser/view/tsc00001/default/table?lang=en .

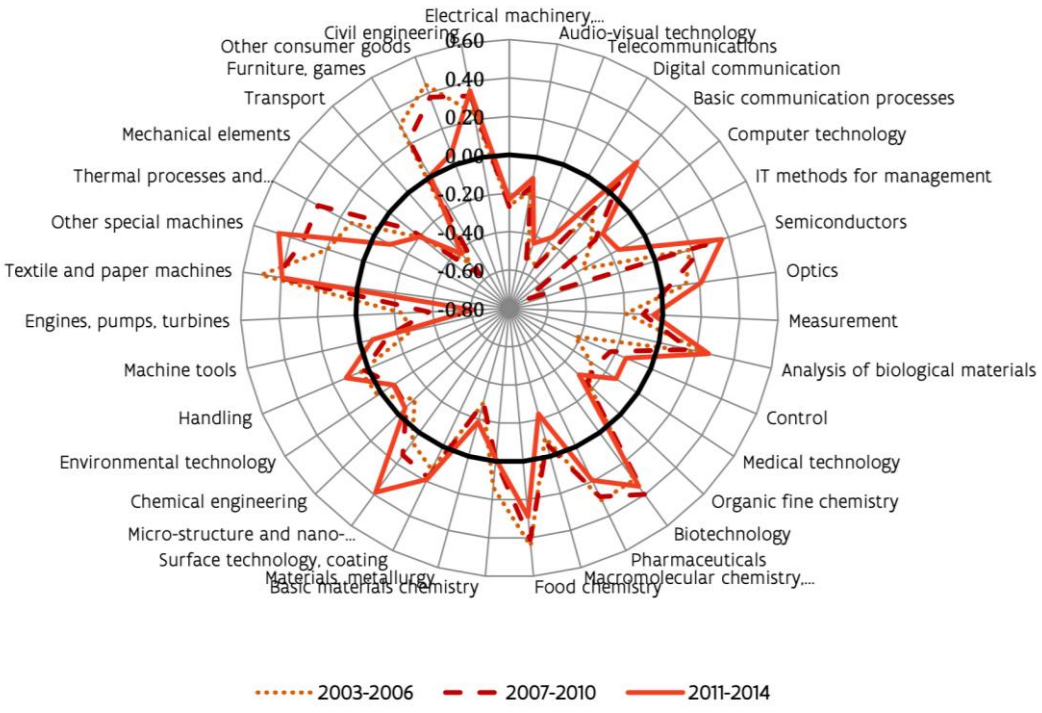
[74] Eurostat, 15 January 2021, *Community Innovation Survey: latest results*. Accessed via https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20210115-2 .

exclusively managed by the federal authority. Tax credits aimed at R&D have become very substantial in Belgium in recent years (EUR 1.3 billion annually since 2015). Tax incentives on R&D investments can be recovered from: up to 85% of the company's net innovation, up to 13.5% of the investment value (at once) or 20.5% on the annual depreciations (staggered), or up to 80% of payroll withholding tax paid on professional income for researchers and academic personnel.

The region monitors a series of indicators through the annual publications of ECOOM such as:

- The **relative specialisation index** which maps the specialisation structure of the science, innovation and economy system. This index compares the distribution of activities from a region with the average distribution of the same type of activities in the whole of Europe. The statistics on respectively the scientific publications, patents, and exports are used as proxies for these kinds of activities. A more than average share of these suggests a specialisation in that specific domain. The **technological specialisation of Flanders** based on the European Patent Office (EPO) patents is displayed hereunder. Patents are grouped in 35 technology domains (see Figure 10) and a specialisation- index RTAN that can vary between -1 (under specialisation) and +1 (maximal specialisation). Flanders has built up a relatively strong technological position in certain chemical domains (e.g. food chemistry, macromolecular chemistry), semiconductors, civil engineering (roads and water engineering), pharmaceutical applications, biotechnology, analysis of biological materials, microstructures and nanotechnology, basic communication processes, semiconductors, optical applications, textiles and paper machinery and other specialised machinery.

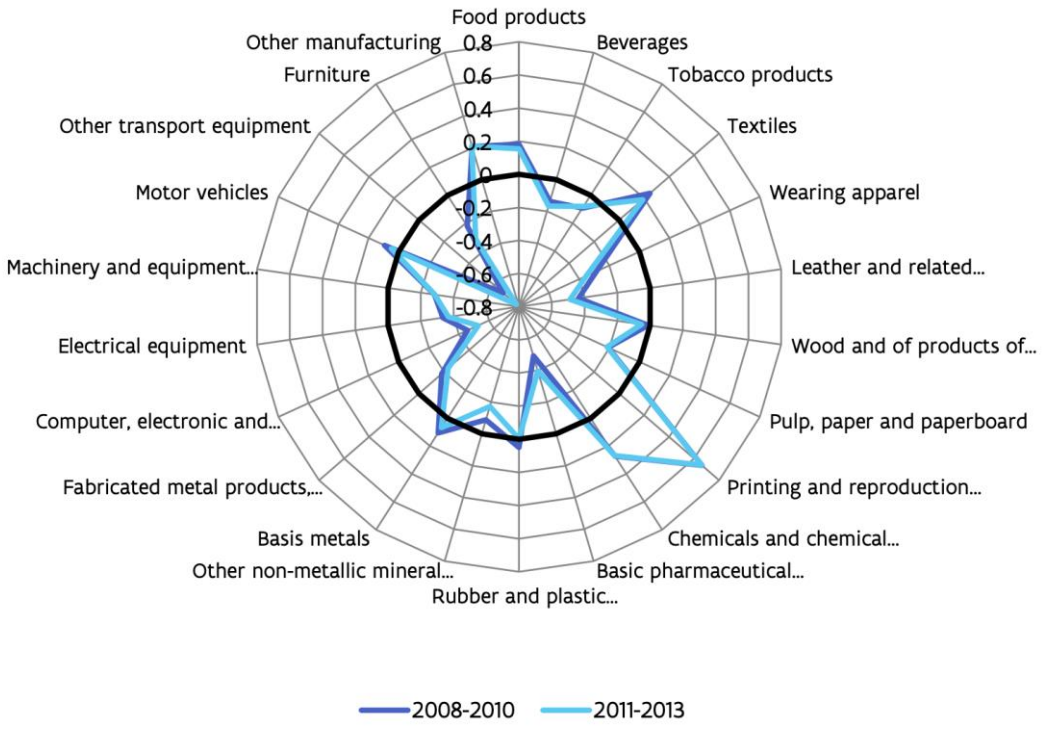
Figure 10 - technological specialisation of Flanders



Source: ECOOM, STI report, 2017

- The **economic specialisation pattern,** Figure 11**,** (based on the relative export shares) of Flanders reflects the maturity of the economy. The Flemish economy has maintained a critical mass to remain competitive in most sectors, while some do not appear as a specialisation due to the given conditions (e.g. mining).

Figure 10 - Economic specialisation pattern of Flanders



Source: ECOOM, STI report 2017

VLAIO, the one-stop-shop for SMEs and innovation agencies, provides a mix of grant, loans and financing, as well as information, guidance and advice.[75]

The **innovation performance** of the region, resulting from the programmes and instrument mix, can be seen through various indicators, outlined below:

In 2020, Belgian companies, universities and research institutions submitted **2,400 patent applications**[76] to the European Patent Office (EPO). That is almost as many as in 2019 when

[75] See website of Flemish Agency for Innovation and Entrepreneurship (VLAIO), accessed via Shttps://www.vlaio.be/nl/subsidies-financiering .

[76] Flemish Government, 16 March 2021, *European patent applications: Flanders 11th European region*, News. Accessed via https://www.ewi-vlaanderen.be/nieuws/europese-octrooiaanvragen-vlaanderen-11de-europese-regio

2,422 patent applications were submitted. in 2020, 1,580 patent applications were filed from Flanders (Vlaanderen, table below) with the European Patent Office (EPO).

Source: European Patent Office 2021

Figure 11 - Ranking of patents filed by EU regions

	Region	Country	2020	Change
1	Bayern	DE	7 204	-7.6%
2	Île-de-France	FR	6 507	-0.1%
3	Baden Württemberg	DE	5 421	+0.9%
4	Nordrhein-Westfalen	DE	5 047	-4.5%
5	North Brabant	NL	3 281	-12.6%
6	Stockholm	SE	2 382	-0.3%
7	Greater London	GB	1 973	-3.3%
8	Niedersachsen	DE	1 969	+9.9%
9	Hessen	DE	1 851	-9.2%
10	Rheinland-Pfalz	DE	1 820	+4.2%
11	Vlaanderen	BE	1 580	+1.7%
12	Lombardia	IT	1 538	+3.0%
13	Auvergne-Rhône-Alpes	FR	1 463	+10.2%

This puts Flanders at number **eleven** in the top twenty of European regions for patent applications at the EPO. Solvay was again the most active applicant with 214 patent applications, followed by IMEC (158), Umicore (96), Agfa (81), the Catholic University of Leuven (81) and Ghent University (62). The Belgian top ten includes two universities and three research institutions - which is more than in most other countries.

The **Regional Innovation Scoreboard** (RIS) was developed by the European Commission (EC) to analyse 240 European regions. Flanders is **ranked 27th** in 2021[77]. The Flemish Region is a 'innovation leader', and innovation performance has increased since 2014. The comparison with the innovation leaders indicates that Flanders scores very well for cooperation with innovative SMEs, as well as for innovations in products, processes or the organisation. Flanders scores weakly for lifelong learning and design applications and is also less strong for innovation spending at SMEs and employment in knowledge-intensive sectors.

Flanders **ranks 3rd** in the **ZEW Innovation indicator**[78] demonstrating excellent innovation foundations notably by connecting public, private and academic players.

Stimulating **high-growth innovative firms**[79] is an important policy issue as most jobs are created by a limited number of high-growth firms. The region is aiming at increasing their number. Some good indicators overall for Belgium are, for example: 3rd in Europe for the

[77] European Commission, 2021, *Regional Innovation Scoreboard 2021.* Accessed via https://ec.europa.eu/growth/industry/policy/innovation/regional_en .

[78] Innovations Indicator, 2020, *Innovations Indicator 2020.* Accessed via http://www.innovationsindikator.de/2020/

[79] VARIO, 2018, *Advice 4: High-growth innovative firms with impact.* Accessed via https://www.vario.be/nl/publicaties/advies-4-innovatieve-hoge-groeibedrijven-met-impact .

proportion of enterprises with innovation activities (2018 Eurostat Community Survey, see above), 2nd to Austria within the EU for innovation linkages, and 5th best research system in the EU[80] (European Innovation Scoreboard). Belgium is also the 14th most innovative economy around the globe[81].

2.2.3.2 Financial instruments

The most important **providers of private equity and venture capital on the private side** are Ban Vlaanderen, the Business Angels Network in Flanders, and GIMV (Flanders Investment Company). GIMV focus on 4 sectors: Connected consumers, Heath & Care, Smart Industry, and Sustainable cities. GIMV is a European investment company, listed on Euronext Brussels. It manages a portfolio of around 55 companies with a combined turnover of EUR 2.5 billion and 14,000 employees. GIMV plays an important role in the financial anchoring of Flemish growth companies with nearly 40 years of experience in private equity.

The main public financial intermediary is PMV (Flanders Holding Company). PMV provides risk capital, loans, guarantees and mezzanine finance, and manages other funds such as:

- Biotech Fonds Vlaanderen[82] (BFV) established in 1994 as Flanders' public fund aimed to further stimulate the biotechnology sector in Flanders.
- Gigarant - providing market-based guarantees from one and a half million euros.
- GIMV is owned partly by PMV (27% of the shares).
- The Flemish Environmental Holding (VMH) was a public investment company for the environmental sector that are regarded by the Flemish government as strategic. VMH also provided venture capital to companies that are in an early-stage development to accelerate the transition to the circular economy. VMH also holds a 100% participation in Aquafin, the Flemish water treatment company.

The PMV position in 2020 concerning entrepreneurs and start-ups can be found in Figure 12 below.

[80] European Commission, 2020, *European innovation scoreboard 2020 - main report*. Accessed via https://ec.europa.eu/docsroom/documents/42981

[81] Xavier Biseul, 25 January 2018, *Innovation: Frances overtakes the USA (Seriously!),* Silicon France. Accessed via https://www.silicon.fr/innovation-france-usa-197413.html .

[82] Frank De Leenheer, 1 June 2020, *BIOTECH FONDS VLAANDEREN IS NOW MANAGED BY PMV*, PMV News. Accessed via https://www.pmv.eu/nl/nieuws/biotech-fonds-vlaanderen-voortaan-beheerd-door-pmv .

Figure 12 - PMV position in 2020

	PMV	PMV	TOTAL
Number of companies in portfolio	149	1 312	1 461
Number of projects in portfolio	70	-	70
Number of funds in portfolio	52	-	52
Invested capital in companies (in millions of euros)	395.9	196.5	592.4
Invested capital in projects (in million euros)	314.6	-	314.6
Invested capital in funds (in millions of euros)	205.1	-	205.1
TOTAL invested capital (in million euros)	**915.7**	**196.5**	**1 112.2**

Source: https://www.pmv.eu/nl/rapportering

VLAIO also published a report in 2020 on all Flemish financial intermediaries both private and public accepting to provide their data[83].

3.1.1.1 Partnerships

A major approach for international collaboration is the integration of the Flemish funding programmes into different international networks such as Eureka clusters, JTIs, Art 185 and ERA-NET initiatives. In addition, Interreg funding supports the integration and sharing of networks and infrastructures across EU regions as well as an accelerated diffusion of knowledge and models between different EU initiatives.

[83] Flemish Agency for Innovation and Entrepreneurship, *Venture Capital: What is Venture Capital?,* information and advice. Accessed via https://www.vlaio.be/nl/begeleiding-advies/financiering/mogelijke-financieringsbronnen/risicokapitaal-venture-capital .

Table 6 - H2020 opportunities mapped against Flanders smart specialisation domains

Flanders Domains	H2020 Societal challenges	H2020 Industrial leadership
Sustainable chemistry	Climate	
Advanced materials		NMBP
Smart manufacturing		NMBP
Health and life sciences	Health	NMBP
Specialised logistics	Transport	
Agro-Food	Agro-Food	
Electronic systems, Iot and photonic systems		ICT
Energy	Energy	
Environment & cleantech	Climate	
Blue Economy		

Source: strategische nota S3 25.05.18 OK SEP 05.04.19 v2 clean

Participation in H2020 programme is important for international collaboration, in particular for the Flemish priorities within the societal challenges and industrial leadership priorities of H2020. H2020/ Horizon Europe offers an opportunity for international collaboration for which they can rely on support from the Flemish government through the NCP team. The table above shows a mapping of opportunities conducted for H2020:[84]

Flanders has also contributed to the concept of smart specialisation and has also been among the initiators of the vanguard Initiative 'New Growth through Smart Specialisation' in November 2013, that has grown to include 30 regions from 13 EU member states. Flanders is also a lead partner in 3D-printing and bio-economy and participates in de- and re-manufacturing for circular economy, high tech farming and marine renewable energy in the EC thematic platforms on industrial modernisation, energy and agri-food.

2.3.3 Identified advanced practices

Four advanced practices identified in the Flemish case that can be classified as: 'developing', 'promising', 'good' or 'best' practices are presented below (see definition in Section 1.3)

Advanced Practice 1 (best). Strong long-term commitment both political and financial into STI programs. A broad-based strategy for STI policy has been defined around the mid-1990s. It has since then been developed through a series of initiatives, treaties, parliament acts, decrees, agreements, decisions, MoU's and statements to implement and evaluate policy. This is underpinned by renewed 2019-24 political agreement (following the 2014-2019 agreement), and a substantial public budget for research and innovation (close to 3% today for R&D intensity). The 2050 vision also shows stability and continuation. Possibly transferable to Slovenia.

Advanced Practice 2 (good). Key intermediary institutions. Flanders has established key institutions such as Strategic Research Centres and spearhead clusters, or VLAIO, the innovation agency. Together, they allow the innovation system to translate policy objectives into reality in the 10 areas of specialisation defined by the government. Transferable to Slovenia in the middle term.

[84] NMBP stands for Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing

Advanced Practice 3 (good). International networks. Flanders is well connected, for example with Vanguard or TAFTIE to which SPIRIT is also a member. TAFTIE is a great opportunity to learn, get feedback and implement good practices from other countries. Flanders has also been among the initiators of the vanguard Initiative 'New Growth through Smart Specialisation' in 2013. Flanders is also a lead partner in 3D-printing and bio-economy and participates in de- and re-manufacturing for circular economy, high tech farming and marine renewable energy in the EC thematic platforms on industrial modernisation, energy and agri-food. VLAIO has mapped international opportunities (see Table 6 above). Highly transferable to Slovenia.

Advanced Practice 4 (best). Independent monitoring. VARIO, the Flemish Advisory Council for Innovation and Enterprise, advises both the Flemish Government and the Flemish Parliament on its science, technology, innovation, industry and entrepreneurship policy. The council does this on its own initiative as well as on request. VARIO works independently from the Flemish Government and the Flemish stakeholders. Highly transferable to Slovenia.

Advanced Practice 5 (good). Smart specialisation. Flanders has adopted early the concept of smart specialisation and monitors a series of indicators through the annual publications to follow their implementation. Highly transferable to Slovenia.

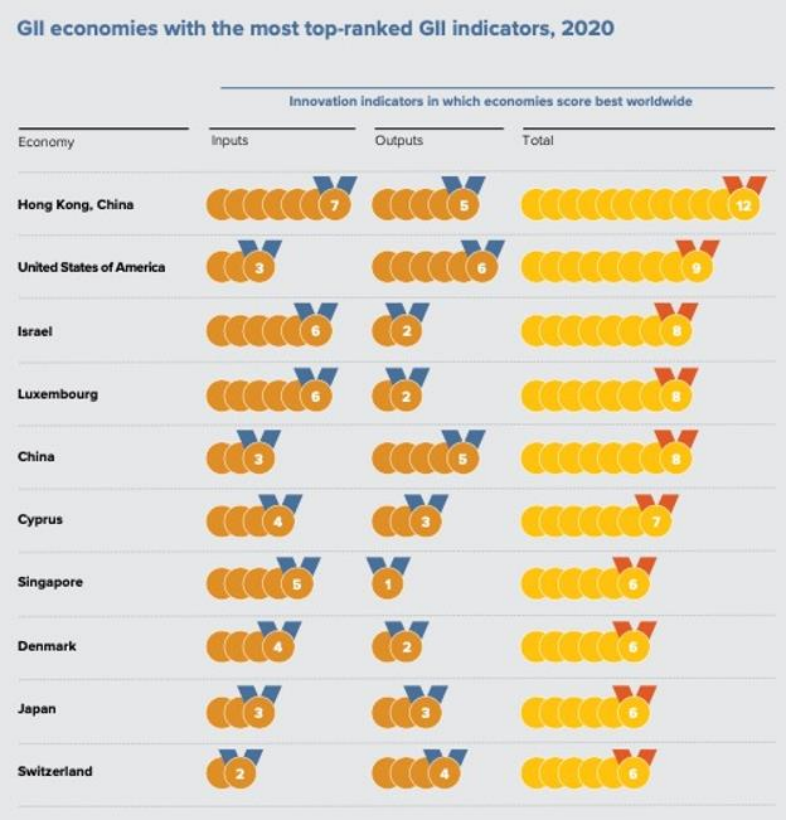
2.4 Israel

2.4.1 Selection rationale

Israel has rightfully earned the name of "**Start UP Nation**"[85] following the success of many Israeli Start-up companies. Israel is well-known for the quality of its human capital, entrepreneurial culture and bold innovation spirit along with government commitment to support breakthrough R&D activities. Israel is also ranked among the most innovative country in the world, often in the top 25, thanks to high share of R&D expenditure as percentage of GDP – about 4.9% in 2019 according to the OECD[86],. The country ranked third, just behind the United States, in terms of the most recent Global Innovation Indicators, see Figure 13 below (WIPO, 2020).

[85] The Story of Israel's Economic Miracle is a 2009 book by Dan Senor and Saul Singer about the economy of Israel.
[86] https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm

Figure 13 - Global Innovation Indicators 2020



Source: Cornel University et al. (2020)

A mix of deregulation and a liberalisation of Israel's financial markets provided an environment for doing business. Today the aim is to become a **Scale-UP nation**.

2.4.2 The innovation system

Policy environment

Israel features a vibrant entrepreneurial culture exemplified by the largest number of start-ups per capita in the world, a highly skilled workforce, and state-of-the-art technological infrastructure in the private sector, as indicated by the presence of more than 350 R&D centres[87] of multinational corporations (MNCs). Israel is typically ranked among the most innovative countries in the world.

A mixed environment of deregulation and a liberalisation of Israel's financial markets provided an attractive environment for doing business is composed of:

- **Relevant strategies**: The government has, over the years, encouraged technological entrepreneurship and investment in industrial R&D through various programs via the **Office of the Chief Scientist** (OCS) and, more recently, the

[87] Interview with Israel Innovation Authority.

Israel Innovation Authority [See IIA Section below]. Research by Prof. Shaul Lach[88] indicates that the direct result of governmental support in R&D is the creation of new research of up to two to three times higher value than the amount of the initial government grant. This research further indicated that governmental support creates an added value to the industry which is five to ten times higher than the governmental investments. It also indicated the complementarity of public and private R&D investments.

- **Tax incentives**: Government support includes **direct measures** with direct government investments in the form of grants or R&D loans dedicated for the business sector or for inter-government R&D activities such as military R&D or technology acquisition; and **indirect support** mostly with various tax incentives for companies dealing with R&D and innovation.
- **EU synergies**: Israel has been a full member of the EU's framework programs, Galileo, the Euro-Med Agreements and the GLP Agreement with the EU. Israel joined the OECD in 2010.
- **Financing and investment**: Israel's thriving technological entrepreneurial activities draws investors and mega companies from all over the world. Israeli entrepreneurs are known for their creativity, high skills, audacity, and multidisciplinary thinking. Today, Israel is ranked **first in Venture Capital investments as percentage of GDP**. Some 5,000 Start-up companies are active in Israel and a net of 600 more are launched on an annual basis.

2.3.3.1 Key players

The central public player in the country's innovation system is the **Israel Innovation Authority (IIA)**, established as recently as 2016 as the successor to the Office of the Chief Scientist (OCS) – which was a division in the Ministry of Economy and Industry. The new agency was given the role of central operator in promoting innovation far and wide in the Israeli NIS. The Chief Scientist of Israel – a position that long pre-existed the new agency – serves as the IIA Chairman. Although the Chief Scientist sits in the Ministry of Economy and Industry, s/he is assisted in the function of IIA Chair by a very active Board of Directors representing all stakeholders of the agency including the private and public sectors and academia. Hence the independence of IIA from then Ministry.

The IIA was created to provide a variety of practical tools and funding platforms addressing more or less the whole spectrum of innovation. This, for instance, includes early-stage entrepreneurs, mature companies trying to innovate, and academics with potentially exploitable ideas. IIA also facilitates networking between foreign and domestic players such as assisting foreign corporations to find Israeli collaborators or assisting Israeli companies locate markets abroad.

Other key players are:

- **Universities**: The Weizmann Institute and the Hebrew University are ranked 61 and 65 globally according of the Centre for World University Rankings in 2020. Tel Aviv

[88] Saul Lach, 2008, *The impact of government support on innovative R&D in the business enterprise sector*, the Hebrew University in Jerusalem. Accessed via http://saullach.weebly.com/research.html

University and Technion – IIT are also well ranked (between 150-160). Three other universities are: Ben Gurion University, Bar-Ilan University, and the University of Haifa.

- **Platforms and clusters:** The Innovation Labs Program provides support to entrepreneurs with access to unique technological infrastructure, market insights, marketing avenues, and industry expertise, in order to reach a proof of concept and transform technological ideas into products.
- **Private**: During the last few decades, multinational corporations operating at the frontiers of technology have established hundreds of R&D centres in Israel. Today, they account for about 50% of the business enterprise R&D expenditure according to the OECD[89]. Over the years, many of these multinational corporations have acquired significant numbers of Israeli start-ups and other companies, feeding the Israeli innovation ecosystem with monetary resources, leading research, skilled personnel, technological leadership in several areas and a well-established innovation ecosystem.
- **Start-ups.** Israel has the highest number of start-up companies per capita in the world[90]. It ranks third after the United States and China in company listings on the NASDAQ exchange.

2.3.3.2 Programmes and instruments

The IIA is organised on the basis of six divisions[91]. This subsection intends to illustrate the comprehensiveness of this government agency by these divisions. However, it only goes into detail for the first two (start-up and growth), which are deemed to be of primary relevance for Slovenia.

Start-up Division

The Startup Division offers unique tools to support the early developmental stages of technological initiatives at the pre-seed or initial R&D stages, thus helping transform their ideas into reality while reaching significant funding milestones.

- *Incubators Incentive Program*: targeting entrepreneurs interested in founding a company based on an innovative technological idea. Supporting fledgling operations at the early-stage R&D with difficulties to access financing. Grants of up to 85% of the approved budget up to a maximum 3.5m Shekels (approx. 0,9m EUR) for a period of up to 2 years (public funding). The remaining 15% covered by a further grant from the incubator. Possibility of a further grant for a third year. Entrepreneurs can start up a company after the approval of the grant with the assistance of the incubator.
- *Innovation Labs Program* – Incentive Program to finance infrastructures and expertise to prove the feasibility of a technological idea. The assistance is provided

[89] OECD Data, 2009-2019, *Gross domestic spending on R&D*. Available at: https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm

[90] Deloitte, Perspectives, *The Israeli Technological Eco-system*. Available at: https://www2.deloitte.com/il/en/pages/innovation/article/the_israeli_technological_eco-system.html

[91] For reference, see: https://innovationisrael.org.il/en/contentpage/israel-innovation-authority

through innovation labs operated by the industry's leading corporations via a model of open innovation. 33% of the costs are funded.

- *Tnufa (Ideation) Incentive Program*: supporting entrepreneurs reaching proof-of-concept and business feasibility of early-stage projects. Providing grants of up to 200K Shekels (50,000 EUR) corresponding to 85% of the approved budget. Funds distributed in equal batches of 100K Shekels (25,000 EUR) each year. Funds to be used for building a prototype, IPR, business development, materials, subcontractors and consultants, patent attorneys, exhibition expenses.
- *Early-Stage Companies Incentive Program*: Designed for start-ups trying to develop and promote an innovative technological project and penetrate the market by raising private investment. It offers preferred incentives to minorities and Ultra-Orthodox Jewish entrepreneurs. The goal is to provide an incentive for private investments in. early-stage companies carrying out R&D and encouraging the development of high tech in the country. Targeting startups from all sectors that raised up to $10m (EUR 8.21 million) and had revenues up to $1m (EUR 821K) in the previous year, interested in developing or upgrading innovative products to penetrate targeted markets. Conditional grant of up to 50% of the approved budget, with a maximum of 10m Shekels (EUR 2.5 million) per year. Additional sums provided to companies operating in depressed areas. Further support for Ultra-Orthodox minorities.
- *Renewable Energy (Cleantech) Technology Centre*: Information gained through interview; no further public information was available.
-

Growth Division

The Growth Division operates a wide range of incentive programs that assist hi-tech companies in the sales growth stage as well as mature hi-tech companies that utilize growth channels based on technological innovation and/or seek assistance in funding innovative research and development

- *Incentive Program to Encourage the Establishment of MNC R&D Centres in Biotechnology and Health*: enabling large foreign industrial corporations in biotech and health to establish or expand their R&D and technological innovation operations in Israel as well as the management of their GVCs. The program also aims at increasing the employment of non-R&D workers in Israel by these companies.
- *Incentive Programs for Innovation with Government Entities*: collaboration between the IIA and various government departments to focus state effort on selected fields including support for high-risk projects, support for regulatory authorities for pilot regulatory programs, access to state-owned testing locations and facilities. Aims at raising the impact of technology on the general economy. Listed programs include the fields of transportation, environmental protection, digital health, government companies, space, agriculture, reducing greenhouse emissions, cyber defence, government ICT authority, local authorities, construction and housing, Israel Securities Authority.
- *Generic R&D Incentive Program for Large Companies*: supporting long-term R&D developing infrastructural knowledge by large companies that can be implemented

in a series of future products. Eligibility for companies employing more than 200 people, spend at least $20m (EUR 16.44milllion) in R&D, and sell at least $70m (EUR 57.5 million) in three years (or the parent corporation has at least $2.5b of global sales). Grants supporting 20%-50% of the approved long-term R&D expenditures. Additional support of 10% for companies operating in depressed areas. IIA does not receive royalties from the R&D outcomes.

- R&D Fund: supports private sector Israeli companies creating new products or upgrading a technology. This is the largest public grant in support of R&D in Israel. It supports R&D across all sectors, including hardware, software, communications, complex systems, life sciences, medical devices, cyber, internet of things, fintech, cleantech, and others. Provides subsidies of 20%-50% of the approved R&D expenditure. Additional preferential funding is available for companies operating in depressed (development) areas and/or run by minorities, Ultra-Orthodox Jews and female entrepreneurs. The IIA subsidy is to get repaid via royalties from sales if the project is successful and reaches commercialisation. Since May 2020 the Early-Stage Companies Incentives Program has been merged into the R&D Fund.

Other division activities, concluded to be less relevant to the Slovenian case, are listed below:

Technological Infrastructure division

The Technological Infrastructure Division focuses on funding applied R&D infrastructure, promoting applied research in academia, technology transfer, Leveraging R&D for Dual Use Technologies, exchange of knowledge and experience and developing of ground breaking innovation by an integrated group of researchers from academia and industry.

- *TELEM (National Infrastructure Forum for Research and Development)*
- *Leveraging R&D for Dual Use Technologies*
- *Applied Support of Research Institutes*
- *Promoting Applied Support in Academic*
- *Technology Transfer*
- *Generic Technologies R&D Consortiums*
- *Users' Association R&D Infrastructure*

Advanced Manufacturing division

The Advanced Manufacturing Division focuses on promoting the implementation of R&D and innovation processes in companies in the manufacturing sector in order to strengthen their competitiveness in the global arena and improve productivity across a variety of industrial sectors.

- *R&D Preparatory Incentive Program for Companies in the Manufacturing Industry*
- *MOFET – R&D in the Manufacturing Industry*

International collaboration division

The International Collaboration Division is responsible for coordinating international collaboration in innovative R&D knowledge and technology between Israeli companies

and counterpart organizations abroad, thus offering various competitive advantages for the Israeli industry in the global market.

- *Bilateral Programs for Parallel Support*
- *R&D Cooperation with Multinational Corporations*
- *EU Framework Agreements – Horizon 2020*
- *Boosting Participation of Israeli Companies in the European Framework Program*
- *European Programs for Parallel Support*
- *Incentive Program for Adapting Products for Emerging Markets*
- *Bi-national Funds*

Societal Challenges division

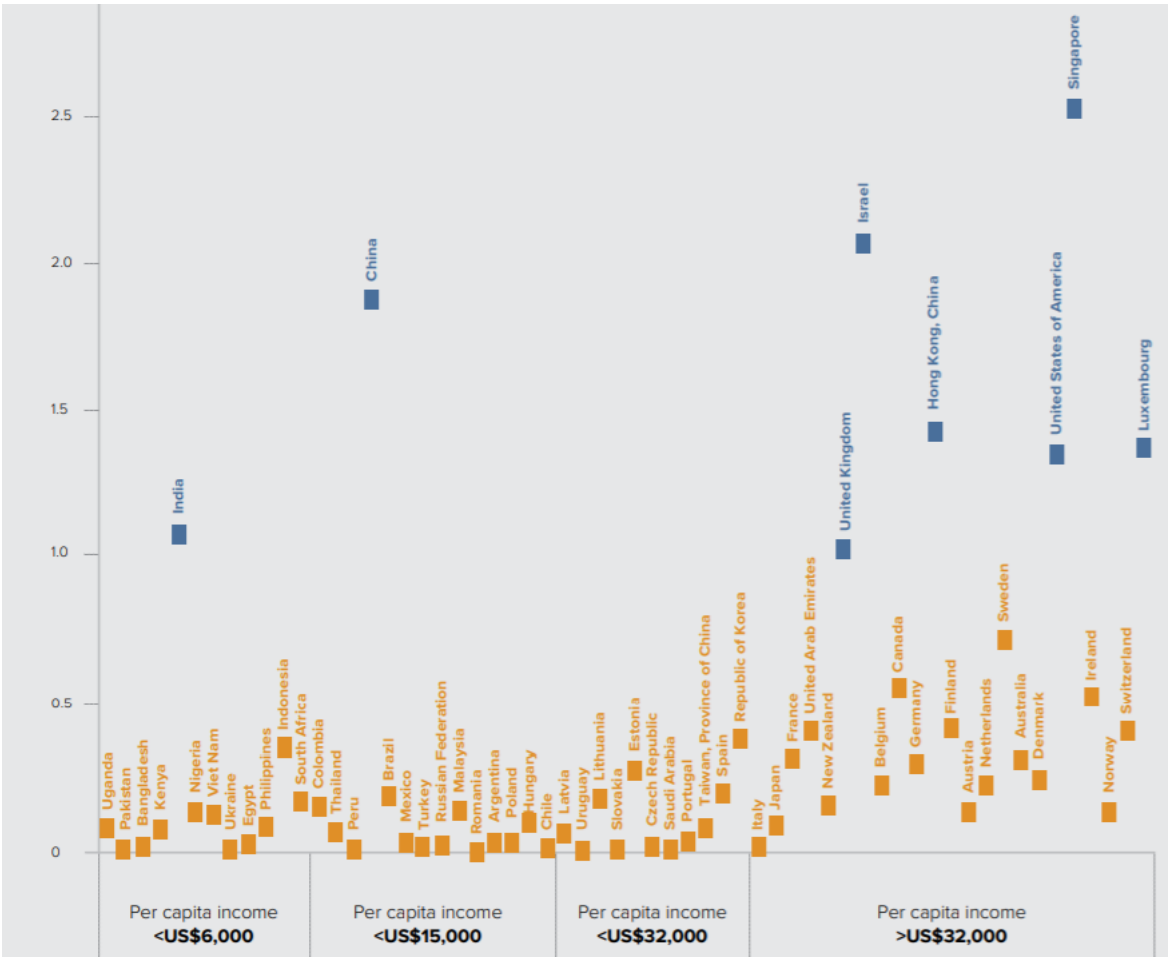
The Societal Challenges Division focuses on improving the effectiveness and quality of public sector services, as well as enhancing social welfare and quality of life through technological innovation.

- *GCI – Grand Challenges Israel Incentive Program*
- *Coding Bootcamps Program*
- *Digital Innovation for Public Sector Challenges*
- *Assistive Technology for the Disabled Incentive Program*

2.3.3.3 Financial instruments

Besides tax incentives and R&D loans, Israel has a rich environment for financing the whole gamut of the innovation process, from ideation to market introduction. The summary of IIA activities in the previous section are a testament to this. However, the country has become most famous internationally and ranks first in the non-autocratic world in terms of VC penetration (ratio of VC investment to GDP). See Figure *14* below.

Figure 14 - VC penetration in selected economies 2016-2018



Source: Cornel University et al. (2020)

In terms of overall numbers, as of 2017, there were 559,567 companies in Israel 99.5% of which were SMEs employing up to 100 workers each[92]. Policies for SMEs and entrepreneurship are primarily designed by the Ministry of Economy and Industry and implemented by the Israel Innovation Authority (IIA) and the Small and Medium Business Agency (SMBA).

Important recent policy steps include the passage of a law in January 2017 that separates credit card companies and banks as part of a broader effort to amplify competition in the banking sector and lower financing costs for SMEs. April 2019 saw the launch of a central credit database for households and SMEs which is expected to improve competition and data accessibility in the credit market. Also, in 2017, the Israeli legislature (Knesset) passed the Ethics of Payments to Suppliers Law (known in the EU as Late Payments Directive). This law determines the maximum period within which payments can be made to suppliers for the sale of goods, provision of services, or performance of work. The purpose of the law is to reduce the payment period for the business sector, diminish the need for working capital credit, and increase transparency in payments.

[92] This section is primarily based on OECD (2019, 2020).

2.3.3.4 Partnerships

Israel pursues an open policy regarding international cooperation. The activity is led by a special division of IIA. In terms of national level agreements, the country is well connected to Europe, implemented through the programmes of the International collaboration division (see section above).

An especially noteworthy fact is the huge success of Israel in attracting foreign major corporations to set up R&D labs in the country. Invest in Israel, under the Ministry of the Economy, is the agency promoting the country to foreign private investors. In contrast to the formal research integration with Europe with programmes like those listed above, inward private research and innovation investment activity has been dominated by United States corporations, by far the most active (around two-thirds), followed at some distance by China, and further below by Germany, the UK, and India. The presence of MNCs from the rest of Europe is sparingly low.

The start-up nation - Factors Contributing to Israel's Innovative Edge[93]

The software company Intel recognised Israel's strengths as early as 1974 by building its first R&D plant outside of the United States there. Over the next forty years, it became Israel's largest tech employer and exported a billion processors. Several of these were developed by Intel Israel, reportedly including the 8088 (the first PC processor), the Pentium MMX (arguably the most popular processor of the 20th century), and the Centrino (the first laptop processor with Wi-Fi). More than 350 multinationals have R&D labs in Israel nowadays[94]. Both greenfield and brownfield investments are prevalent, where brownfield involves the acquisition of small domestic companies to build on.

Israel has earned the reputation of a highly entrepreneurial nation producing large numbers of start-ups, some of them becoming billion-dollar unicorns later bought out by foreign tech giants such as Viber (acquired by Rakuten) and Waze (acquired by Google) while other listing on exchanges like NASDAQ. After the US and China, Israel is the most represented country on NASDAQ. Describing this type of success, Singer and Senor (2009) coined the term "start-up nation".

What much of the analysis points out is that, with limited potential in resource-intensive primary and secondary industries, Israel has had little choice that depending on the **intellectual capacity of its people and on knowledge-intensive sectors**. To bypass geopolitical isolation and small internal markets – being a nation of 9 million people – the country has tended to gravitate toward high-tech industries such as software and the internet. Almost half of its exports are in high-tech. In the field of cybersecurity Israeli companies hold a 10% global share.

Immigration has been one of the keys of Israel's economic vitality. In the 1990s alone, close to a million citizens from the former "Eastern Block" moved to Israel. Many of them

[93] This section is drawing heavily on Yin (2016, 2017).

[94] Reports about how many foreign R&D centres are in Israel vary. Numbers vary from the mid-300s to the mid-500s.

had strong science and engineering backgrounds and were highly motivated to "make it" in the new country thus being willing to take risks. Under stress, the Israeli government did what it does best: turn disadvantages (huge number of immigrants to be accommodated) to opportunities (enable these immigrants with the right policies to take risks in high tech such as the Yozma program that underwrote the development of one of the most efficient venture capital industries in the world). The immigrants directly contributed to Israel's high-tech boom. They were willing to do things differently and more efficiently, with few conventions to hold them back. America is quite used to that same type of phenomenon.

According to OECD, 51% of the Israeli adults has a college degree in 2019[95] (EAG 2020), with more than half of them specialising in STEM subjects (63% in short cycle tertiary education).[96] The country spent more than 6% of GDP in 2017 (EAG 2020) on **education** and boasted several of its universities to be highly ranked globally including Tell Aviv U., Weizmann Institute, Technion. Five Israeli-born citizens won the Nobel Prize within a 15-year period (2002-2016). Most importantly, **universities have been highly incentivised to transfer technology and seek commercialisation**. Several, including the three mentioned above, are patenting their research at globally high rates. All major universities have set up technology transfer units to sell or license university IP or to help starting up companies with such IP.

A prominent example is Yissum Research Development Company[97], the technology transfer company of the Hebrew University of Jerusalem. Yissum figures to be the third tech transfer company created in the world founded in 1964. It is said to have founded more than 170 start-up companies, over 100 of which were still active in 2020, to have registered over 10,750 patents globally, and to have licensed over 1050 technologies. Yissum's partners include companies such as Boston Scientific, Google, ICL, Intel, Johnson & Johnson, Merck, Microsoft, Novartis, GRAIL, and many more. It has also signed collaboration agreements with renowned educational institutions such as Caltech, Cornell, Carnegie Mellon University, Columbia University, Johns Hopkins University, New York University, Northwestern University, and Stanford University, among others, in the US alone. The company receives significant annual income from such activities which it invests into new ventures and academic research. The three elements of Yissum success are: [98]

1. Degree of autonomy: Yissum is a for-profit company fully owned by the Hebrew University of Jerusalem (HUJI) which is a not-for-profit entity. This makes Yissum a non-typical entity. In addition, its board is mainly drawn from industry;
2. Hiring policy: Yissum hired experienced technology transfer staff with deep knowledge into field of research;

[95] OECD, 2020, *Education at a Glance*. Accessed via https://www.oecd-ilibrary.org/education/education-at-a-glance-2020_69096873-en

[96] ibid

[97] http://www.yissum.co.il

[98] https://ub-cooperation.eu/pdf/cases/I_Case_Study_Yissum.pdf

3. Equity sharing: a strict policy for equity sharing to incentivise commercialisation: 40% of revenues to the individual researcher and their team, 20% to the laboratory, and 40% to the university. More than 40% of the university staff is involved in technology transfer as a consequence.

A well-known fact is the very important role of the **military forces** in the Israeli technical enterprise.[99] The strategic importance of developing a robust domestic military-industrial complex was clearly crucial, and several of the famous Israeli inventions can be traced back to this complex. This includes, for example, in the IT sector pattern recognition technologies, data storage technologies, cutting-edge technologies in machine learning and vision, data mining technologies, and cybersecurity. Beyond this, Yin (2016/2017) stressed Israel's conscription set-up as a crucial driver in the country's start-up scene.[100]

In addition, the very active corridor of expatriate exchange with the US centers of entrepreneurship such as Silicon Valley cannot be underestimated. The accelerator idea arrived at Israel's shores with such an expatriate who led Microsoft's accelerator in Tel Aviv in 2012 after studying the business models of Y Combinator and Techstars while working in the US. Just in five years this had exploded into eight locations around the world and 9000 applications for 150 positions. Intensive interaction of research scientists and engineers (many of them from Microsoft) with entrepreneurs is a daily occurrence.

Accelerators, incubators and a variety of entrepreneurship-oriented activities have proliferated in the "start-up nation". Ideas of **clusters**, of the importance of close physical proximity, open innovation, and of private-public partnerships have proliferated. The role of the military, by highly selecting and training the most promising conscripts into the latest technologies, and by instilling camaraderie during long service tours is critical.[101] Industry duly moves around military bases. The situation has been turned around since the late 1980s with the government very actively oriented towards releasing the potential of the private sector, encouraging entrepreneurs to take risks and experiment with ideas.

One important example is the IIA's Technological Incubators program initiated in 1991 that provides capital and resources to new entrepreneurs. Within a quarter of a century, the program had established 24 incubators that were mostly privatized through public tenders. A number of private incubators and accelerators also operate in the country obviously under different rules. Yin (2017) roughly estimated a 5-6 times leverage of the public funds into the program EUR 535 million ($650m) by private investment into the incubated companies.

Venture capital and scale-up[102]

Israel is only second to Silicon Valley in its rate of startup formation, with a ratio of 1 startup per 1400 people.[103] The country also has the highest number of engineers per

[99] As proved with French weapons during the 6-day war of 1967.
[100] We will not expand on this topic in the present report.
[101] Military service extends to three years for men and two years for women.
[102] This section is drawing primarily on Daniely (2020).
[103] J. Yerman, 2019, *A Startup Nation: Why Israel Has Become the New Silicon Valley,* Airline Passenger Experience Association (APEX). Accessed via https://apex.aero/articles/startup-nation-israel-become-silicon-valley/

capita and the second highest R&D expenditure rate. The country ranks first or second globally for VC availability.

There does however exists an "exit culture", referring to a phenomenon – also heavily afflicting the US – whereby entrepreneurs do not aspire to build global, publicly traded, leading companies but rather ones that will be purchased as soon as possible by large multinationals with deep pockets.[104] While this practice has brought significant income into the country, it also arguably has a downside: it exports the country's most valuable know-how and hinders the development of large local companies. Secondary negative effects are related to job creation, tax revenue for public services, and opportunity inequalities between the serial entrepreneurs and the rest. For counter examples one can consider other small, developed nations such as the three Nordic EU member states, Switzerland, and Singapore.

A recent PwC report counted 539 innovation centres by multinationals in Israel.[105] While this is a huge sign of success, it can also be a problem. For example, by draining local highly skilled personnel from domestic companies. Another way is that, by "having their fingers on the pulse", MNCs have privileged information for identifying promising companies and rush to acquire them. Somewhat surprisingly for followers of venture capital investments in North America and Western Europe, Israel seems to face the opposite limitation in VC investment funds. The country reportedly lacks multibillion-dollar funds that invest at the stage where a company can scale-up from selling a single product overseas to a large company employing thousands of workers.[106] Israeli pension funds have been reported to be more likely to invest in overseas real estate markets than they are to invest in a growth-stage Israeli company. Moreover, a large number of start-ups are funded by corporate venture arms. A third factor is said to be the small scale of the Israeli stock market, pushing many successful young companies to seek listing on NASDAQ and avoiding the Israeli market altogether.

2.4.3 Identified advanced practices

Eight advanced practices identified in the Israeli case that can be classified as: 'developing', 'promising', 'good' or 'best' practices are presented below (see definition in Section 1.3)

Advanced Practice 1 (best). A very high share of **highly skilled,** military trained (disciplined), human capital with long historical cultural affinity to entrepreneurship (going back many centuries). This human capital is being replenished continuously by attracting Jewish people from around the world – with the most notable example the 1 million people

[104] Yaron Daniely, 2020, *Israel's Challenging Transformation from a Start-Up Nation to a Scale-Up Nation*, In WIPO Global Innovation Index 2020.

[105] Amir Mizroch, May 27, 2019, *530 Multinationals from 35 Countries Innovating in Israel*, Forbes Magazine. Accessed via https://www.forbes.com/sites/startupnationcentral/2019/05/27/530-multinationals-from-35-countries-innovating-in-israel/

[106] See, however, the programs of IIA's Growth Division summarized earlier. The public money may still not be enough.

emigrating from the former Soviet bloc countries in the 1990s (many of them highly educated and motivated to "make it" in the new land).[107] Not transferable to Slovenia.

Advanced Practice 2 (best). A **strong expatriate network** whose members are distributed across developed countries, but also containing large communities in developing countries such as those in Latin America. Many of these people are heading, or are working for, major tech enterprises in the US and elsewhere, and are highly committed to contributing to Israel. What is equally important, this global expatriate community carries the critical tacit knowledge for building and growing business companies. This is supplemented by an **acute awareness among Israeli policy makers** – due to geopolitical and historical reasons – of the critical importance of their expatriate communities and the very extensive (indeed, unsurpassed) energy and effort spent in engaging this population with the Israeli economy. Not transferable to Slovenia.

Advanced Practice 3 (good). A **highly productive university system** in terms of both academic publications and industrial applications (patents, technology transfer). **Universities are incentivized to focus on technology transfer and new firm formation**. These functions are performed by university technology corporations (private entities) – as compared to more traditional TTOs – which were some of the first in the world to be established. Possibly transferable to Slovenia in the longer term.

Advanced Practice 4 (good). A STI system which has always been geared towards industrial applications, nurtured by very active government policy at all levels and all kinds. The Israeli government heavily assists domestic entrepreneurs with a comprehensive toolkit of policy measures, but also exposes them to fierce domestic and international competition on the other. It incentivises these entrepreneurs to compete both domestically and internationally by keeping an open economy. Possibly transferable to Slovenia in the longer term.

Advanced Practice 5 (best). Very efficient VC industry for start-up mainly. Transferable to Slovenia in the foreseeable future.

Advanced Practice 6 (good). Economic openness is pursued as a way of scaling-up enterprises that cannot reach maturity just on the basis of the relatively small internal market. The Israeli mixed environment of deregulation and liberalisation of Israel's financial markets might inspire Slovenia, especially in attracting direct investments and big multinationals (decision centres) to Slovenia. Transferable and critical for Slovenia.

Advanced Practice 7 (developing). Scaling up is a big concern in the high-tech sector despite a very efficient and rich VC industry and the fastest rate of creation of start-ups per capita in the world. Reasons include an "exit culture" of modern entrepreneurs, relative scarcity of growth capital, praying practices of MNCs, and lack of deep capital markets. Policy decision makers are trying to address the problem. Definitely a concern for all small countries and also Slovenia.

Advanced Practice 8 (good). A competent innovation agency (IIA) with a broad and deep mandate for industrial innovation, with clear plan, overlapping alternatives for business

[107] The population of Israel has increased five-fold from its founding in 1947 (1.8 million) to nowadays (about 9 million). This has created a melting pot of people with various backgrounds, beliefs, and capabilities.

funding of all types, and seemingly efficient operation. The IIA needs to be further studied. Transferable to Slovenia.

Conditions like those above and accommodating policies have nurtured a formidable "technical enterprise" and the "start-up nation" since the late 1980s, boasting the highest number of start-ups per capita in the world and only third in rank in terms of companies on the NASDAQ tech exchange. Indeed, there are lessons for others, but the success of a wholesale effort to transfer the Israeli system of policies supporting knowledge-intensive industries to Slovenia should be taken as inspiration rather than a model for reform. This unique context is outlined in **Figure *15***.

Figure 15 - The unique Israeli context

The preceding interpretation of the strengths and weaknesses of the Israeli innovation system must be interpreted in connection to the particular geopolitical context of the country which certainly affects the transferability of practices. In particular:

3. Forced **isolation due to special regional geopolitical conditions** keeps Israeli residents alert to security dangers and which is arguably related to some of their impressive accomplishments in fields such as cybersecurity, agriculture, water management, weapons, etc.
4. This geopolitical environment has also enabled **critical, and very difficult, policy decisions** such as the famous example of the Yozma program that underwrote the development of one of the most efficient and effective venture capital industries in the world.
5. Almost complete **lack of natural resources** besides the sun and seawater – with the exception of the recent discovery of large gas fields in the sea water basin shared with Cyprus – has forced Israeli governments to pay attention to their most valuable resource: human capital. This phenomenon can be also observed in countries like Korea. The development of a highly skilled workforce has been an overarching priority of the Israeli government since the day of establishment of the new Jewish state. Almost half of Israeli citizens have university degrees – with very extensive discrepancies between Jews and Muslims. Hundreds of MNC research labs operate in the country of 9 million people, many of them Fortune 500 companies. Several of Israel's universities are world class, partnering with the top higher education institutions around the world.

3. Benchmarking

3.1 The Slovenian national innovation system

This section largely draws on the conclusions from the State of Play Report, which was part of the previous activity for this project.

3.1.1 Overall economic situation

Already in 2019, before the hit of the COVID-19 pandemic**, Slovenia's economic growth decelerated considerably but remained robust**[108]. After growing by more than 4% in 2017 and 2018, the economy was expected to grow at a slower rate of 2.5% in 2019 and 2.7% in 2020 and 2021 as the pandemic hit growth rates. In the first quarter of 2020, the economy contracted by 4.5% quarter on quarter[109]. The rise in unemployment was rather modest due to government support measures[110]. According to the forecasts, economic growth in Slovenia in 2021 will be at 4,6%[111]

The Slovenian economy **remains very much linked to external/international factors** and the slowdown in 2020 was expected due to a declining contribution of the external sector, arising from the global slowdown in trade.

A comparison of GRP per capita growth rates for the benchmark countries can be in Figure 14 found below.

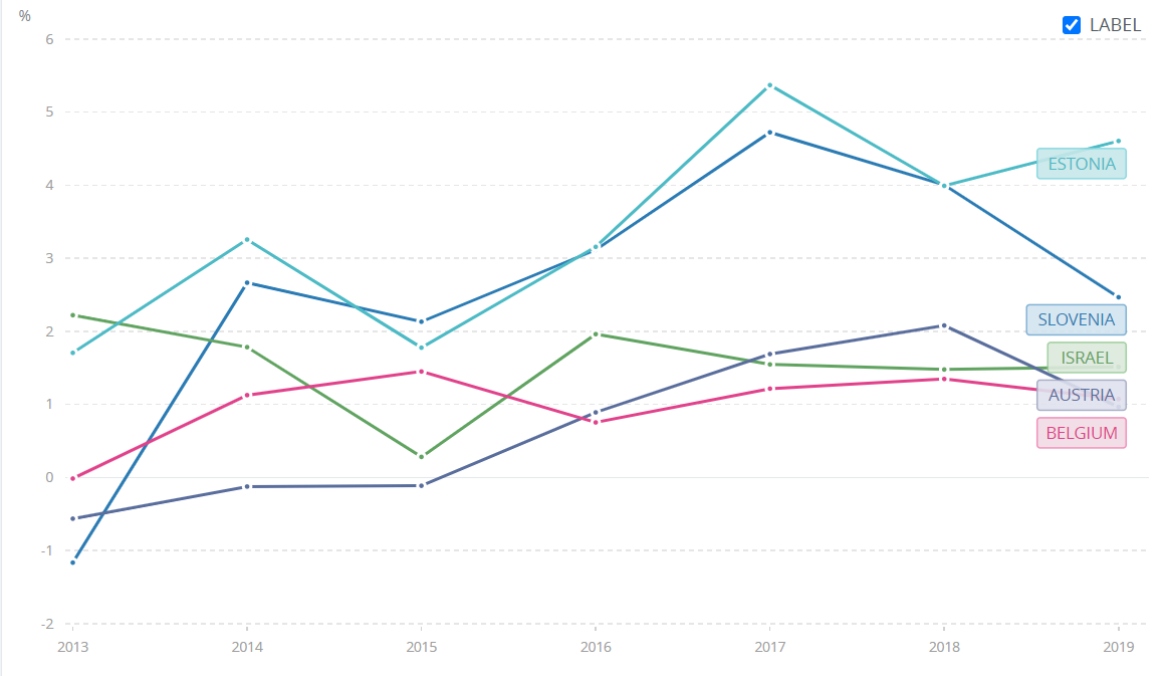
[108] European Commission, 2020, *Country Report Slovenia 2020: Assessment of progress on structural reforms, prevention and correction of macroeconomic imbalances, and results of in-depth reviews under Regulation (EU) No 1176/2011.* Accessed via https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020SC0523&from=EN .

[109] European Commission, 2020, ECFIN Forecasts. Accessed via https://ec.europa.eu/economy_finance/forecasts/2020/summer/ecfin_forecast_summer_2020_si_en.pdf .

[110] *ibid*

[111] Institute of Macro-economic Analysis and Development, 2021, *Spring forecast of economic trends 2021*, Slovenian Government. Accessed via https://www.umar.gov.si/napovedi/single/napoved/news/pomladanska-napoved-gospodarskih-gibanj-2021/?tx_news_pi1%5Bcontroller%5D=News&tx_news_pi1%5Baction%5D=detail&cHash=71e93e081b41deb38d78ce6ac582c89f .

Figure 14 - GDP per Capita Growth rates 2013-2019



Source: World Bank 2021

3.1.2Innovation indicators

As has previously been stated, Slovenia now belongs to the group of **Moderate Innovators** as its performance declined relative to that of the EU in 2012. The 2021 European Innovation Scoreboard (EIS) listed Estonia, Austria and Flanders all in the category of 'Strong Innovator', along with France, Germany, Ireland, Luxemburg and the Netherlands, which means that the performance of the benchmarked countries is above or close to the EU average (the definition of the group).[112]

While the EU average performance in Human Resources increased by 15.2% between 2012 and 2019, performance declined for 13 Member States**. The strongest declines were seen in Slovenia** (-47.8%, due to a strong decline in Doctorate graduates).

Performance in **Innovation-Friendly Environment** for 25 Member States has improved between 2012 and 2019. **Performance decreased for Belgium (-21.9%) and Slovenia (-24.5%)**[113]**.**

When looking at **performance in Finance and Support**, for nine Member States, performance has decreased, in particular for Bulgaria (-49.4%), Ireland (-34.1%) and **Slovenia (-19.4%).** The EU average increased by 15.5% between 2012 and 2019[114].

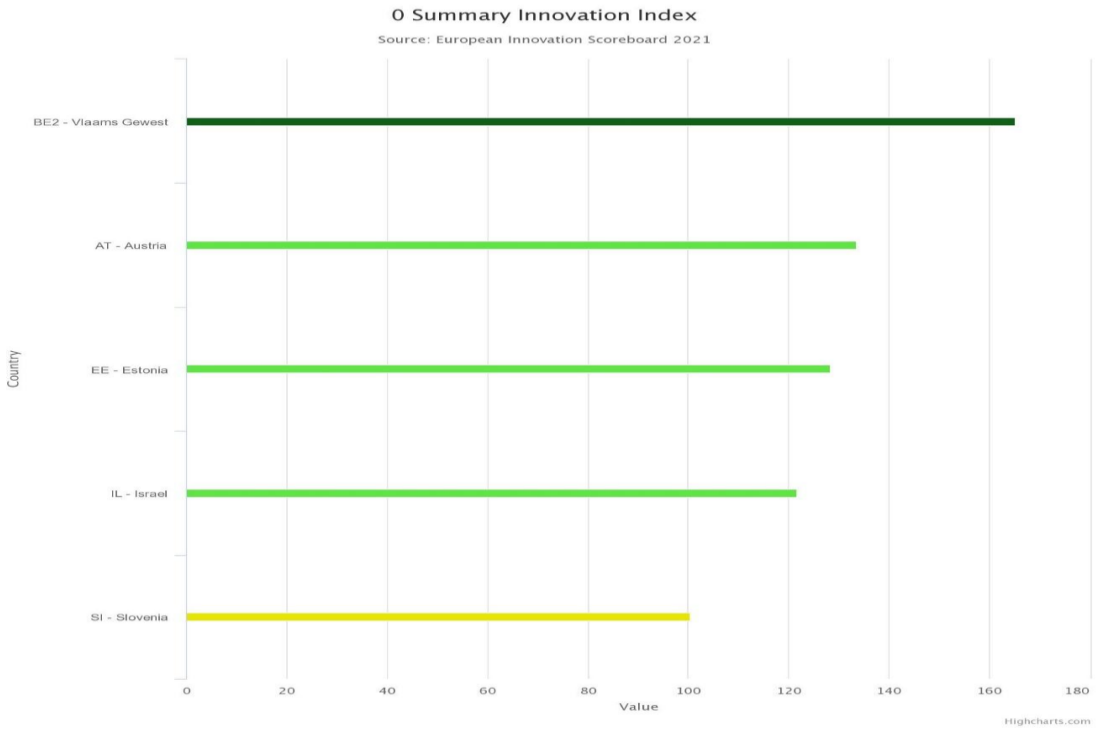
[112] European Commission, 2020, *European Innovation Scoreboard 2020*. Accessed via https://ec.europa.eu/commission/presscorner/detail/en/QANDA_20_1150
[113] *Ibid*
[114] *Ibid*

In performance in the **Innovators** dimension, 15 Member States' performance declined, in particular for Germany (-36.1%), Romania (-26.7%) and **Slovenia (-25.6%).** The EU average decreased by 10.6% between 2012 and 2019[115].

The highest rate of performance in **Linkages** increase was observed in Greece (43.4%), **Austria and Estonia (**for both a 25.8% increase). For 15 Member States, performance declined, in particular for Cyprus (-34.4%), Hungary (-23.0%) and **Slovenia (-22.2%).** The EU average increased by 3.0 % between 2012 and 2019[116].

Figure 16 below is the summary innovation index of the European Innovation Scoreboard 2021 for the benchmark countries (and in the case of Belgium, the region of Flanders), which contains all of the above indicators, can be seen below. As can be seen, Slovenia has the lowest overall score (although it is still average of all countries in the EIS) while Flanders having the highest combined indicator score. The overall score is formed of 32 individual indicators. Flanders had the strongest scores in the following indicators: Innovative small and mid-size enterprises (SMEs) collaborating; business process innovators; innovation expenditures per person employed and; employment at innovative enterprises.[117]

Figure 16 - Summary Innovation Index EIS 2021



Source: European Innovation Scoreboard 2021.

[115] *Ibid*
[116] *Ibid*
[117] Flanders Investment and Trade, 2021, Belgium and Flanders rank as innovation leaders in the EU. Accessed via: https://www.flandersinvestmentandtrade.com/invest/en/news/belgium-and-flanders-rank-innovation-leaders-in-eu

3.1.3 State of play in innovation ecosystem

The outcomes of the state of play report named the following barriers and drivers in the Slovenian Innovation ecosystem:

Drivers

As stated in the Country Report Slovenia 2020[118], the **country has a competitive advantage in certain areas, such as artificial intelligence and robotics.**

Slovenia also has an **excellent track record in scientific and technological fields** including physics, materials, biochemistry and more recently in areas tackling climate-related challenges.

Moreover, the country has **successfully conducted scientific research in artificial intelligence** since the early 1970s.

While **blockchain technologies** are already used in the Slovenian FinTech sector, these technologies potentially have a much wider reach for the economy as a whole[119].

With the **new VEGA EuroHPC Supercomputer**, Slovenia is setting up supercomputer centre at PETA scale level. The project has clear orientation towards research that includes fields of artificial intelligence, although it is to be seen how this will spill over to business and commercialisation. It has been operational since April 2021.

Slovenia's **dynamic start-up ecosystem in the area of information and communication technologies, backed by solid business support services**, forms an important driver for the country's industrial transition.

The Slovenian innovation system remains **highly internationalised in some respects,** like participation in European R&D programmes with much less internationalisation in other aspects like attraction of foreign researchers and students or participation in international value chains[120].

As a small open economy, Slovenia is relatively strongly involved in global value chains, while higher levels of involvement continue to be achieved by strong innovators while in this respect, the leading innovators lag Slovenia.

The level of R&D self-financing of the business sector has **increased between the years 2008 and 2017 from 93% to 97%.[121].**

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[118] European Commission, (2020b) Country Report Slovenia 2020, Assessment of progress on structural reforms, prevention and correction of macroeconomic imbalances, and results of in-depth reviews under Regulation (EU) No 1176/2011. Source: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020SC0523&from=EN

[119] European Commission, (2020b) Country Report Slovenia 2020, Assessment of progress on structural reforms, prevention and correction of macroeconomic imbalances, and results of in-depth reviews under Regulation (EU) No 1176/2011. Source: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020SC0523&from=EN

[120] OECD.Stat (2021) Venture capital investments. Source: https://stats.oecd.org/Index.aspx?DataSetCode=VC_INVEST

[121] Ibid.

Successful socioeconomic development, a successfully managed transition to a market-based economy and integration into the international economy are seen as the key strengths of Slovenia by the OECD Reviews of Innovation Policy Slovenia[122].

Slovenia has established functional innovation support infrastructure and has human capacities being able to services the innovation system needs. The question remains how the infrastructure will be efficiently used and how personnel in innovation and business support system will be specialised to offer necessary support in different stages of the innovation process.

There has been an increase in the number and quality of scientific publications, which showed efforts to achieve high academic standards were paying off back in 2012. Still now Slovenia scores high on International scientific co-publications, public-private co-publications as measured by the European Innovation Scoreboard 2021[123].

Barriers

The Country Report Slovenia 2020[124] also indicates the **fourth industrial revolution as a challenge for the Slovenian research community and economic performance** in general.

Opportunities for **teaching staff to do industrial work at public universities are limited** due to regulations, salaries as well as taxation system of the country. For instance, expected teaching in Slovene language limits access to European and other international scholars.

The current system of financing system offers little or no incentives for the universities and faculties to actively pursue foreign students the **students from abroad in Slovenia made up only a small proportion of the tertiary education student population** (4.5 %), for example, compared to Austria (17,5%) or Belgium (10,5%)[125].

Opportunities for teaching staff at the universities and in the Public Research Organisations (PROs) to **blend opportunities in business and teaching/research are limited**.

The highest contribution to Slovenia's integration into the global value chain comes from motor vehicle production and metal products with **lower value added**[126].

The **institutions supported with public funding** in the innovation system **are not financed based on their performance** but on equal basis through their eligible costs. This causes uneven innovation performance which is also identified as a barrier for

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[122] OECD (2012) OECD Reviews of Innovation Policy SLOVENIA. OECD Publishing. http://dx.doi.org/10.1787/9789264167407-en

[123] European Commission, (2021) European innovation scoreboard 2021, Electronic source: https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en

[124] Ibid.

[125] Eurostat, (educ_uoe_mobg03) (2020) Learning mobility statistics. Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Learning_mobility_statistics#Students_from_abroad

[126] UMAR (2020) Poročilo o produktivnosti 2020. UMAR, Ljubljana, november 2020.

innovation by the Country Report Slovenia 2020 which states that funding for research and innovation should be rewarded based on performance, while gaps in the innovation system will have to be addressed at the same time[127].

The widely differing views of stakeholders on scientific excellence, relevance of research, including for technological applications, and research priorities are being smoothed while the key barrier seen by the industry is a **lack of long term and premeditated cooperation among knowledge institutions and industry[128]**.

Crucially, the divide between the **government, public funded sector and other actors in the Quadruple helix is observed as a key barrier for development**.

Collaboration with the people, the society factor in quadruple helix, is the weakest point in the system with limited collaboration noted.

A large part of the innovation and R&D funding in Slovenia is coming from EU sources. This causes a lack of flexibility as well as complex planning and control mechanisms. This also shows a lack of political commitment of the country towards the topics of innovation and research which are sending negative signals to the quadruple helix stakeholders.

The country still shows a productivity gap vis-à-vis European and OECD averages, despite strong productivity growth, this is still not enough to cover the historic gaps[129].

A lack of internal purchase power for innovation is caused by the practical absence of a venture capital (VC) market in Slovenia.

According to experts in the venture capital market interviewed for this study, the annual VC funding needs in Slovenia are around 70 million EUR but the country has only a fragment of this amount ready to invest.

Slovene innovation managers still lack knowledge and experience in commercialisation and scale-up. This causes a lack of push in the whole innovation process as the perspective of the user, consumer and the focus on markets and revenues are weak.

Open innovation and other modern innovation principles (Six Sigma, Agile, Design Thinking, Global Innovation Management Methodology and other) **are not widely used in the country** and, even though they are seen in some organisations, wider use of modern innovation approaches is still weak.

Tax incentive regulations are currently limiting the research and development support and these need to be updated to enable wider support of research and

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[127] European Commission, (2020e) COMMISSION STAFF WORKING DOCUMENT Country Report Slovenia 2020, Assessment of progress on structural reforms, prevention and correction of macroeconomic imbalances, and results of in-depth reviews under Regulation (EU) No 1176/2011. Brussels, Belgium.

[128] OECD (2012) OECD Reviews of Innovation Policy SLOVENIA. OECD Publishing. http://dx.doi.org/10.1787/9789264167407-en

[129] OECD (2012) OECD Reviews of Innovation Policy SLOVENIA. OECD Publishing. http://dx.doi.org/10.1787/9789264167407-en

development, while not being narrowly linked to the success of businesses in projects related to public calls.

Slovenia is able to show strong endowment of scientific and creative talent. Slovenia is comparatively strong in human resources and well known for their creativity in a broad range of areas[130] while this must materialise in improved indicators for SMEs product/process innovations, SMEs marketing/organizational innovations and SMEs innovating in-house where Slovenia according to European Innovation Scoreboard 2020 [131] performs lower than EU average.

3.2 Cross-analysis

The following cross-analysis has used the above country case studies to build a set of characteristics against the identified barriers and drivers.

3.2.1 Policy environment and actors

System set up

The general set up for the benchmarking countries is two main funding bodies, with two main implementing agencies, complimented by a financial instrument institution and specific ministerial involvement on key topics. Estonia's main agencies are Enterprise Estonia and the Estonian Research Council, each with an advisory committee attached. For Estonia, there is a clear division between the ministerial mandate. Similar to Slovenia, there are also other ministries involved for specific calls, although in Estonia each ministry also has an influential advisory committee. All of the ministries and activities related to research an innovation are overseen by the Estonian Research and Development Council, which consists of four ministers and eights members appointed by the government. In Austria, the two funding bodies: the Austrian Research Promotion Agency (FFG) and the Austrian Science Fund (FWF) are complemented by the Austrian Promotional Bank (AWS), mirroring the Slovene Enterprise Fund. One key difference is the importance of advisory and consulting services, which form a key part of AWS work.

Of specific importance in the Austrian case is presence of the Austrian Cooperative Research (ACR), a network of private research institutes offering applied R&D for companies. The 17 ACR services are tailored to meet the needs of SMEs offering testing, inspection and certification as well as technology and knowledge transfer. The sustainability of this network is achieved through private funding and public competitive funds (including European Funds). Although an interesting practice, the setup is quite unique to the Austrian system and there are more transferable examples of sustainable research networks (namely in Flanders) for Slovenia.

Both Flanders and Estonia have set up 'one stop shops' for innovation. The VLAIO agency is far more developed and is the only contact point for entrepreneurs in Flanders. It

[130] OECD (2012) OECD Reviews of Innovation Policy SLOVENIA. OECD Publishing. http://dx.doi.org/10.1787/9789264167407-en

[131] European Commission, (2020) European innovation scoreboard 2020, Electronic source: https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en

encourages and supports innovation and entrepreneurship while contributing to a favourable business climate. The Flemish agency is the most comprehensive of the EU case study countries, providing 4 services:

- Funding for research and innovation through EU networks (fund the Flemish part or integrate in EU networks such as EUROSTAR, Eureka clusters, JTIs, Art 185 or ERA-NET initiatives)
- Information services (Enterprise Europe Network - EEN, and National Contact Point for H2020)
- Networking with other EU agencies (TAFTIE),
- Allocation of Structural funds (ERDF, Interreg).

In Israel, the central public player in the country's innovation system, the Israeli Innovation Authority (IIA) is probably the most independent agency of benchmarked countries. Although the Chief Scientist is the IIA chairman and sits in the Ministry of Economy and Industry, s/he is assisted in the function of IIA Chair by a very active Board of Directors representing all stakeholders of the agency including the private and public sectors and academia. This independent set up, although crucial to the strength of the agency, is not a transferable model for Slovenia, given the number of instruments and ministries currently involved in innovation funding. While Slovenia does have the two main ministries and funding agencies, along with the separate Slovene Enterprise Fund. There are a number of other, bodies for example, GODECP, the Slovene Export and Development Bank and Slovenian Regional Development Fund. Therefore, having just one highly independent agency, as in Israel, does not appear to be an option without significant management structure adjustment for the ministries and agencies already in the system.

Furthermore, Slovenia does not have a central innovation, research, and development coordination. Unlike Estonia and Austria, which has just one, In Slovenia there are two key coordination verticals in place, one for the research and development under the domain of the Ministry of Education, Science and Sport and its agencies (e.g., ARRS) and the other for the growth, smart specialisation and start-up under the domain of the Ministry of Economic Development and Technology and its implementing institutions and networks (e.g., SPIRIT, SEF, SIO network, TTOs, SRIPS). By contrast, the comprehensive and centralised activities of VLAIO lessen the need for a unified coordination vertical and so may be a better fit for Slovenia.

Strategies and Policy Documents

In terms of strategic documents, over the past few years there has been a general consolidation in the EU benchmark countries and a deregulation and liberalisation of the policy environment in Israel since the 1990s. The net effect is some form of long-term planning of at least ten years to support the development of a sustainable innovation ecosystem. Estonia previously had three R&I strategies and now has just one, Estonia 2035. It is a holistic strategy based on societal challenges and used as a base document for planning EU funding. In Austria, the 2030 strategy shows the vision for the next decade. The strategy is supported by 6 ministers and is operationalised through an inter-ministerial pact. An outline of how the pact functions can be seen in **Figure 17** below.

Figure 17 - The Implementation pact in Austria

The current pact runs from 2021-2023 and is a 3-year plan containing strategic priorities and measures to achieve these goals[132]. This pact shows interesting reform points such as concentration of funding, cross-departmental collaborations (to finance research, and to coordinate), clarification of the instrument portfolio, and more open topics for basic research. The use of societal challenges as an instrument to deepen collaboration between basic research and industry is also key.

In Flanders, the key strategic documents are 5 years' plans and the Transversal Policy Note Flanders 2050 (Vision 2050: a long-term strategy for Flanders). The case of Israel is different. A mix of deregulation and a liberalisation of Israel's financial markets over the past decades has provided an attractive environment for doing business in the country. It therefore has shorter strategic periods (the current strategy is 2018-2022), made possible by an overarching long-term commitment to innovation at a political level.

Slovenia has comparatively a high number of key strategic elements of the policy framework. For example, the Industrial Policy, Strategy for Internationalisation of Slovenian Higher Education 2016-2020, Research and Innovation Strategy of Slovenia, Development Strategy of Slovenia, National strategy of Open Access to Scientific Publications and Research Data in Slovenia 2015−2020, Programme for the Development of the Innovation System. Moreover, the policy documents exhibit a larger degree of detail, and subsequently overlap, than the benchmark country strategies. While detail is of course crucial, an overarching strategic commitment such as those evidenced by the benchmark countries is also essential.

It is worth mentioning that, in Flanders, innovation and valorisation of research by the business sector have always been a priority. This can be seen in the high commitment for the budget and 5 years plans. This political commitment can be seen for example in the 2014-2019 coalition agreement of the Flemish Government policy priorities:

1. A demand-driven and market-oriented policy in the field of economy and innovation.
2. A simplification and rationalisation of structures and instruments with faster and easier procedures, more transparency, better client-friendliness and a clear one-stop-shop function.
3. A higher focus on business-oriented innovation and valorisation, strong knowledge organizations with excellent research and a growth path for the 3% target for R&D, whereby public outlays strive towards 1% by 2020.

[132] Austrian Ministry for Education, Science and Research, 2020, *RTI Strategy 2030 - the Federal Government's strategy for research, technology and innovation*. Accessed via https://www.bmbwf.gv.at/Themen/Forschung/Forschung-in-%C3%96sterreich/Strategische-Ausrichtung-und-beratende-Gremien/Strategien/FTI-Strategie-der-Bundesregierung-.html

This means that, since 2005, several governmental actions in Flanders have gradually influenced the specialisation of the region. These are outlined more in **Figure 18** below.

Figure 18 - Smart Specialisation in Flanders since 2005

- The Flemish Government launched a discussion on a "new business plan for Flanders" (2005);
- The Agency VRWI (replaced in 2016 by VARIO), the Flemish Science and Innovation Council, conducted a SWOT analysis (2006) of the scientific and technological potential of Flanders in comparison with the EU combined with a European foresight study of 15 key areas;
- VRWI conducted a foresight study (2012-13) with a time horizon up to 2025 leading to define a transition model consisting of: one horizontal transition area: Society 2.0; and six vertical transition areas: (a) E-Society, (b) Food, (c) Health - Well-being, (d) Smart Resources, Management & Manufacturing Industries, (e) Urban Planning, Mobility Dynamics & Logistics, and (f) New Energy Demand and Delivery;
- EWI developed a policy note on the "Strategic framework for Smart Specialisation in Flanders"[133] (2014) describing the policy process towards the prioritised areas;
- The 2014-2019 new governing agreement called for a cluster policy to tackle the Flemish innovation paradox (2014). The policy note "2014-2019 for Work, Economy, Science and Innovation" mentions cluster as a cooperation mean for actors from the triple helix to develop innovative value chains in specific domains. The Flemish Government also approved a Concept Note on a Cluster policy (2015);
- The cluster strategy elaborated 2 types of clusters: (large-scaled) spearhead clusters on the one hand, and (smaller- scaled) innovative enterprise networks on the other hand (2015-16).

As outlined in the state of play analysis, the smart specialisation policy in Slovenia was successful in integrating fairly large number of entrepreneurs, businesses, and public research organisations in the innovation process. However, the selection of nine priority areas for Smart Specialisation was considered to be too many. In comparison, Austria selected eight, Estonia selected seven and Flanders selected ten priority areas. Flanders was however a very early adopter of Smart Specialisation, and so was able to be more ambitious with the number of priorities.

The strategic set up in Israel meanwhile is very specific. With limited potential in resource-intensive primary and secondary industries, Israel has had little choice that depending on the intellectual capacity of its people and on knowledge-intensive sectors. To bypass

[133] Flemish Government, 2014, *THE STRATEGIC POLICY FRAMEWORK for SMART SPECIALISATION in FLANDERS.* Accessed via https://s3platform.jrc.ec.europa.eu/documents/20182/226007/BE_Flanders_RIS3_201412_Final.pdf/c84147c7-bf20-475e-9971-cf993d101042 .

geopolitical isolation and small internal markets, the country has tended to gravitate toward high tech industries such as software and the internet. Almost half of its exports are in high-tech. In the field of cybersecurity Israeli companies hold a 10% global share. This is a very different situation to Slovenia or the other benchmark countries.

Long-term strategic commitment as a prerequisite for transferability in Slovenia.

Stability of the landscape is therefore a key element that features in all the benchmark countries and is crucial for success. A 2019 peer-review of the Estonian RTDI system suggested that a "lack of clarity about relative priorities and aspects of implementation leave limited space for effective coordination at the thematic level." The new 2035 strategy is therefore, in part, an attempt to remedy this. Austria meanwhile has experienced a remarkable catch-up process in the past two decades, showing long-term stability and important successes such as reaching 3.2% GDP invested in R&D in 2019.

Again, the unique case of Israel capitalised on large amounts of highly skilled immigration. In the 1990s alone, close to a million citizens from the former "Eastern Bloc" moved to Israel. Many of them had strong science and engineering backgrounds and were highly motivated to "make it" in the new country thus being willing to take risks. Policies such as the Yozma program, between 1993 and 1998, underwrote the development of one of the most efficient venture capital industries in the world.

Slovenia has quite the opposite set of conditions to Israel. In 2017, the OECD noted how low wages, lack of modern organisation and management and low numbers of international students in Slovenia's higher education system contributed to an outflow of high-skilled workers.[134] Having said this, all actors in the current innovation ecosystem are well recognised among the stakeholders. What can be noted is a lack of trust in the implementing agencies because arrangements and instruments are known to change in the short term (within 2 years). One key to implementation in Slovenia is ensuring a lower turnover of high-skilled positions in both the public and private sector through tax, wage and internationalisation of higher education, as was noted in interviews and workshops by a number of stakeholders.

Crucial also for long-term planning is having coherent structures across the innovation ecosystem. Estonia and Austria have perhaps the strongest coordination methodologies of the EU benchmarks. See **Figure 19** below for more information.

Figure 19 - Policy Coordination Structures in Estonia and Austria

Estonia's coordination system is organised according to development plans and programmes for each societal challenge. The compilation, implementation, and coordination of changes of the is the responsibility of the Government Office, in cooperation with the Ministry of Finance. [135] The policymaking process for innovation is

[134] OECD, 2017, OECD Skills Strategy Diagnostic Report: Executive Summary. Accessed via https://www.oecd.org/skills/nationalskillsstrategies/Skills-Strategy-Diagnostic-Report-Executive-Summary-Slovenia.pdf .

[135] Estonian Government, 08.10.2020, *The Government approved the national long-term development strategy "Estonia 2035"*. Accessed via https://www.valitsus.ee/en/news/government-approved-national-long-term-development-strategy-estonia-2035 .

also coordinated in central government, by the Prime Minister's Office, and it aims to ensure that innovation is linked with other relevant strategies.

In Austria coherence across all ministries was ensured during the process of developing the 2030 strategy through a Task Force. The Task Force concentrated particularly on output, impact, excellence and openness. This task force also had a 'drafting group', which contained key stakeholders in the innovation ecosystem.

In Slovenia, research and innovation policy is increasingly being embedded horizontally into other policy areas, such as the environment, climate change, social and health policy, regional policy, education, training, and skills policy. However, the pace of change needs to be increased and Estonia and Austria may have practices to offer here, which operational development plans and drafting groups.

In Estonia, one of the outcomes of their coordination system is that the two ministries with a mandate for Research and Innovation have created a combined strategy, aligned with the new ESIF priorities. This (new) strategic collaboration between the ministries is a conscious decision to encourage cooperation over competition (for funding and political priorities) and in order to avoid an overlap of activities. Although the ministries are still tasked with education/research and innovation respectively, they now have a shared remit, for example to promote knowledge transfer, and therefore work together closely in specific and common areas. The process for developing this strategy may be useful for developing the implementation plan for recommendations in Slovenia.

One point to note for comparison is that, although Austria has an excellent governance and research budget, it insufficiently converts its high research budget into corresponding innovation outputs. It has therefore identified a number of opportunities to tackle these challenges in its 2030 strategy. These include decreasing its administrative complexity for start-ups and research funding, rebalancing direct funding towards more competition, and addressing societal challenges or missions as a driver for change. It is also looking into the creation of a single research and innovation council, instead of the two it currently has.

3.2.2 Programmes and instruments

Types and format of instruments

This section will go into detail regarding the various programmes and instruments currently in use. It should be read in coordination with section 3.2.4, which outlines the major instruments identified during benchmarking.

In Estonia the major instruments are all financed based on quality and competition and the application process is mainly internationalised, all applications are submitted in English and peer reviewed with international reviewers. Similarly, in Austria, most of the funds allocated

by the Austrian Research Promotion Agency**,** the innovation agency, are competitive calls such as: single firm projects, collaborative projects on specific topics, structures and infrastructures including the COMET competence centres. The system in Flanders is characterised strongly by continuously open calls, with no deadlines for instruments. All systems balance the need for stability and competition to different extents. In Flanders, as many calls are continuously open and they cover many areas, there is no TRL gap *per se*, although there is a continuous adaptation to the needs of the society (challenges / missions) and opportunities.

The IIA agency in Israel provides a comprehensive set of programmes, from those targeting start-ups (incubators incentive program, innovation labs program, etc..), to growth (incentive program to encourage the establishment of MNC R&D centres in biotechnology and health, generic R&D incentive program for large companies, etc..), to technological Infrastructure, advanced manufacturing, partnerships, and societal challenges.

Slovenia, on paper, lists over 70 different support mechanisms available from the Slovene Enterprise Fund, Slovene Research Agency, SPIRIT, Ministry of Economic Development and Technology, Ministry of Education, Science and Sport. However, the main challenge is consistent availability year on year of instruments covering all TRL levels. The Flanders system of continuously open calls may be useful to ensure a stronger baseline of support.

Instrument focus, distribution and demand

In Israel, the IIA was created to provide a variety of practical tools and funding platforms addressing more or less the whole spectrum of innovation. This, for instance, includes early-stage entrepreneurs, mature companies trying to innovate, and academics with potentially exploitable ideas. IIA also facilitates networking between foreign and domestic players such as assisting foreign corporations to find Israeli collaborators or assisting Israeli companies locate markets abroad. In addition to TRL coverage, one potentially interesting feature for Slovenia to consider for the implementation of recommendations is the Entrepreneurship Development Programme in Estonia, it provides a 360-degree advisory service and the condition is that the business raises its added value with 10% after the treatment.

Furthermore, Estonia is advanced in terms of EU financial instruments, for example those available through the European Investment Bank. A list is available in section 2.2.2.3 of this report. The EIB has been active in Estonia since 1993 and in 2020, EIB Group financing for Estonian projects equalled 2.48% of Estonian GDP, the highest percentage of all EU countries.[136] The country has a strong history in the use of financial instruments and good return on investment.[137]

EIB activity is smaller in Slovenia and during the 2007-2013 period, the funding of Financial Instruments (FIs) was limited. The ERDF allocation to FIs amounted to about EUR 105 million, which represented around 11% of the total ERDF allocation for enterprise support. In addition, key tools such as soft loans were missing until 2021. In March 2021 SID Banka, launched a 30 million euro loan guarantee scheme to support research, development and

[136] European Investment Bank, 2020, *EIB Group activity in Estonia in 2020*. Accessed via https://www.eib.org/attachments/country/factsheet_estonia_2020_en.pdf .

[137] FI Compass, 12 December 2017, *Estonian success stories with financial instruments*. Accessed via https://www.fi-compass.eu/news/2017/12/estonian-success-stories-financial-instruments

innovation (RDI) projects of micro, small and medium-sized enterprises.[138] Programmes such as French ANVAR programme, the Small Firms Loan Guarantee in the UK, the Czech START programme, and the Polish Technological Credit could be helpful as a best practice in this area, alongside the benchmark countries.[139] The Austrian Funding Bank (AWS) also provides funding for corporate business development. It supports companies with low-interest loans, grants, guarantees as well as consulting and other services. Following simplifications, the bank focuses on four activities: developing ideas, setting up a business, sustainable expansion, and connecting services. It provided EUR 1,145 million in 2017, EUR 1,100 million in 2018, and EUR 1,120 million in 2019. The bank also operates several funds: The AWS Mid Cap Fund, The AWS Founders Fund, and the ERP fund. Flanders also has different thematic funds, outlined in more detail in **Figure *20*** , below.

Figure 20 - Features of the Financial Instruments in Flanders

In Flanders, PMV (Flanders Holding Company) provides risk capital, loans, guarantees and mezzanine finance, and manage other funds such as: Biotech Fonds Vlaanderen established in 1994, Gigarant, GIMV and the Flemish Environmental Holding (VMH). But the most important providers of private equity and venture capital on the private side are Ban Vlaanderen, the Business Angels Network in Flanders, and GIMV (Flanders Investment Company). GIMV focus on 4 sectors: Connected consumers, Heath & Care, Smart Industry, and Sustainable cities. GIMV is a European investment company, listed on Euronext Brussels. It manages a portfolio of around 55 companies with a combined turnover of EUR 2.5 billion and 14,000 employees. GIMV plays an important role in this the financial anchoring of Flemish growth companies with nearly 40 years of experience in private equity.

Specific to Venture Capital, Israel is ranked first in investments as percentage of GDP. Some 5,000 Start-up companies are active in Israel and a net of 600 more are launched on an annual basis. In the longer-term, Slovenia could consider making some key changes that feature in Israel related to finance and VC, such as the creation of a Small and Medium-sized Business Agency (SMBA). While the IIA has a longstanding presence in the Israeli policy framework and focuses on leading technology-based start-ups and SMEs, the SMBA has been established more recently to cater to all SMEs in Israel's main economic sectors. The agency provides business management training and coaching, subsidised access to finance (for example, through the national loans guarantee programme), and supports a new network of business development centres (called MAOF centres).

[138] Radomir Ralev, 11 March 2021, Slovenia's SID Banka launches 30 mln euro loan guarantee scheme to back MSMEs, See News. Accessed via https://seenews.com/news/slovenias-sid-banka-launches-30-mln-euro-loan-guarantee-scheme-to-back-msmes-734166

[139] European Commission, 2021, *Study on the effectiveness of public innovation support for SMEs in Europe*. Accessed via https://op.europa.eu/en/publication-detail/-/publication/d031aa03-9295-11eb-b85c-01aa75ed71a1/language-en/format-PDF/source-search .

3.2.3 Collaboration and networks

Estonia shows a similar path to Slovenia for large structural collaborations and networks, most were created in late 2000s and early 2010s with the help of European structural funds via clusters, competence centres and similar programmes. At the time of writing, it is estimated that there are around five centres left in operation. These underwent a legal transition and are now registered R&D institutions, which means they are part-funded by the government and eligible to apply for Calls for Proposals from the research funders. In Austria similarly, financial sustainability of networks is an area for improvement, particularly through more competition (open calls rather than regular funding for basic research) and addressing societal challenges or missions as a driver for change. In Flanders, collaborations and networks are strong, due to long-term support. Flanders was an early adopter of the concept of smart specialisation and the landscape is well-organised today with 4 strategic research centres and 6 spearhead clusters. The specific case of Israel is outlined more in **Figure 21** below. These Israeli networks, although interesting, are perhaps too advanced to serve as models for Slovenia.

Figure 21 - Israel collaboration networks

Israel has focused on developing collaboration networks, two of the most relevant examples from the IIA agency are:

- the Innovation Labs Program providing support to entrepreneurs with access to unique technological infrastructure, market insights, marketing avenues, and industry expertise, in order to reach a proof of concept and transform technological ideas into products.
- R&D Cooperation with Multinational Corporations: during the last few decades, multinational corporations operating at the frontiers of technology have established more than 350 R&D centres. Over the years, many of these multinational corporations have acquired significant numbers of Israeli start-ups and other companies, feeding the Israeli innovation ecosystem with monetary resources, leading research, skilled personnel, technological leadership in several areas and a well-established innovation ecosystem.

In Slovenia, as in Estonia, Competence Centres and (and incidentally SRIPS), struggled to find their role in the RTDI system (with some exceptions). In Estonia for example, they tend to compete with HEIs and with industry, which is counterproductive for the system as a whole. In Austria, the COMET programme (Competence Centres for Excellent Technologies) had some success for establishing new research priorities by creating major competence centres, as well as laboratories and special research infrastructures. The funding initiative COMET promotes the cooperation between companies and scientific facilities within the context of a jointly defined but high-level research program. So far 5 COMET Centres (K2), 24 COMET Centres (K1) and 63 COMET Projects with the total volume of about 2.24 billion EUR have been funded. Similar to Estonia and Slovenia, financial sustainability in Austria is a challenge.

Overall, Flanders exhibits the most successful approach to collaboration networks of the benchmark countries. The focus on strategic research centres (Figure 22) and spearhead clusters (Figure 23) is a gradual specialisation strategy. The focus is not to select a number of topics in which support of research will be concentrated, but to create an environment to foster the evolution from discovery to market introduction through collaboration. This is also called the entrepreneurial discovery process in which the innovation system is mainly based on bottom-up programmes. The Flemish system of smart specialisation aims to provide an intensification and strengthening around a number of centres and clusters within an open and flexible system that allows, and even encourages, cross-links and remains open for bottom-up initiatives that complement the focused approach.

Figure 22 - Flemish Example of Strategic Research Centres

To acquire critical mass, the foundation of **strategic research centres** was key. This started in the 1980's with the foundation of IMEC but was continued in the following years with the most recent one, Flanders' Make, in 2014. Such institutes receive a donation from the government and participate in different programmes for support to research institutes on a competitive basis. They are all involved in tech transfer and have an active interaction with industry. All strategic research centres are involved in triple helix collaborations.

- **IMEC (1984)**, a fusion between the former IMEC (1984) with a focus on nano-electronics and iMinds (2004) with a focus on broadband technology. IMEC is a large research institute, its staff counts more than 3,500 people including industrial residents and guest researchers. IMEC has a strong track record for conducting research with major international companies through which it has established a high level of self-sustained financing. Its turnover has risen from approximately 300 million euro in 2010, to 500 million euro in 2016 and is estimated at 640 million euro in 2019, with 73% contributed by industry.[140]
- **VITO (1991)**, a research centre with 784 people mainly focuses its research and development activities on sustainable development and cleantech. Companies can turn to VITO for expertise, test facilities, joint ventures, joint project proposals, and more. The knowledge of VITO is valorised through contract research, venturing, and internationalisation. VITO offers new and sustainable technologies and processes that are demonstrated on the institute's own test facilities, through living labs or in external set ups from clients. VITO has a focus on grand societal challenges such as climate change, food security, scarcity of raw materials, sustainable energy, aging, etc...
- **VIB (1995)** (Flemish institute in Biotechnology) is a virtual centre combining 75 research groups embedded within 5 main universities. VIB conducts front-line research in life sciences and translates the results into societal and

[140] IMEC, 15 January 2020, *The 10 things you need to know about imec in 2019*. Accessed via: https://www.imec-int.com/en/articles/the-10-things-you-need-to-know-about-imec-in-2019

economic value, with a particular strong valorisation record through the creation spin off biotech companies. The main topics are on oncology, brain and disease research, inflammation, neuro-genetics, microbiology, plant systems biology, structural biology and medical biotechnology.

- **Flanders' Make (2014)** was established through the cooperation of different existing organisations like Agoria, Sirris, Flanders' DRIVE, Flanders Mechatronics Technology Centre and the five Flemish universities with the mission to strengthen the long-term international competitiveness of the Flemish manufacturing industry by performing excellent, industry-driven, pre-competitive research in the domains of mechatronics, product development methods and advanced manufacturing technologies'. Flanders' make acts partially as a virtual research centres but, in contrast to VIB, has a focus on joint R&D projects with equal partnership between knowledge institutes and existing enterprises.

In 2018 the four strategic research centres receive from the Department of Economy, Science and Innovation the following **grants** (million €):

imec	110,2
vib	60,5
vito	48,9
Flanders Make	18,7

Figure 23 - Flemish Example of Spearhead Clusters

Spearhead clusters must be focused on the long term (10 year), large-scaled, limited in number, strictly selected, require a triple helix model, and in future make a difference from economic point of view. A choice was made for clusters and sectors that match with the regional strengths of the Flemish industry and knowledge base to make a difference at the international level. Spearhead clusters act in triple helix collaboration, develop strategic roadmaps, have a central role in the innovation ecosystem and provide a leverage to international collaboration. All six of the current spearhead clusters will therefore develop an international orientation. In the selection process, the domains defined in the European Regional Development Fund (ERDF) programme 2014-2020 were used as an indicative group of domains.

As a direct result of the recent calls for proposals, **six spearhead clusters** have been selected. Spearhead clusters have a budget for organisational working costs which are funded half by the government (max. 500.000 €/year) and half by the enterprises. In addition, they act as a coordinator for their members that have access to all programmes available for support for R&D&I in Flanders on a competitive basis. Depending on the nature of the members, this can include state aid or aid for non-economic activities. Activities range from basic research to dissemination and

implementation. The clusters stimulate and assist their members to participate in international programmes for RTDI:

The following clusters were selected:

- **Catalisti** in the domain of sustainable chemistry. The cluster has four main innovation programmes: "Renewable Chemicals", "Sidestream Valorisation", "Process Intensification and Optimisation" and "Advanced Sustainable Products".
- **Flanders' Food** in the domain of agro-food. The cluster has two knowledge-driven strategic objectives (lead in knowledge and lead to knowledge) and two business-driven strategic objectives (accelerate efficient & effective innovation and cross/create value chains). The knowledge-driven strategic goals will focus on (1) World Class Food Production, (2) Resilient & Sustainable Agrifood Systems and (3) Personalized Food Products & Healthy Diets.
- **SIM** in the domain of advanced materials. SIM aims to further strengthen the favourable position of the Flanders Materials related eco-system, with strengths such as materials for 3D printing, nanoparticle production, handling and encapsulation.
- **Flanders Logistics cluster** (VIL) in the domain of specialise logistics. Its programming is centred around four main themes: (1) digitization with three sub-themes: smart technology, business models and data management, (2) sustainability themes like CO_2 reduction and energy efficiency objectives for logistics in smart cities, circular and sharing economy, infrastructure (3) ambition 'Flanders gateways', i.e. Flanders as a global connected trading partner and (4) omni-channel distribution systems for various application.
- **Flux50** in the domain of energy (smart grids). 5 innovator zones have been selected: energy harbours, micro grids, multi-energy solutions for districts, energy cloud platforms, intelligent renovation
- **Blue cluster** with an emphasis on sustainable economic activities related to the North Sea and beyond. The cluster is active in (1) coastal protection and mineral resources, (2) renewable energy and fresh water production, (3) maritime connectivity, (4) sustainable food production and marine biotechnology, (5) blue tourism and (6) ocean pollution.

In 2017 more than **45 million €** from VLAIO is allocated to projects with spearhead clusters in 90 projects. More than **2000 companies** in Flanders paid a membership contribution to a spearhead cluster (1196) or an innovative business network (825).

From the benchmarking, the conclusion is that the immediate focus in Slovenia for the SRIPs and similar is to become financed on the merits of success or performance, not on eligible costs. Furthermore, a lack of coordination with the ministries relevant to each SRIP thematic area means they are not as integrated into the policymaking process as they could be. There must be one SRIP contact point in each relevant ministry (transport, health etc).

With regards to funding, the transformation that Competence Centres undertook in Estonia and Austria may look to be a short-term solution for SRIPS, allowing them to sustain themselves on the basis of each competence centre being responsible for applying to and winning competitive calls to build their revenue. In the longer-term however, the Flanders example should be seen as the ideal., which has the highest percentage of funds coming from the private sector.

3.2.4 Major initiatives in benchmark countries

This table provides a summary of the initiatives outlined in the preceding chapters of the report, including the case studies.

Austria	Estonia
Flanders	Israel

Name of initiative[141]	Call method	Total budget	Target recipient	TRL coverage
COMET	Open calls	2.24 billion	Companies and scientific facilities	Higher TRLs
Qualification and talent	Open calls	undefined	SMEs, Large companies, Universities, Universities of applied sciences, Competence centres, Research facilities, Start Up, Multipliers / Intermediaries	All TRL
Various supports to participate in EU programmes (Horizon 2020, EUREKA, Eurostars-2, COST, COSME)	Open calls	undefined	SMEs, Large companies, Universities, Universities of applied sciences, Competence centres, Research facilities, Start Up, Multipliers / Intermediaries	All TRL

[141] Austrian Research Promotion Agency, 2020, *Current Funding Opportunities*. Accessed via www.ffg.at/en/content/funding

BRIDGE – Knowledge transfer between science and economy	Open calls	Undefined up to 80 % of cost covered	SMEs, Large companies, Universities, Universities of applied sciences, Competence centres, Research facilities, Start Up, Multipliers / Intermediaries	Higher TRLs
Innovation Voucher	Open calls	Undefined 80% of max. € 12,500	SMEs	Higher TRLs
Industrial PhD	Continuously open	Undefined	Research, companies and research institution	All TRLs

Name of initiative[142]	**Call method**	**Total budget**	**Target recipient**	**TRL coverage**
Personal research funding	Calls for proposals	Unknown	Person or a research group working at an R&D institution.	Unspecified, presumably lower TRLs
Mobilitas Pluss	Calls for proposals	The budget for Mobilitas Pluss is 35 373 770 euros, 83.5% of which is covered by the European	Person or a research group working at an R&D institution. Researchers working abroad (counteract brain drain)	Unspecified, presumably lower TRLs

[142] This information was gathered through an Interview with Estonian Research Council and Enterprise Estonia and supported with information on their websites.

		Regional Development Fund.		
Partnership and Cooperation Programme including: ● ERA-Nets ● Baltic Research Cooperation Programme ● European Molecular Biology Organisation ● NordForsk Bonus	Calls for Proposals	Not specified – this is a portfolio of grants	Various actors, researchers in R&D institutions, companies, policymakers	Various – this is portfolio of grants in its own right
Infrastructure funding	Unknown	Unknown Support for research infrastructure is provided by different funding instruments.		Presumably all TRL for RI
Applied research funding	Calls for Proposals	The volume of funding in a call for proposals is up to 9 million euros, the	Collaboration between R&D institutions and companies (in RIS3 areas)	Higher TRLs -the funding supports companies in commissioning necessary applied research or product

		maximum volume of funding per project is 2 million euros		development projects from universities or research institutions.
Enterprise development programme	Unknown	63,000,000 euros	Companies	Higher TRLs and company development

Austria	Estonia
Flanders	Israel

Name of initiative[143]	**Call method**	**Total budget**	**Target recipient**	**TRL coverage**
Specialisation of the economy on 10 fields	Not direct, through the 10 Strategic Research Centers (SRC) and clusters in charge of one each	Not defined	All companies including SMEs in Flanders	Higher TRLs

[143] Flemish Agency for Innovation and Entrepreneurship, Subsidies for Entrepreneurs. Accessed via https://www.vlaio.be/nl/andere-doelgroepen/flanders-innovation-entrepreneurship/subsidies-entrepreneurs/subsidies

SME e-wallet / growth subsidy - financial aid in the purchase of training and advice	Continuously open	Undefined SME e-wall: €7,500 for the SME SME growth subsidy: €50,000 for the SME	SMEs in Flanders	Higher TRLs
Development project / Research project / Strategic transformation support	Continuously open	Undefined Development project / Research project: 20 to 60% of the project Strategic transformation support: 8% of the investment / 20% of the education	both SMEs and large enterprises in Flanders	Higher TRLs
Incubators	Continuously open	Undefined max. €1,000,000 for investments	Entities being able to provide accommodation for research-intensive starters in Flanders	Higher TRLs
Development project on a pilot scale	Continuously open	Undefined 25 to 50% subsidy of the project budget (min. €100,000)	All companies in Flanders	pilot-sca le/demo activities

Subsidies for innovation and R&D in an international consortium[144]	Continuously open	Undefined	All companies in Flanders	Higher TRLs
PhD	Continuously open	Undefined 50 to 80% of the staff and operating costs of the PhD student	Flemish enterprise, a Flemish university and a PhD student	All TRL

Austria	Estonia
Flanders	Israel

Name of initiative[145]	**Call method**	**Total budget**	**Target recipient**	**TRL coverage**
Technological Innovation Incubators Program	Open calls	Undefined up to 85% of the approved budget (max. €900,00)	Entities that are interested in establishing technological incubators	Higher TRLs

[144] Flemish Agency for Innovation and Entrepreneurship, *Subsidies for O&O&I in an international consortium*. Accessed via https://www.vlaio.be/nl/subsidies-financiering/subsidies-voor-ooi-een-internationaal-consortium/networks

[145] Innovation Israel, 2020, *The Israel Innovation Authority.* Accessed via https://innovationisrael.org.il/en/contentpage/israel-innovation-authority

Tnufa (Ideation) Incentive Program:	Open calls	Undefined up to 85% of the approved budget (max. €51,000)	SMEs	Higher TRLs
Early-Stage Companies Incentive Program	Open calls	Undefined up to 50% of the approved budget (max. €25,000)	start-ups	Higher TRLs
R&D fund	Open calls	Undefined 20%-50% of the approved R&D expenditure IIA gets royalties from sales	companies	All TRLs
Generic R&D Incentive Program for Large Companies: supporting long-term R&D	Open calls	Undefined 20%-50% of the approved long-term R&D expenditures	Large Companies	All TRLs

3.2.5 Monitoring and Evaluation

In Estonia, although the monitoring and evaluation system is advanced, improvements are still being made. In particular these seek to improve the consistency between monitoring and evaluation. For example, one particular challenge is to ensure that the *ex-post* assessments of programmes are carried out in time to feed into the next round of the policy cycle (i.e., the design of the follow up programme.) In this regard, the roles of having mirrored public/ private scientific advisor networks, although a newer policy (since 2020), may help Estonia in the longer term and should be monitored by Slovenia. Overall, the monitoring and evaluation system is the most developed in Austria, with the mandate of the Austrian Council for Research and Technology Development. The role of the Austrian Council for Research Technology and Development, its composition and outputs as well as its coordination and ways of working is described in **Figure 24** below.

Figure 24 - Example of the Austrian monitoring entity [146]

The Austrian Council for Research and Technology Development is an independent entity that monitors the entire national innovation system. It may be consulted by both federal and regional institutions. Its role is the following:

- Advising the Federal and State Governments (Länder) and, if requested individual Government Ministers, on all matters regarding research, technology and innovation.
- Drawing up guidelines for a long-term Austrian RTD strategy and monitoring its gradual implementation.
- Drawing up proposals regarding the definition of key areas for national research and technology programmes and for funding policy for all research, innovation and technology-oriented institutions with federal participation.
- The independent submission of proposals for national research and technology programmes.
- Drawing up proposals to improve cooperation between science and industry, in particular by bringing together university research, applied research and technology development.
- Developing proposals that conform to international standards for monitoring all research, innovation and technology-oriented institutions in which the Federal Government is involved.

Its overall task is to make recommendations to the Austrian Government on all issues relating to research, technology and innovation policy. These either take the form of strategy documents with a recommendatory nature or, in specific cases, are made as individual recommendations. The council is made of eight members with voting rights, four of whom were appointed by the Minister of Education, Science and Research and

[146] Austrian Council, About Us. Accessed via: https://www.rat-fte.at/about-us.html

four by the Minister of Climate Action, Environment, Energy, Mobility, Innovation and Technology. The Minister of Climate Action, Environment, Energy, Mobility, Innovation and Technology, the Minister of Education, Science and Research, the Minister of Digital and Economic Affairs and the Minister of Finance or their designated representatives hold seats but have no voting rights.

Furthermore, it should be noted that monitoring and evaluation in Austria is complemented by periodic analysis, such as the one outlined in **Figure 25**. This practice is interesting for Slovenia as it features sub-contracted responsibilities to independent institutes, combing national and international experts. The Austrian Council's innovation monitoring shows that the performance of the Austrian RTDI system has definitely improved since 2010, although it identified a lack of efficiency in the return on investment for key instruments. The OECD has confirmed the assessment, by raising the challenge to transform its sizeable investment in RTDI into more decisive economic and social impacts.

Figure 25 - Example of sub-contracting of monitoring and evaluation activities

In 2008, the Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology (BMK), together with the Federal Ministry for Economic Affairs and Labour, commissioned the system evaluation of research funding and funding to four independent institutes WIFO, KMUFA, Prognos and convelop. 22 national and international experts were also involved. The aim was to analyse the performance of the Austrian innovation system and to identify improvements. The 9 reports are public and available online. [147]

In Flanders, governance, monitoring and evaluation is under the responsibility of the government (EWI, the department of economy, science and innovation). The policy initiatives, evolution, whereabouts, available budgets and statistics that describe the Flanders' research and innovation landscape are being monitored and reported on in a structural manner mostly by the EWI Department. However, various EWI agencies also provide information and data about their own specific initiatives and budgets, or conduct studies, as does the advisory body VARIO (studies, advice, benchmarks) or ECOOM (see below).

Figure 26 - Monitoring indicators in Flanders

Flanders monitors a series of indicators through the annual publications of ECOOM monitoring the efficiency of the policy such as:

- The **relative specialisation index** which maps the specialisation structure of the science, innovation and economy system. This index compares the distribution of activities from a region with the average distribution of the same type of activities in the whole of Europe. The statistics on respectively the scientific publications, patents, and exports are used as proxies for these kinds of activities. A more than average

[147] *ibid*

share of these suggests a specialisation in that specific domain. The **technological specialisation of Flanders** based on the EPO patents is displayed hereunder. Patents are grouped in 35 technology domains (ISI, Fraunhofer Gesellschaft) and a specialisation- index RTAN that can vary between -1 (under specialisation) and +1 (maximal specialisation). Flanders has built up a relatively strong technological position in certain chemical domains (e.g. food chemistry, macromolecular chemistry), semiconductors, civil engineering (roads and water engineering), pharmaceutical applications, biotechnology, analysis of biological materials, microstructures and nanotechnology, basic communication processes, semiconductors, optical applications, textiles and paper machinery and other specialised machinery.

- The **economic specialisation pattern** (based on the relative export shares) of Flanders reflects the maturity of the economy. The Flemish economy has maintained a critical mass to remain competitive in most sectors, while some do not appear as a specialisation due to the given conditions (e.g. mining).

In addition, VARIO, the Flemish Advisory Council for Innovation and Enterprise, advises both the Flemish Government and the Flemish Parliament on its science, technology, innovation, industry and entrepreneurship policy. The council does this on its own initiative as well as on request. VARIO works independently from the Flemish Government and the Flemish stakeholders as VARIO council members take part in their personal capacity. For example, during 2012-13, VARIO has defined 7 key priority transition areas, and 9 themes that cover society's needs on economic, ecological and sociocultural levels to be achieved by 2050. However, the Flemish system, although effective, has many moving parts submitting data and information and was built up over time. It also lacks consistent overall instrument evaluations and would therefore be complex to attempt to transfer all these elements to the Slovenian context.

In Slovenia, although there is regular monitoring of individual projects, the implementing bodies do not conduct detailed reviews of implementation for specific instruments. One might be chosen each year depending on the implementation (for example depending on the availability of funds) or changes in the needs of the target groups (to see how interest rate changes affect the use of instruments). Evidence of this can be seen with the patent voucher, which is periodically discussed in terms of 'needs' with the patent office and other stakeholders. However, the analysis is not deep or systematic, and lack comparable indicators, control groups or other elements which would be a normal practice in the evaluation processes. This lack of consistency is obviously sub-optimal when considering the resources placed into monitoring and evaluation in the benchmarked systems. In this regard, the internal management and coordination of the Austrian Council for Research and Technology Development should be further investigated when developing an implementation plan for recommendations.

3.3 SWOT Analysis

The Cross Analysis and State of Play report have revealed the following strengths, weaknesses, opportunities and threats (SWOT) for each of the benchmark country systems. This has been overlayed with a SWOT of Slovenia, resulting from the state of play analysis conducted in the previous report.

Austria	Estonia	**Slovenia**
Flanders	Israel	

Strengths	Weaknesses
Economic growth, although slowing, remains robust.	**Weak Venture Capital market**
Slovenia scores high on International scientific co-publications and public-private co-publications.	**Absence of a coherent strategic document on the innovation ecosystem development**
There is successful participation in European innovation and research programmes.	**Sub-optimal division of responsibilities between public authorities**
Slovenia has a competitive advantage in certain areas, such as artificial intelligence and robotics.	**Low number of doctoral students.**

The country has an excellent track record in selected scientific and technological fields, including physics, materials, biochemistry and more recently in areas tackling climate-related challenges. **There exists a dynamic start-up ecosystem in the area of information and communication technologies, backed by solid business support services.**	**Perceived unwelcoming innovation environment (e.g. tax environment)** **Low levels of national funding and low levels of foreign direct investment.** **Short term planning of the instruments and perceived fragmentation of instruments across ministries** **Productivity gap vis-à-vis European and OECD averages** **Lack of internal purchasing power for innovation (related to weak Venture capital market)** **Lack of collaboration network sustainability** **Inefficiency of public instruments on firm innovation or business models** **Very low levels of knowledge transfer and decreasing numbers of patents**

'Strong Innovator' (EIS) in particular on **collaboration efforts between innovating firms, private and public sectors**, and the extent to which the private sector finances public R&D activities. Austria also proposes an **attractive research system.** Policies is based on **long-term plan and strong long-term** commitment both political and financial into STI programs. The leading companies play a key role as drivers of innovation in Austria. SMEs also take a huge share in the innovation landscape.	Austria is still a relatively **small country** with limited resources **Inefficiency and insufficient conversion of high research budget into corresponding innovation outputs.** Austria invests an above-average high amount in its R&D system, but this only generates comparatively moderate innovation output. Shortage of **risk capital**
Small but effective system **without fragmentation** Strong political interest and understanding of RTDI Competitive research performers High net migration with Estonians increasingly returning home[148]	**Low levels** of funding Weak participation by the **private sector** Declining university enrolments and advanced skills shortage[149] low private investment in R&D insufficient cooperation between businesses and academia,

[148] OECD, *Benchmarking Higher Education Performance*, 2019. Accessed via https://www.oecd-ilibrary.org/education/benchmarking-higher-education-system-performance_be5514d7-en

[149] ibid

		insufficient prioritisation of research and innovation investment, Lack of entrepreneurial discovery process.
	Policy is based on middle to long-term plan **Strong long-term commitment** both political and financial into STI programs 'Strong + Innovator' (EIS) in particular on the following **cooperation of innovative SMEs**, as well as for innovations in products, processes or the organization Strong **patent application** (EPO) with both companies, and universities Strong **intermediary institutions**: VLAIO, VARIO, and Strategic Research Centers and spearhead clusters Favourable demographic trend, projected growth in younger population who could become innovators.[150]	**Small country.** Economic theory states that smaller countries are more vulnerable to international economic fluctuations, given the openness of their economy, They usually seek specialisation in order to be internationally competitive, and often rely on one or two export products. Furthermore, their export is concentrated on specific markets. The value-added of these specific products or markets can be a strong factor in overall economic growth.[151] **Productivity growth decline** in Flanders Low levels of science and technology graduates Comparatively low levels of trademarks and app creation.[152]

[150] OECD, 2019. *Benchmarking Higher Education Performance*. Accessed via https://www.oecd-ilibrary.org/education/benchmarking-higher-education-system-performance_be5514d7-en.

[151] See, for example, the work of Petar Kurecic and Đana Luša, 2014, *The economic growth of small states and small economies in regional economic organizations and integrations: similarities and differences*, Journal of Education Culture and Society.

[152] WIPO, 2020, *Global Innovation Index: Belgium*, accessed via https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020/be.pdf .

Start-up nation Advanced **risk capital** ecosystem Skilled human capital Large and engaged expatriate network Highly productive university system STI system geared to application.	A state under siege Culture of quick profit
Opportunities	**Threats**
Social norms can be a huge driver for the Slovene system if they are successfully orientated towards innovation (for example reducing the current aversion of uncertainty and risk, or more widely promoting public innovation infrastructure and equipment to different social groups through workshops, trainings, communication and dissemination campaigns) **Strong history and development in key technologies, such as blockchain and artificial intelligence. Blockchain is**	**Open economy vulnerable to international shocks** **Improvement is conditional upon future efficient use of infrastructure and knowledge by industry of how to use it and what is available.**

	already widely used in the Slovene FinTech sector[153], and AI has a long history in Slovenia dating back to the 1970s.	
	Moving from 'Strong Innovator' to 'innovation leader' on the European Innovation Scoreboard **Decreasing administrative complexity** for Start-ups, and research funding. Rebalancing direct funding towards **more competition** Addressing societal challenges or missions (under discussion at the moment) Creation a single council (instead of two supporting basic research and applied research) for science, research and innovation could strengthen coordination and advance innovation relevant issues.	The past improvement is not sufficient to move in any significant way towards the level of the innovation leaders. Austria today still lags innovation leaders such as Denmark, the Netherlands, Sweden and Switzerland
	Improve **public-private collaboration** (still a weakness)	Maintaining **international competitiveness**

[153] See for example, Charlotte Tucker, *February 22 2021*, 10 promising Slovenian startups to watch in 202. Companies such at GETON, Bloacksquare and Oxcert, Cargo X and ICONOMI are a;ll developing blockchain solutions and are also strong players internationally. In 2020 the third blockchain conference was hosted in Ljubljana. Analysis. accessed via https://www.eu-startups.com/2021/02/10-promising-slovenian-startups-to-watch-in-2021/

	Improve competitiveness in thematic strong areas (ICT…) Enhance regional links and international collaboration with Scandinavia and the Baltic states	
	Become an innovation leader (EIS) by focusing on innovation spending at SMEs and employment in knowledge-intensive sectors. Societal transformation on the following areas: circular economy transition, smart living, industry 4.0, lifelong learning transition, caring and living together transition, mobility transition, and energy transition	Societal transformations[154] (e.g. transitions) that require radical innovations (vision 2050): world population growth, urbanisation, an aging population, climate change, growing demand for water and energy, digitalisation, diversification and individualisation of society, inequality in health and prosperity, etc.
	Scale up nation Huge numbers of foreign R&D labs located in the country Very extensive expatriate population well networked with the motherland	Inability to grow 1st tier international players Regional instability

[154] Flemish Government, 2018, *Vision 2050*, strategy. Accessed via https://publicaties.vlaanderen.be/view-file/28831

3.4 Benchmarked profiles

Overall, the benchmarking countries have the following characteristics evaluated against usefulness in the Slovenian context:

Austria: A system with strong behavioural incentives and long-term commitment. Austria has had decades of commitment to building its innovation ecosystem, despite frequent political changes. Like Slovenia, it also struggles with an inefficient public funding system, albeit counteracted with much higher levels of investment. It does not share any notable threats with Slovenia but does share similar opportunities related to decreasing the administration needed to access public money and moving towards greater competition, which could allow for a joint learning process.

Estonia: An accessible and reasonably efficient system. Low levels of fragmentation and a small number of actors mean Estonia offers demonstrable best practices for topics related to competitive instruments and agency set-up. It should be said though that Estonia faces a lot of challenges, including similar weaknesses and threats to Slovenia relating to low levels of national funding, international competitiveness, and participation of the private sector.

Flanders: A client-orientated and commercially focused system. Strong patent revenues, private sector involvement and simplicity of intermediaries and agencies characterise this country. Like Slovenia and others, it is also facing declines in productivity but beyond that does not share too many similarities.

Israel: A unique system and not easily replicated. The analysis has shown that Israel has many advanced practices, but the conditions are too dissimilar to Slovenia for directly transferable advanced practices. There may however be some inspiration drawn from the advanced risk capital system and application of innovations more generally.

Outcomes and conclusions

4.1 Priority areas for Slovenia

Based on the analysis conducted for the state of play report, and the outcomes of the gap analysis workshop and co-construction roundtable, the following three priority areas have been selected for further analysis and will form the basis of recommendations and capacity building in Activities 4 and 5.

This report seeks to consider the views of various actors and stakeholders when making the analysis, some of which may indeed be contradictory. Conceptually, different innovation ecosystems must be seen as the result of trade-offs at various levels, depending on the narrative of the policy mix over many years. Questions looking at topics such as the 'right' amount of funding for industry or 'how long a structural network (i.e., competence centre) becomes financially independent', can therefore only be assessed retrospectively. With this in mind, the recommendations report will build on concrete policies and programmes presented and the preliminary assessment provided below.

N.B The order of the priority areas does not reflect importance at this stage, individual recommendations will begin to be prioritised during activity 4 of the project.

4.1.1 Priority area – Building the Risk Capital ecosystem

Sub-priority: Structure the investment landscape.

Currently, with the exception of tickets up to 50.000 EUR, venture capital (VC) is unstructured in Slovenia. While the Slovenian Enterprise fund has developed several instruments (micro-loans, guarantees that are also matched with private investments), and is developing further, the total amount of funding is too small. The same applies to the second key player in Slovenia, SID Banka, the Slovenian Development bank. This gap is particularly acute for early- (pre-seed and seed) but also late-stage (growth) VC, post-TRL 9 and one pre-commercial and innovation stage. On the European Innovation scoreboard Finance and support in Slovenia in comparison to the EU average is only 60,2 %.[155] Early-stage investments from corporate sources are also currently missing and there is a need for an investment regulation streamlining plan. There are ongoing efforts in this area, and Slovenian alternative investment fund legislation (the Law on Alternative Investment Fund Managers) was renovated and passed in 2021.[156] A new law on forms of alternative investment funds is also being written. Both acts were passed in June 2021.

Sub-priority: Build a critical mass for start-ups and SME risk capital.

Some kind of initial public investment into the privately run fund need to be provided to attract private investors. There is also no dedicated Slovenian investment fund (apart from SEGIP – Slovenian Equity Growth Investment Programme, launched in 2019 and based on a collaboration of European Investment Fund (EIF) and SID Banka intended to provide financial support to private equity firms). Poland for example has invested 500 million euros

[155] European Commission, 2021, *European Innovation Scoreboard 2021*. Accessed via https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en

[156] A full list of legislative acts can be found via: http://www.pisrs.si/Pis

of national funds to jump start the VC industry.[157] The SID development bank needs to kickstart the development and there should be the release of large domestic capital resources including the permitting corporate/pension and investment funds to invest in risk capital, within reason. A lot of capital is sitting in residential personal savings, these funds should be promoted for use via the stock market and not necessarily risk capital. Furthermore, spreading some of these funds among different financial instruments, including equities and fixed income, would indirectly support the development of a risk capital market in Slovenia. Within this critical mass, further support to business investment angels in a form of tax break to emulate the British example, the SEIS Tax relief, should be considered. Certain changes on how pension funds, insurance companies, banks and other types of investors are regulated are needed, in order to raise willingness for investing into VC. Slovenia could also benefit much more from existing European funding opportunities, in a way of a local national finance system, that would support and finance local innovation actors, to be embedded into European networks, such as participation in European research and innovation programmes provided by Horizon Europe and the European Institute of Innovation and Technology (EIT). For example, by expanding the participation to most KIC and their venture funding.

Sub-priority: Private sector Venture Capital needs to be attracted & complemented.

The stakeholder's workshops revealed that there is the perception of an unfriendly foreign investment environment in Slovenia. While establishing a company is easy, for any change of capital a notary is required, furthermore the owners of the company must be present in the country. Both of these are a disincentive to foreign investors. One further challenge is the expenses related to employment, the tax rate and social contributions of very high skilled labour are comparatively high and the provision of stock options to employees in Slovenia is impractical.

In the next 5–10-year period, attracting foreign capital should be a key priority. At present, the system is not providing the right incentives for this. Slovenia needs a clear and communicable 'offer' to attract quality foreign investors who need specific benefits.

4.1.1.1 Preliminary recommendations

- Set up a financing scheme for early stage/TRL5 pre-commercial equity investment (that could be implemented in combination with grant support, using a blending approach). This measure would consider primarily tickets between €50k – €200k.
- Set up an Equity scheme for Post-TRL9 innovation (scale-up) to fill in for growth venture capital (deployment) with tickets of €200k to €2M.
- Further develop the "blending approach", developed during the roundtable workshop (i.e. using grant for TRL 6-7, equity for 8-9 and beyond, then guarantees for post-project support).
- Equip SID Banka, the Slovenian development bank and/or the Slovene Enterprise Fund with a VC arm (providing cooperation to fund management firms like EIF does – to stimulate investments into innovative and high-growth companies)

[157] Borys Musielak, 2 October 2017, *Why has Poland become such a hot place for European startups?*. Accessed via https://michuk.medium.com/why-has-poland-become-such-a-hot-place-for-european-startups-b7cbbf4399ee

- Consider a transition of the Slovenian Enterprise Fund from a Public entity to a Publicly owned entity – such as the European Investment Bank
- Reform and improve the tax system to encourage venture capital. This should be done incrementally, and a first step could be to provide support for business investment angels in the form of tax break (for example the UK: Seed Enterprise Investment Scheme Tax relief).
- Integrate Venture Capital priorities in the new set of innovation vouchers currently being prepared from the REACT EU sources. There should also be a focus on filling funding gaps in the post-TRL 9 and pre-commercial stages with national funding.
- Develop a clear and communicable 'offer' for foreign investors.

4.1.2 Priority area – Setting innovation collaboration

Sub-priority: Promote effective use of research, analysis, understanding and knowledge of the problems that currently exist, to select achievable goals.

Slovenia is an analysis-rich innovation system, and the challenge is related to how to organise and disseminate this analysis in such a way as to work towards clear, defined, and implementable goals for the whole innovation ecosystem. This would lead to a requirement of respected institutions, both academies and universities, supported by ministries, to select a small number of common goals to work towards.

On the political side, there have been a number of attempts to set up common goals among stakeholders, which have met with a divergence of motivations at later stages. What is required is for the whole ecosystem to first align their own goals, commit to them and select a small number of overlapping goals to put collectively to the Government Minister responsible.

Sub-priority: The need for stability and a long-term policy planning and implementation for the system.

There is an overall stakeholder impression, supported by the current sustainability challenges, that SRIPs were planned to become sustainable too quickly after their establishment. The SRIPS are funded in 3 key stages of two years each. The first two years of implementation are followed by a maturity stage of two years and an evaluation, whereby if the SRIP does not reach a certain number of points the contract is terminated. Indications from stakeholders and research has suggested that 4 years is too short to conduct such an abrupt go/ no go evaluation. When looking at the benchmarked systems, there are instruments there which have a ten-year rollout phase which has been analysed as what is needed for sustainability. There are also networks and collaborations which combine various levels of competitive funding, rather than block funding. Recommendations have been drafted and not implemented, and capacity building is required to understand where the blockages are and how to clear them. For example, the most recent draft text of the law on research and innovation, which began preparations in 2013, has many recommendations which stakeholders feel are of high quality.

Sub-priority: Build trust and competition within the RTDI ecosystem and confidence in the effective evaluation and execution of initiatives.

This trust element has several facets. The first is regarding trust of researchers, who may have potential innovations to go outside of their comfort zone and pitch their ideas. The second looks at the difficulties surrounding collaboration if partners are not sure of the legal protection of their ideas, linked to awareness raising and IPR. Research institutes similarly struggle to offer their infrastructure on a systematic basis if they are not confident of rules surrounding state aid. All of these factors related to lack of confidence, understanding and trust affect the success and number of collaborations in the innovation ecosystem.

Furthermore, Financial planning of collaboration instruments, including budgeting and salaries, must attract the highest quality people. Evaluation of these measures should have a clear mandate for action or follow up and be published. At the same time, research institutes have the perception that university-level funding, which funds early stage TRL3-6 in other countries, is missing in Slovenia and this is a challenge when it comes to support for innovation collaboration.

4.1.2.1 Preliminary recommendations

- Re-design a set of monitoring and evaluation methods for existing collaboration funding, including the instruments themselves, commercial incentives and the content of those collaborations. The monitoring should be continuous and provides evidence for periodic evaluation. These methods should be applied on the level of strategic implementation and for key instruments.
- Embark on a trust-building initiative between collaborators for projects. This can be operationalised through trainings on key skills, such as IP management, new developments on level of EU state aid regulations etc.
- Ensure ten-year+ stability of collaboration networks and draft a strategic plan to get there and implementation roadmaps.
- Address the challenge of high turnover of human resources in the innovation ecosystem to ensure ownership of recommendations. For example, frequent movement of public administrators between department and changes in terms of responsibilities and portfolios was cited by stakeholders as a challenge when trying to engage consistently with the policy landscape.
- Establish a single platform for SRIPs, involving all stakeholders. The function of such a platform should be multifaceted: e.g. solving technical problems, answering strategic questions, cluster management training and capacity building and monitoring and evaluation dialogue.
- Further integrate enterprise into universities and research institutes. This involves completing a transformation to solve challenges of ownership for universities and public research institutes regarding intellectual property and start-up companies. It also includes making the university environment more stimulating for the establishment of new companies and equipping researchers and students with the entrepreneurial competences needed for successful spin-outs.

4.1.3 Priority area – Support systems for piloting, demonstration and commercialisation.

Sub-priority: Maximise the use and combination of the programmes and instruments already in existence.

Overall, this priority area is characterised by a need for a policy mix approach, focused on the combination and adjustment of existing instruments and programmes rather than the introduction of a range of entirely new initiatives. The state of play report found over 70 instruments and initiatives related to innovation, and there are more than 150 different support mechanisms in Slovenia for RTDI overall. Their integration and the consolidation of support environment is therefore of clear importance, in order to do this there must be consistent oversight and monitoring of at least a sub-set of the largest instruments.

Sub-priority: Increasing the efficiency of investments.

Investment in R&D has declined in Slovenia in recent years, as outlined in the State of Play Report. As a result, it is increasingly crucial to ensure that investments are made as efficient as possible and generate a high rate of return. Although Slovenia has a lower level of overall investment as a percentage of GDP than Israel and Austria, it is higher than other strong innovation performs such as Estonia and the United Kingdom.

There is therefore a need to focus on tracking impact from innovation investments. Naturally, recommendations must develop and/or refine Key Performance Indicators of existing instruments. Inherent in this is a need to find and engage with companies that are technologically ready to adsorb the kind of knowledge being generated by research performers. This topic also includes questions around supporting research institutes and universities to generate additional income from intellectual property, which is currently prohibited in legislation. Additionally, Slovenia should seek to furth building on its success in competitive EU sources (for example Horizon Europe).

Sub-priority: Taxation of individuals, multinational companies and foreign direct investment (FDI)

The Tax Foundation's 2020 analysis saw Slovenia have the highest top combined marginal income tax rates for individuals, at 61.1 percent. By contrast, the Czech Republic has the lowest, at 11 percent.[158] Companies in Slovenia also noted that the taxation system does not incentivise Foreign Direct Investment in innovation from multinational businesses. The combination of high barriers in service and network sectors and widespread public ownership has contributed to one of the lowest levels of foreign direct investment in the OECD area.[159] This has an impact on the availability of human and financial resources for the recipients of existing instruments to capitalise and sustain innovation activities after funding has ended.

Sub-priority: Improve cooperation between industry, academia and intermediaries in the use of research infrastructure for pilot and demonstration.

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[158] Daniel Bunn and Elke Asen, 2021, International tax competitiveness Index 2020, Tax Foundation. Accessed via https://files.taxfoundation.org/20201009154525/2020-International-Tax-Competitiveness-Index.pdf .

[159] OECD, 2020, Economic Surveys: Slovenia. Accessed via https://www.oecd.org/economy/surveys/slovenia-2020-OECD-economic-survey-overview.pdf.

At the most basic level, this sub-priority is about identification and selection of ideas to support. Within this priority is a need to facilitate tech companies to connect with complimentary support and innovative business models. Something to consider when writing recommendations for activity 4 is the lack of Slovenian companies offering a final products on the market. A lot of strong sectors in Slovenia, including automotive and white goods, feature in the supplier value chain. Slovenian support systems should be focused on identifying and nurturing innovation's related to final products, rather than components.

Effective communication of the support systems different actors in the innovation ecosystem can offer one another is crucial. In Slovenia there is a need for SMEs to be able to access to prototype facilities, mentorship, and support on a systematic level. Some institutions are quite open, but this is often the product of motivated individual institutions, it is important to look also at system-wide incentives to open access to infrastructures in key priority areas. Linked to this is the challenge of pilot and demonstration platforms, which are lacking. Support systems should also focus on providing resources, or training for the use of infrastructure. Additionally, support for TRLs 4-6 remains critical, and proof of concept funds, although beginning to develop in Slovenia, must be rolled out faster.

Collaboration between Technology Transfer offices and SRIPs must be supported, but before developing a concrete implementation plan, more information must be sought on identifying the other institutions involved in the process of bringing the idea to the market to fully connected these mechanisms.

4.1.3.1 Preliminary recommendations

- Introduce Industrial PhDs: Grants for PhD students working for companies. These are permitted in current legislation and were previously implemented. Bringing them back would be a positive step.
- Open pilot and demonstration schemes to access prototyping facilities/ access to infrastructure, especially for TRL 4 to 6.
- Larger vouchers from SPIRIT, 15000+ to co-finance external experts and R&D employees but also could be used for marketing purposes, e.g., searching for property for showrooms, demonstrations, testing etc.
- More targeted messaging and information. For both researchers, regarding their career path and where knowledge transfer could feature, but also to companies in terms of what universities can offer them. This includes training to use infrastructure.
- Ongoing efforts to rollout demo centres must be facilitated by dedicated platforms for TTO/ SRIP cooperation to identify potential breakthroughs and projects with higher added value and provide them with the holistic support (i.e both financial and intellectual support), where all existing mechanisms can be involved.

4.2 Selected advanced practices for Activity 4 and 5

This section of the report re-focuses the analysis on three elements:

- The advanced practices identified in previous sections.
- The drivers and barriers outlined by the State of Play analysis.

- The priority areas and recommendations.

From these elements a short list of selected advanced practices has been drawn up based on their usefulness and transferability in the Slovenian context. These advanced practices will be further analysed and translated to the Slovenian context in the recommendations of the report for Activity 4 and will also feature in the selection and programming of the study visits for Activity 5 of the project.

4.1.1 Austria

Best Practice - Long-term commitment of Austrian authorities toward R&D. Capacity should be built during study visits and capacity building regarding how Austria has managed to maintain political commitment despite frequent governmental changes.

Best Practice - An independent monitoring entity and evaluations. Systemic monitoring and evaluation, a pre-requisite to effective adjustments of instruments, featured as outcomes of all the state of play analysis. The internal set up, processes and management of the Austrian Council for Research and Technology Development will be further looked into in subsequent stages of the project.

Best Practice - Nurturing good researchers. The principles of an attractive research environment came to the forefront of Austria's analysis. For example, complying with the principle of the Human Resources Excellence in Research Principles of Euraxess. Diving deeper into this environment should have lessons for Slovenia.

4.1.2 Estonia

Best Practice - Extensive evaluation and monitoring culture. This practice complements the institutional monitoring best practice selected for Austria. Estonia has improved the relevance and effectiveness of monitoring and evaluation outcomes through development of study designs and research questions. This best practice could be replicated in Slovenia and should be additionally valuable since it would support R&I policymakers in Slovenia to improve current design and implementation issues.

Good/ Best practice - Extensive and evolving involvement of scientific experts in government. The presence of a scientific advisor in each ministry, and their formation into a network of advisors could be one solution to improving the political commitment to R&I more generally by developing a closer relationship between scientific experts and policymakers.

Promising practice - Long-term holistic strategy. This was identified as a 'promising' practice because of its relative newness. However, the main focus for Slovenia is the stakeholder involvement in R&I decision making. The Estonia 2035 strategy saw consultations with over 17,000 stakeholders, and a detailed understanding of this process may serve to inform the recommendations around building trust in the system.

4.1.3 Flanders (BE)

Good practice - Key intermediary institutions. The Research Centres and Spearhead Clusters may serve to improve parallel institutions in Slovenia, in particular around sustainability and public/ private funding balance. Furthermore, the innovation agency, VLAIO and its internal structures and management are worthy of further investigation.

Although not a 'best' practice, these institutions are highly transferable to Slovenia and so were selected according to the typology in section 1.1.2

Good practice - International networks. Flanders was among the initiators of the Vanguard Initiative 'New Growth through Smart Specialisation' in 2013 and is a prevalent user of TAFTIE. Further work should look into how the Flanders agencies and ministries coordinate their involvement in international networks. Although not a 'best' practice, it is highly transferable to Slovenia, as Slovenia is already a member of TAFTIE, and so was selected according to the typology in 1.1.2

4.1.4Israel

N.B Given how unique the Israeli system is in terms of its history and development, these practices will not be directly applied to further recommendations, but elements will be selected for inspiration.

Good practice - The role of TTOs and Higher Education. Industrial application of research functions is performed by university technology corporations, in contrast to more traditional TTOs. There were legal barriers which were overcome, and this process may serve to inform the removal of those present in Slovenia.

Good practice - The STI system has always been geared towards industrial applications. Of particular interest are the private incubator programmes, which are estimated to leverage 5-6 times of the public funds into the program EUR 535 million ($650m) by private investment into the incubated companies.

Best practice - A very efficient VC industry. Certain elements of this environment may be transferable to Slovenia in the near future and will feature in the tailored recommendations and capacity building elements of the project. Further study will look into the Yozma program, which ran between 1993 and 1998.

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Website of the Science Directory. Accessed via: https://www.science.co.il

Website of the Slovene Legal Information System. Accessed via: http://www.pisrs.si/Pis

Interviews (6)

Israel:

- Representative from Israeli Innovation Authority.
- Scoping interview with an industry stakeholder working in innovation.

Estonia:

- Representative from Estonian Research Council.
- Representative from Enterprise Estonia.

Belgium:

- Representative from the Flemish Innovation and Entrepreneurship Agency (VLAIO).

Austria:

- Representative from the Austrian Research Promotion Agency (FFG).

Annex I – Summary of gap analysis workshop

REFORM/SC2020/100 – "Strengthening the Innovation Ecosystem in Slovenia "

Gap analysis Workshop

Summary

7th April 2021

14.00-16.00h

Teleconference via Microsoft Teams

Funded by the Structural Reform Support Programme of the European Union

Introduction

This workshop was part of the one-year EU-funded project 'strengthening the innovation ecosystem in Slovenia'. The aims of this project are:

- To perform research and analysis on the barriers and drivers in the Slovenian innovation ecosystem.
- To benchmark the Slovenian state of play against relevant international best practices.
- To draft recommendations and implementation activities.
- To carry out capacity building activities.

The project is organised in cooperation with the Ministry of Economic Development and Technology, the Business Development Agency (SPIRIT) and funded by the European Commission's DG REFORM. The project Steering Committee also features representation from the Ministry of Education, Science and Sport and the Government Office for Development and European Cohesion Policy.

For more information, please see here.

Reflecting on the findings for the 'state of play' report and discussing the gaps the participants of the workshop have pointed out the following:

1. As several studies have recognized before, a huge private investment gap exists in Slovenia. Slovenia used to invest around 5 million euros in early stage seed investments of start-ups and this number has been decreasing in the recent years. In order to reach the per capita figure of the EU average, 70 million euros of investments per year would be needed, which amounts to roughly 500 million euros of venture capital in the next 7 years. In Slovenia, there has been no active venture capital for the last 10 years. Consequently, 97% of venture capital investments are coming from abroad, as a typical condition for receiving the venture capital funds for the start-up is to move abroad.
2. New ventures within the academic environment are not possible in Slovenia, because universities are not allowed to take equity stakes in new ventures. While this has been partially circumvented by licences, the numbers show that there is no academic entrepreneurship.
3. The second gap identified lies in the area of public/private collaboration. Researchers and academia are more focused on the success achieved from publishing a research paper and not necessary from commercialization. The higher education level does not involve the students enough in a business environment, like this is the case, for example, in Switzerland. The universities should work to develop something that is actually needed on the market, not just develop for the sake of receiving funds. Universities should be more aware of what technologies will be needed in the next 5 years, and adjust their study programs accordingly.
4. Key connector for public/private collaboration should be the TTOs, which need to be more market oriented. This is not to say, that basic research is not important, however more research should be focused on possibilities of commercialization and practical use. TTOs are more connected to public research organizations and SRIPs to the business side of the innovation ecosystem. The basic problem is lack of communication between researchers and entrepreneurs, so the idea was/is that TTOs and SRIPs would close this gap by helping their focus groups. In few years it was predicted that TTOs and SRIPs would become self-

sustainable organizations, financed by the sale of their services to their users. Currently, the collaboration of each of these subsystems is unable to be maintained past the funding period of a grant.

- The third gap concerns the support systems for innovation. While the private sector has very innovative individuals, it faces many problems:
    - First, there are huge administrative burdens (applying, reporting, reclaiming investment tax). The support for innovation is too complex to gain and a mismatch between timeframe of instruments and needs of the businesses exists. The additional administrative burden stems partially from the fact that cohesion funds are used to support innovation.
    - Second, the connection with academia could be stronger and subsidized in some way in order to achieve a better knowledge transfer.
    - Third, the business environment in terms of taxation of companies and of high paying jobs could be more favourable. There needs to be an adjustment of tax rates of highly educated workforce, however this needs to be done in coordination with the social partners.

5. A 2018 OECD innovation review of Slovenia, stated that Slovenia should not repeat the mistakes made by Austrian regional innovation ecosystem, which in turn prevented the development of a national ecosystem. However, the challenges faced by specific regions have to be considered to a degree. On the other hand, the problem with regional division of funding was that there was too much funding in one region and too little in the other.
6. In conclusion, one of the biggest causes for some of the problems identified above, is that the innovation funds are originating from cohesion funds. Therefore funding for innovation should be increasingly financed from national budget and a provision of steady calls should provide a more stable innovation environment. Additionally, private funds need to be attracted into the innovation ecosystem. The latter can be achieved by adopting one of the good practices in Croatia, Netherlands, UK (technology transfer), Poland, Latvia and/or Lithuania.

The following three topical areas have been validated for the next workshop:

7. Setting innovation collaboration (public/private and private/private), including role of intermediaries and technology transfer;
8. Building the risk capital ecosystem in Slovenia;
9. Support systems for piloting, demonstration, and commercialisation acceleration.

Annex II – Summary of co-construction roundtable

Strengthening the Innovation Ecosystem in Slovenia: Co-construction roundtable workshop

21 April 2021, 13:00 to 17:00

Workshop Summary

- To present the outcomes of the gap analysis and outline three topical areas for discussion.
- To draw out concrete best practices from the innovation ecosystems in Austria, Belgium, Israel, and Estonia.
- To co-create preliminary policy recommendations and a roadmap for their implementation.

Introduction to the project

This workshop is part of the one-year EU-funded project 'strengthening the innovation ecosystem in Slovenia'. The aims of this project are:

- To perform research and analysis on the barriers and drivers in the Slovenian innovation ecosystem.
- To benchmark the Slovenian state of play against relevant international best practices.
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For more information, please see here.

The team carrying out the project is from

- Valdani Vicari & Associati (VVA), based in Belgium.
- Oikos, based in Slovenia.
- N-Able, based in France.
- KPMG Slovenia, based in Slovenia.

Attendees

Full Name	Organisation
Aleš Hančič	TECOS
Ales Pusrtovrh	University of Ljubljana, Faculty of economy and VC funding
Andrej Ograjenšek	Centre for Creativity
Anja Zorko	TechnoCenter at the University of Maribor
Anton Habjanič	Slovene Enterprise Fund
Darja Fercej-Temeljotov	Novartis in Slovenia
Dragan Mihailović	Jozef Stefan Institute & Nanocenter
Emmanuel Boudard	N-Able
Gregor Anderluh	Kemijski inštitut
Gregor Umek	Ministry of economic development and technology
Hermina Ogrič	COBIK
Igor Milek	SPIRIT Slovenia
Irena Meterc	SPIRIT Slovenia
Jakob Gajšek	Lubjana University Incubator
Jernej Pintar	Technology park Ljubljana
Jordan Hill	VVA Europe
Jurij Kobal	Oikos
Karin Žvokelj	SPIRIT Slovenia
Laura Todaro	VVA Europe
Maja Bučar	Univerza v Ljubljani, Fakulteta za družbene vede
Malin Carlberg	VVA Europe
Marjana Majerič	GZS - Zbornica osrednjeslovenske regije
Marko Močnik	POMURJE TECHNOLOGY PARK
Martina Knavs	Jozef Stefan Institute & Nanocenter

Miha Bobic	Danfoss Trata d.o.o
Peter Glavič	University of Maribor
Pierre Padilla	N-Able
Richard Procee	VVA Europe
Robert Repnik	Slovenian Research Agency
Rudi Panjtar	SRIP Factories of the future
Sabina Žakelj Pediček	SPIRIT Slovenia
Sebastian Somi	KPMG
Simona Kneževič Vernon	TECOS
Stasa Baloh Plahutnik	GZS Zasavska gospodarska zbornica
Tanja Kožuh	Primorski tehnološki park d.o.o.
Tomaz Klemenc	Project Expert
Tomaž Kostanjevec	SPIRIT Slovenia
Urša Jerše	University of Ljubljana
Urška Zupin	Ministry of economic development and technology

Summary of the first plenary discussion

During the first plenary session, the following points were raised by attendees:

1. Work is ongoing regarding the disparity between in high-tech exports vs medium-high tech exports. The project researchers have asked colleagues at the Estonian Research Agency, and their response will be included in the report.

2. A report by the Slovenian Academy of Engineering is issued every year and indicates that the money given to knowledge transfer is just 5% of the EU average. The funds established in the last 20 years have been scaled back drastically, so investment in knowledge transfer is minimal now.

3. The participants noted that the benchmark countries have clear but different pathways to where they are now. Israel for example has had a strong history of innovation for a long time but it was a 'bootstrap process' – i.e., self-starting. The main similarity all the benchmark countries have is that innovation, in some form or another, is at the centre of policymaking. In Slovenia innovation is not high on the agenda.

4. The participants noted that it is important for work with politicians and collaboration with ministries allows for bottom-up pressure. The preparation of the new Estonian strategy involved hundreds of stakeholders and process could be a model for forming a common consensus in Slovenia.

5. One further challenge is that everything that was previously successful has not been maintained in recent years. Consistency in financial support needs to be built in a way that collaboration is the first priority, with finance coming afterwards. Companies will always find the way to get money, but they are looking for a supportive environment in the first instance. Without collaboration, public/ private actors cannot make the further step but it is important to remember that the universities and institutes are also not allowed to establish start-up companies.

6. The Innovum project, based at the University of Maribor, analysed business, and innovation environments in different countries, in collaboration with the incubator venture factory university of Maribor. It presents three main theoretical principles of how to organise the environment: Regional/ political model, for example in Brno, CZ, follows the principle of the strong city, funded south Moravian technology agency with 4-year period innovation strategies at regional level. The second model is Ideon science park in Lund, established already in 1984 and has a strong university/ business partnership at its core. The third principle is to the economically organised environment. The example here is the high-tech campus in Eindhoven, Netherlands where Philipps established their own technology park for research institutes to start-up and spin-off.

7. The R&D investment in Slovenia is low, at 1.9%. In real numbers it may be even lower as companies overreport at the end of the year and inflate investments in R&D for tax cuts. of R and D investments. However, it is also important to note that other successful systems, such as the United Kingdom, are investing less money (as a percentage of GDP) into R&D than Slovenia. Research efficiency is therefore also key, and an understanding of what happens with this money once its invested is crucial for the recommendations.

8. What is crucial additionally is connection in the different ecosystems (research companies, digitised sources, platforms etc) with regards to bringing final products to the market. This is related to the fact that Slovenia does not have widespread access to prototype infrastructure or demo centres for research, design, and implementation of state-of-the-art design. If you look at western EU member states, there is far more systemic access (e.g., factories of the future.) furthermore, Slovenia is focused more on a different kind of digitalisation, on soft topics that can bring society on higher level but not focused on industry and production specifically.

Breakout session - Support systems for piloting, demonstration and commercialisation.

During the breakout session, the following points were raised by attendees:

1. The current taxation system in Slovenia disincentivises Foreign Direct Investment (FDI). The taxes are high and foreign direct investment into start-ups still leaves them tied to the local human capital. In Slovenia this is subscale with only 2 million population.

2. A multinational business is measured on Earnings Before Interest and Tax (EBIT). The current system disincentivises accurate reporting of earnings, and it was reported anecdotally that local branches of multinational companies make EBIT the smallest number possible. This avoids the reduction of local bonuses in favour of funds going to the parent company.

3. Universities have slipped in the international rankings and this makes it more difficult for businesses to justify collaboration on innovation projects. Although university management inherits the situation that there was previously, there is a need to address the drops in international rankings as soon as possible. Universities are public institutions; they are autonomous, but they rely on public funds.

4. A point regarding the rate of return for investments in technological innovation: one stakeholder presented the view that innovations in business models have a faster rate of return than technological innovation. Although start-ups are mainly created by younger people, the incentive is still to study as long as possible, as studying is free. So, there is a question of encouraging students to create start-ups while studying or set them up to launch their businesses as soon as they graduate.

5. There is one challenge identified by stakeholders concerning the lack of focus of the policies from the smart specialisation strategy. All the instruments were felt to be disbursed on the basis of satisfying different stakeholders, as opposed to a strategic plan of what the system needs. The frequent changes to different instruments in different programming periods is also a challenge as the system lacks continuity.

6. The example of SRIPs was given in terms of continuity as they were previously competence centres and then changed. In each programming period there seem to be new instruments introduced. In addition to this, these instruments do not usually have appropriate KPIs, they are more orientated towards number of participants and not number of innovations. The support instruments for innovations are focused more on their sectoral KPIs and the link is not there. Some felt that there was actually no need to develop new instruments but a need to merge existing initiatives together.

7. Demo centres must consist of a whole policy mix. There are already many good options put on the table in the past. One of the big challenges is how to engage politicians with the topic. For example, the research and innovation strategy of Slovenia, stakeholders felt there are lots of good solutions and policy measures, but it was not implemented to a large extent. The example benchmark countries have been committed since the mid-1990s and it really takes time to build up the system. One further challenge for these demo centres is sustainability. If they are funded by cohesion funds, then Slovenia will have the same issue as with SRIPs. In this sense, universities must be important anchor institutions. There is a further challenge that the greater part of industry in Slovenia is low tech and they do not know, or do not have use for, what universities can bring.

8. It was noted that PhD students, vouchers and grants etc. can be used in combination with SRIPs. There are no industrial PhDs yet, but it is permitted in the law, the model being Denmark. Slovenia had this mechanism before, but it is not currently used. Stakeholders felt that the Industrial PhD was a very good solution; however, it would not be enough to just bring it back. It is also necessary to have a change of thinking or research culture by researchers. They are not all interested in this bridging of technology. It is therefore crucial to think about the important points in careers of researchers, and how to motivate them to be part of the knowledge transfer process. This must be included in all the documents related to the careers of researchers.

9. It must be accepted that not all companies are interested in knowledge transfer. Slovenia should aim to focus on support systems which help to find those companies that are technologically ready to adsorb this kind of knowledge.

10. There is a question of consistency, it was mentioned by one participant that the Ministry of Economic Development and Technology has been creating measures and not harmonising them with the Ministry of Education, Science and Sport, for example.

11. One further challenge for Slovenia is the lack of companies offering final products on the market. A lot of sectors (e.g., automotive, white goods) are more of less companies in the supplier value chain and so any innovation is related to these semi-products only. There needs to be support systems targeting companies able to offer final products.

12. There is the possibility of various vouchers to reduce administration, available for smaller companies. SPIRIT have created some, but there is the potential to improve beyond 10K to 30K. These may be offered for co-financing of external experts and co-financing of R&D employees. Vouchers for innovation are generally considered effective instruments, and could even include ‘searching for property vouchers’ for show-rooms, demo testing etc.

13. Speed of execution is crucial; commercialisation needs to be done quickly and should be seen as a means to an end. There should also be more focus on how well technological innovation moves into proper business models. Also, the speed of change in Slovenia is too slow, the country needs to change to high-tech at a faster pace.

14. Demo product financing is regarded as missing from the current mix. The 10-15K SPIRIT mechanism exists but there needs to be a larger mechanism as well, for 6-12 month maximum. SRIP factories of future is currently implementing a project as a pilot action. It has 5 companies with 5 service providers on a fast-track industrial transition. The wider idea is a future platform to identify needs of the companies, investments service providers etc. to create a value chain. There is still another two months until completion. After companies were selected, they had to make a Memorandum of Understanding (MoU) with service providers. There are no timesheets, and the project is intended to be low admin, just requesting the results - a proof of concept. The aim is to translate the outcomes into a national instrument. The experience has shown that there is a great need to have SMEs access to prototype facilities, quick access, mentors, etc. Important to note that, although the networking and educational part of the ecosystem is open, the research part is still very much dependant on motivated individuals.

15. One further challenge is that companies do not have resources or personnel who are skilled enough to use facilities and infrastructure. Access to infrastructure, established and maintained in a long-term, is therefore a crucial element of any improvements to the system.

16. There are already a lot of evaluations at national level, as well as international audits etc. The system has been studied and the common denominator is stability and long-term orientation of measures. Integration and consolidation of support environment, it was reported by one stakeholder that there are more than 150 support mechanisms in Slovenia already.

17. Support for TRLs 4-6 remains critical, proof of concept funds widely available in Slovenia, although they are developing. This should be brought closer to the universities, the practice in other countries is that already at the university level there are funds available for innovation funding available. The biggest drawback of SRIPs is that support was not provided holistically, they are support mechanisms, but the scope of their support is limited, and they do not have a clear way to cooperate with each other.

18. There is a need to better identify the potential breakthrough and projects with higher added value to provide them with the holistic support where all of these mechanisms can be involved, under some kind of umbrella level. The ministries could start with a

call for project ideas, each applicant shows a cost benefit plan, sustainability plan with KPIs and then ministry will receive list of projects and they can receive feedback on the kind of interest in the market.

Breakout session - Setting innovation collaboration.

During the breakout session, the following points were raised by stakeholders:

1. The group discussed how the goals of excellent science should also include commercial goals. While it was accepted that focusing on publication volume perhaps could be refined, the discussion centred more around the need for a mechanism to identify and select ideas with strong innovation potential.

2. The participants noted that there have been many attempts to set up common goals with stakeholders in the system, but what happens is a diversion of interests. The whole ecosystem, all universities, SRIPS etc need to first align their own goals internally and the government could say 'these are the common goals of the ecosystem and we can go towards that'. But the system does not currently allow for a responsible person, minister, lead actors etc. to come forward.

3. For the large networks, there have been different funding combinations for funding SRIPs but none of them have produced a sustainable model post-funding. This is also the case for many Technology Transfer Offices (TTOs). It was reported by one stakeholder that the last calls for projects which included collaboration were included in 2016, since then there has not been a call open for projects supporting collaboration.

4. A key challenge is that there are already many recommendations on how to improve collaboration in the system, but implementation is lacking. For example, the draft text of the law on research and innovation has been in the process of preparing and changing since 2013.

5. There is a question of timing. All the collaboration measures introduced in the benchmark countries have lasted 10 years or more. This links to making the environment attractive for people to stay long-term. From research undertaken for MEDT, SPIRIT and GODECP, in all of the cases where clustering initiatives were successful, they were supported for a minimum of ten years. There is a need to maintain SRIPs beyond cohesion fund period, having them self-financed within 3-4 years was not seen as effective or realistic.

6. Trust needs to be built between collaborators for projects. This links to questions including IP management, defining who owns IP and clear recommendations on how it is managed and new developments on level of EU state aid regulations. Also trust in researchers themselves, many researchers find it difficult to go outside of their comfort zone and pitch their ideas. It is still a fairly new concept. Trust is also needed in the network conditions having the right incentives. SRIP project salaries for example, were not felt to be nationally benchmarked.

7. Evaluation measures should include both content of the outputs and the instrument itself, to differentiate between successful initiatives within the same funding

programme. This would also require a clear mandate for action and publishing of these evaluations. It was felt that tenders are not supporting the whole innovation cycle and TRLs 3-6 are often missed.

Breakout session - Building the risk capital ecosystem.

During the breakout session, the following points were raised:

1. Currently, with the exception of tickets up to 50.000 EUR, venture capital (VC) is completely missing in Slovenia. While the Slovenian Enterprise fund has developed several instruments (micro-loans, guarantees, that are also matched with private investments), and is developing further, the capacity of the fund is too small. From the perspective of companies, the fund is only seen as backup and less preferred than raising through other means. The same applies to the second key player in Slovenia, the Slovenian Development bank. None of the two key players is deemed to be risk-taking enough from an innovation (not financial) standpoint.
2. The participants pointed out that if venture capital was missing for early- (pre-seed and seed) but also late-stage (growth) VC, there are two key gaps to highlight: one post TRL9 and one at a pre-commercial innovation stage. On the European Innovation scoreboard Finance and support in Slovenia in comparison to the EU average is only 31,7 %.
3. Poland has invested 500 million euros of national funds to jump start the VC industry. Slovenia needs to get at least on par with them. The Croatian pension funds are investing 5 times the amount of the Slovenian pension fund into the Slovenian VC system. In Slovenia, equity early stage TRL5-pre-commercial equity ticket size should be between 50 – 200 thousand euros, while post-TRL 9 ticket size should be 200k to 2 mil.
4. The participants pinpointed 4 objectives for building the risk capital ecosystem:
    a) Structure the investment landscape
    b) Build the critical mass for risk capital for (start-ups, SMEs), attract external risk capital
    c) Attract & complement private sector VC
    d) Anchor SI start-ups
5. The current environment is not correctly focused. Despite the support of Centres of Excellence and SRIPs, the SI innovation commercialisation performance is not where it should be. Several measures were called for, starting from the investment environment:
    a. Participants all called for an investment regulation streamlining plan to facilitate the establishment and growth of private innovation risk capital in Slovenia. The following measures are strongly related to this aim of a streamlined and investment-friendly regulatory framework.
    b. For instance, one could consider the corporate tax rate rather friendly in Slovenia. The problem is however that the expenses related to employment, the tax rate as well as social contributions of very high skilled labour are too high. Even more noticeably, it is impossible to give stock options to employees in Slovenia and the taxation over share transfers is hampering start-up

development and investment perspectives. The same applies to other regulated items such as the administrative burden and obligations weighting over foreign investors (notification of change in capital, establish locally, etc.).

c. Early-stage investments from corporate sources are currently missing, with incentives from corporate tax break. This favourable context should be more broadly supported by adjustments to the national regulation applicable to private investment entities (by Law a lot of corporate/pension and investment funds are not allowed to invest in risk capital, which should be lifted to a certain degree). One of the main reasons, why foreign investors do not come to Slovenia is because the Slovenian legal system is perceived by some to be very unfriendly for investors. Establishing the company is easy, however for any change of capital a notary is needed, which is expensive. Furthermore, the owners of the company need to be present in the country, which foreign investors are not going to do. These things are unpractical in 2021.

d. Participants also called for support to business investment angels in a form of tax break (emulate the British example, the SEIS Tax relief).

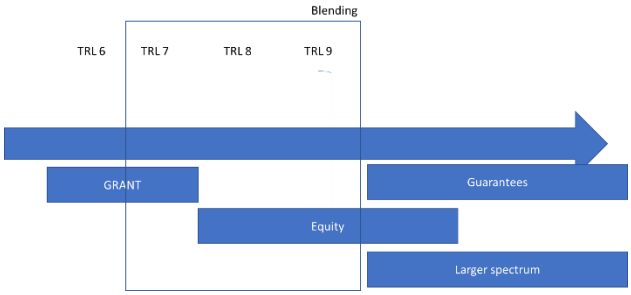
e. In the next 5–10-year period, foreign capital should be attracted. At present, the system is not providing the right incentives for this. High quality foreign investors need specific benefits as they do much of the heavy lifting. The previously discussed instruments will require local financial investors (pension funds, insurance companies, banks). Therefore, certain changes on how these types of investors are regulated and also motivated in order to raise willingness for investing into VC.

6. The priority measures set by the group were :

   a. Set up a financing scheme for Early-stage/TRL5 pre-commercial equity investment (that could be implemented in combination with grant support, using a blending approach). This measure would consider primarily tickets between €50k – €200k.

   b. Set up an Equity scheme for Post-TRL9 innovation (scale-up) to fill in for growth venture capital (deployment) with tickets of €200k to €2M.

   c. Further develop the "blending approach" that is illustrated in the figure below – developed during the workshop session:



   d. Further develop the "blending approach" that is illustrated in the figure below – developed during the workshop session:

7. Other measures are to support the development of innovation risk capital investment:
    a. Adapted innovation support to mature SI innovations – SPIRIT is for instance currently preparing a new set of innovation vouchers from the REACT EU sources.
    b. Equip the Slovenian Development Bank (and/or, in a second stage, the Slovene Enterprise Fund) with an equity arm (fund of funds)
    c. Consider a transition of the Slovenian Enterprise Fund from a Public entity to a Publicly owned entity – such as the European Investment Bank
8. Ensure skilling and awareness for more mature companies whose 'smart' money is not always enough to build internal capacity (ownership structure, management, etc.) There are several options to begin building the environment. Slovenian development bank should develop a Slovenian investment fund (similarly to EIB). Some kind of initial public investment into the privately run fund need to be provided to attract private investors. The SID development bank should kickstart the development this would serve to release of large domestic capital resources While a lot of capital is sitting in residential personal savings, these funds should be promoted stock market and not necessarily risk capital.
9. Slovenia could also benefit much more from existing European funding opportunities, in a way of a local national finance system, that would support and finance local innovation actors, to be embedded into European networks, such as European Institute of Technology or participation in European project such as Horizon.

Summary of the second plenary discussion

This session focused on gathering feedback and discussing the recommendations from the breakout sessions.

In the "**Building the risk capital ecosystem in Slovenia**" a lot of contextual background was discussed as well as the following points:

System: There is a need to empower Slovenian Development Bank and the Slovene Enterprise Fund in the development of new instruments.

Objectives: The pinpointed 4 objective for building the risk capital ecosystem are as follows:

1. Structure the investment landscape
2. Build the critical mass for risk capital for (start-ups, SMEs), attract external risk capital
3. Attract & complement private sector VC
4. Anchor SI start-ups

Governance: Grow the Enterprise Development Fund and Slovenian development bank

Instruments:

- Early stage TRL5 pre commercial: 50k-200k€
- Equity growth VC post TRL9: 200k-2M€

Additional recommendations:

- Engage into an investment regulation streamlining plan
- Business Angel Investment support – tax break (EIS in UK)

In the feedback session for **"Support systems for piloting, demonstration and research commercialisation"** the following points were raised:

Recommendations:

- Industrial PhDs: Vouchers / grants for PhD students working for companies are missing at the moment. They existed in the past.
- Opening schemes to access prototyping facilities. Some facilities such as demo platform are not open to work with industry, access to infrastructure is needed especially for TRL 4 to 6
- Vouchers are needed from SPIRIT 10- 15000 to co-finance external experts
- The government approved the financing of a science centre building in the order of 20 million from structural funds, but is not sure what to put in the building. This would be good place to put some demo centres inside.

In the feedback session for **"Setting innovation collaboration"**, the following points were raised:

Summary of Recommendations:

— Analysis exists, focus on implementation
— Need of stability (financial and political over time)
— Translate trust in scientists to political action
— Build trust among the RTDI ecosystem
— Long-term policy of common good in RTDI
— Common agenda at national level
— Facilitate co-creation through effective IP management
— Effective evaluation – what works? What is needed?
— Instruments to cover the whole innovation cycle

Further comments from the participants:

— Public research organisations should be allowed to participate in equity because that allows for a better alignment.
— Academic progression should not be only tied to papers published, but also to commercial participation.
— We need a mechanism for producing a coherent long-term strategy and policy.