Strengthening the Innovation Ecosystem in Slovenia

REPUBLIC OF SLOVENIA
MINISTRY OF ECONOMIC DEVELOPMENT AND TECHNOLOGY

Current state of play of the Slovenian national innovation ecosystem

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Abbreviations:

ARRS	Research Agency of Slovenia
CD	Capacity development
EC	European Commission
EEA	European Economic Area
EFSI	European Fund for Strategic Investments
ESIF	European Structural and Investment Funds
EU	European Union
EUR	Euro
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation (EU GDPR)
GERD	Government Expenditure of Research and Development
GNI	Gross National Income
HERD	Higher Education Expenditure of Research and Development
IMAD	Institute of Macroeconomic Analysis and Development of the Republic of Slovenia
IPR	Intellectual Property Rights
MEDT	Ministry of Economic Development and Technology
MESS	Ministry of Education, Science and Sport
OECD	Organization for Economic Co-operation and Development
PRO	Public research organization
SEF	Slovene enterprise fund
SDG	Sustainable Development Goals adopted by United Nations Member States in 2015
SIO	Subjects of the innovative environment
SME	Small and medium sized enterprises
SPIRIT	Public Agency for Entrepreneurship, Internationalization, Foreign Investments and Technology
SPOT	Slovenian Business Point
SRIP	Strategic development-innovation partnership
SURS	Statistical office of Slovenia
TRL	Technology Readiness Levels (TRLs)
TTO	Technology transfer office
PCT	Patent Cooperation Treaty

1 Executive Summary

This document constitutes the revised report for Activity 2: Report on the current state of play in the Slovenian national innovation ecosystem under the contract REFORM/SC2020/100 – Strengthening the Innovation Ecosystem in Slovenia. The data for this study was collected through desk research, which provided the initial evidence base, and was then triangulated using qualitative (in depth interviews with stakeholders, coordinators of instruments, beneficiaries of the instruments) and quantitative methods (online survey and calculations of the performance of instruments based on secondary data obtained from beneficiaries and company business records), leading to the conclusions presented herein. In the part of the study covering the performance the study used quasi-experimental methods comparing data received from Beneficiaries of instruments assessed by this study with a selected control group.

Overall circumstances

Already in 2019, before the hit of the COVID-19 pandemic**, Slovenia's economic growth decelerated considerably but remained robust**[1]. 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[2]. As the second quarter was more affected by confinement measures, the decline in GDP was expected to be even steeper. The rise in unemployment was rather modest due to government support measures[3]. According to the forecasts, economic growth in Slovenia in 2021 will be at 4.6%[4].

According to the **European Innovation Scoreboard 2020**[5], since 2012 innovation performance increased in 24 EU Member States and decreased in only two. Performance has increased the most in Lithuania, Latvia, Portugal and Greece, and decreased the most in Slovenia and Romania. Slovenia recorded rather slow recovery from the 2008 crisis which lasted until 2015. Slovenia now belongs to the group of **Moderate Innovators** as its performance declined relative to that of the EU in 2012. The decrease since 2018 is explained by worsened performance for new doctorate graduates and the indicators using Community Innovation Survey (CIS) data[6]. While Slovenia had higher number of new doctorate graduates than EU average, it fell close to the EU average; the number of doctorate students is high on broader international level, too, as for example Israel had 174 PhD students per million while Slovenia had 230 per million in 2018[7]. Slovenia shows the

[1] 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. Electronic source: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020SC0523&from=EN

[2] European Commission, (2020) ECFIN Forecasts. Electronic source: https://ec.europa.eu/economy_finance/forecasts/2020/summer/ecfin_forecast_summer_2020_si_en.pdf

[3] ibid

[4] UMAR (2021) Pomladanska napoved gospodarskih gibanj 2021. Electronic source: 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

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

[6] Ibid

[7] OECD. Stat Graduates by field Source: https://stats.oecd.org/Index.aspx?DataSetCode=EDU_GRAD_FIELD

highest positive difference (i.e., biggest progress) to the EU in **average annual change in GDP**, **employment share in manufacturing** and **turnover share SMEs**, and the biggest negative difference (i.e., biggest decline) in **top R&D spending enterprises**, **enterprise births** and **government procurement of advanced technology products**[8].

According to the **Digital Economy and Society Index 2020**[9] **Slovenia has improved compared to previous years and now ranks 16th** out of (then) 28 EU Member States. Based on data prior to the pandemic, Slovenia has improved its score in all five dimensions, but advanced in the ranking only in the dimension integration of digital technology. In the human capital dimension, its score has risen from 46.3 to 48.3 and is now close to the EU average score of 49.3. While the score for use of internet also rose from 49.8 to 51.7, Slovenia continues to lag the EU average score of 58.0 the most in this dimension.

As a small and open economy, Slovenia is highly integrated in global value chains (GVC). In general, GVC participation is higher in small economies, especially as they usually do not have sufficient natural resources and are unable to exploit economies of scale due to limited size of the domestic market[10]. **For example, in 2019 Slovenia's share of exports and imports in GDP** (84.4% and 75.3%, respectively) **was significantly higher than the comparable average figures for the EEA** (48% and 44.1%, respectively)[11].

The COVID-19 crisis occurred after a decade of slower productivity growth, which fell from 3.0% in the period 2000-2008 to 0.6% in the period 2009-2019 (or to 1.4% in the years 2014- 2019)[12]. This also slowed down the catching-up with more developed countries in economic development, which was based mainly on increasing employment. In the medium term, the possibility of economic growth with higher employment will be limited due to demographic challenges therefore **GDP growth can be achieved almost exclusively by increasing productivity**, which will have to be significantly accelerated if Slovenia is to catch up with more developed EU countries, Austria[13]for example. **Developing young people's skills will be essential for Slovenia to achieve its aspirations to become an innovative society with a high value-added, digital, and green economy.**

The Slovenian National Innovation System

Slovenia has developed a somewhat complex set of institutions for R&D and innovation policy implementation based on experience of twinning partners in Austria, Ireland and Germany, and elsewhere. The country has developed and approved policies, strategies, action plans aimed at coordination among different parts of the innovation system. Ministry of Economic Development and Technology, Ministry of Education Slovenian Research agency (ARRS), SPIRIT and Slovenian Enterprise Fund (SPS), regional and local development agencies form the political system that creates and implements R&D and innovation policy.

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[8] Ibid

[9] European Commission, (2020d) Digital Economy and Society Index (DESI) 2020 Slovenia. Electronic source: https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=66929

[10] Banka Slovenije (2020) Analiza učinkov COVID-19 na slovensko gospodarstvo. Banka Sovenije, marec 2020, p 14.

[11] Ibid

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

[13] Ibid

Intermediary institutions and support services such as technology centres, technology platforms, centres of excellence, clusters, technology transfer offices and financial intermediaries actively work on R&D and innovation scaling up and commercialisation. An extensive network of infrastructure such as technology parks, business and university incubators, 'one-stop-shops' and similar was created to provide a framework for development and collaboration of all parts of the system, including the industrial system. The two largest universities (University of Ljubljana and University of Maribor) and Jožef Stefan Institute dominate the education and research system.

Formats of collaboration between R&D and business have evolved and changed due to changes in financing and strategic set up, for example from support for clusters, competence centres and centres of excellence to SRIPs. Some collaborative formats remained stable even after the change of the funding mechanisms (e.g. changes in types of support and calls for proposals) or the policy changes (e.g. amendments of strategies and programmes) which seems to be due to the stronger links and better developed services they are providing to their members.

The survey in this study revealed that most respondents (46%) believe that quadruple helix partners in Slovenia **establish periodical cooperation based on ad hoc proposals**, another 35% believe that cooperation is established **due to financial incentives**, while only 18% believe that this cooperation is well established, well thought out and exists in the long term (n=89). The stakeholders in the Slovenian innovation system are aware of the importance and the priorities of the country and are certain that a more open and collaborative approach to hard principles (legislation, regulations) and soft principles (ethics, social norms) in the innovation system would be beneficial for everyone in the innovation ecosystem.

Actors and Governance

Slovenia does not have a central innovation, research, and development coordination. 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 specialization 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, SRIPs and their network). A third vertical may be noticed within the scope of the Government Office for Development and European Cohesion Policy with the Smart Specialization Strategy coordination and interlocutor with the EC on the matters related to the S4. The SRIPs network is closely linked to the Ministry of Economic Development and Technology and SPIRIT with financing and the implementation arrangements.

The interview process conducted in this study confirmed the vertical principle of coordination but indicated a lack of coordination among several strategies and policies that are being developed. On one hand, **the coordination between the two verticals is recognised as one of the key factors of success** and R&I policy is increasingly being embedded horizontally into other policy areas. On the other hand, the interview results

showed that this process lacks appropriate pace and motivation and that international scale-up and commercialisation are missing from the innovation ecosystem in Slovenia.

While the bodies of the political system are well recognised by other stakeholders, the interview process **revealed a lack of trust in the implementing agencies because some of the agencies change implementation arrangements and implement instruments in the short term (up to 2 years).** One of the criticisms directed at the current set-up is that with the closure of the Technology Agency (TIA), which operated in the area of technology, the link between research and development and business has deteriorated. Lack of link between R&D and business has been noted before: In its Review of Innovation Policy of Slovenia published in 2012, the OECD noted that the most important public research organisations (PROs) receive 79% of their funding from the national government through a combination of "institutional" funds (research group grants, project-based awards) and that they mainly follow a scientific rationale while other goals, such as collaboration with industry are secondary activities.

It appears that in Slovenia both the funding institutions and the current users of the innovation funding system are rather closed. Moreover, planning and implementation of the funding mechanisms does not really consider the innovation ecosystem members as customers and therefore the support system and calls for proposals are not tailored to needs and capacities of smaller actors. However, there have been attempts to change this, specifically with the Strategic Research and Innovation Partnerships (SRIPs) which bring together representatives of the businesses, knowledge institutions and the state in the target areas of the Smart Specialization Strategy.

An analysis conducted by the Chamber of Commerce and Industry of Slovenia[14] shows that more innovative companies openly and actively cooperate with various stakeholders in the innovation ecosystem. An observation from the interviews in this study is that companies, regardless of size, lack knowledge about structuring their in-house innovation strategies, models and processes. The same applies to researchers, who have strong expert knowledge, but lack entrepreneurial ambition and skills, and this makes collaboration between businesses and researchers more difficult. Public higher education institutions continue to provide formal courses that seldom include entrepreneurship or any other subjects relevant for start-ups[15]. One key finding from the interviews is that there is a need to facilitate long-term collaborations (including both projects and platforms) between businesses, researchers and research institutions that would give them enough time and space to identify the knowledge potential, scope potential areas and options for close collaboration, to structure that collaboration and then carry it through to completion.

[14] Chamber of Commerce and Industry of Slovenia (2020) Takšno je dejansko stanje inovativnosti v slovenskem gospodarstvu. Glas gospodrastva, december 2020. Source: https://www.gzs.si/Portals/SN-informacije-Pomoc/Vsebine/GG/2020/December/gg_12_lores.pdf

[15] ABC Accelerator, (2018) SOUTH-EAST EUROPE STARTUP REPORT 2018. Source: https://www.startup.si/en-us/strategy-and-goals/documents/southeast-europe-startup-report-2018

Collaboration

A survey for context and network assessment performed for this study among a variety of randomly selected actors has shown that according to the respondents, **well-established long-term cooperation is rare and that it is most common between knowledge institutions and industry**.

When looking at results of cooperation among different types of actors, comparison showed that cooperation with educational institutions on all levels (including vocational training and higher education) as well as all types of research institutions is **likely to be less results-oriented, and often yields no commercialised results. It is often focused on innovation and research for new products or services and new knowledge for future products**, rather than drawing value from further development of existing products or services.

It may be concluded that institutional, long term cooperation is low. Most of cooperation between the actors of innovation ecosystem is set up on an ad hoc basis or on the basis of matching interest for applications for funding sources. **Public administration communicates inconsistently with the public**, thus its innovation policies, strategies, incentives as well as results and good practice are largely unknown to the broader public.

SRIPs are not widely recognised as strong innovation drivers. They are known to a limited number of actors, possibly those that are their members or cooperate closely with their members. **Universities and institutes are strongly involved in innovation, but the cooperation with other actors varies** across faculties and/or departments. They provide a backbone for innovation projects, however, are sometimes too closed for initiatives by other actors. There are several **companies that are highly recognised as important drivers of innovation** in the country. These are mainly in hi-tech, pharmaceutical and automotive sectors.

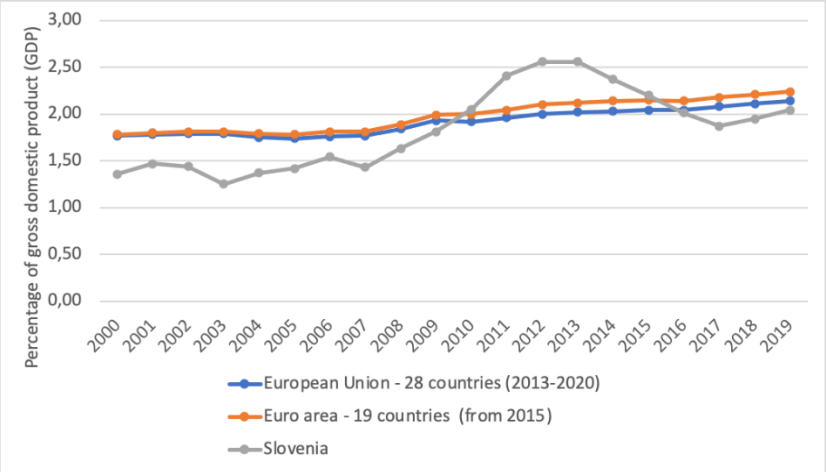
Financing

Slovenia invests modestly in RTDI, compared with EU-27 and countries used for comparison in this study. In the EU accession process, Slovenia started to gradually approach the average R&D intensity and has surpassed the EU average in 2010, however it is again lagging behind[16]. The R&D intensity in the EU Member States in 2017 in terms of R&D expenditure as % of GDP was at 2.07% on average, while Slovenia hit a low point at 1.86% in that year[17].

[16] EUROSTAT, (2019) Newsrelease. January 2019. Source: https://ec.europa.eu/eurostat/documents/2995521/9483597/9-10012019-AP-EN.pdf/856ce1d3-b8a8-4fa6-bf00-a8ded6dd1cc1

[17] Maja Sever (November 2018), Research and Development Activity, Slovenia, 2017, Statistical Officer of the Republic of Slovenia. Accessed via: https://www.stat.si/StatWeb/en/News/Index/7765

Figure 1 - Gross domestic expenditure on R&D, in percentage of gross domestic product (GDP)



source: EUROSTAT[18]

Like comparator countries, Slovenia has been increasing R&D expenditure as a share of GDP roughly since late 1990s, but has, contrary to Austria and Israel experienced sharp decline between 2013 and 2017 – similarly to Estonia where the decline started a year earlier and was overturned a year earlier.

In Slovenia, the highest share of R&D spending was recorded in the business enterprise sector (75%) similar to Hungary (73%)[19]. Gross Domestic Expenditure on R&D by sector of performance shows to higher expenditure on R&D of business sector per capita followed by government, higher education and private non-profit sector. Business R&D intensity is relatively high, but public R&D expenditure is modest; in 2018 business R&D expenditure stood at 1.45% of GDP in 2018 (above the EU average of 1.41%)[20]. Business expenditure on R&D in Slovenia is mainly concentrated in pharmaceuticals, machinery, computer technology and technologies related to electrical energy[21].

Sustainability of R&D&I funding is an issue for the Slovenian government, which planned a constant increase in the resources dedicated to R&D to achieve the Europe 2020 target of 3% of R&D intensity. Today, investment in R&D is growing at a rather slow rate which is, according to the European Commission's Country Report Slovenia 2020 (2020), detrimental to the achievement of United Nations Sustainable Development Goals (SDGs) no. 8 and 9[22].

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[18] Eurostat, accessed via ttp://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

[19] EUROSTAT, (2019) Newsrelease. January 2019. Source: https://ec.europa.eu/eurostat/documents/2995521/9483597/9-10012019-AP-EN.pdf/856ce1d3-b8a8-4fa6-bf00-a8ded6dd1cc1

[20] European Commission, (2020) 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.

[21] Ibid.

[22] European Commission, (2020) 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.

Public expenditure on R&D is partly boosted by EU Structural Funds. In the period **2004-2006** the Structural Funds provided EUR 237.5 million out of a total budget of EUR 334.5 million for the implementation of the Single Programming Document in Slovenia. In that period almost 6,000 small and medium-sized enterprises received support from Structural Funds that was mainly focused on the creation of networks of technology and centres of excellence and on promoting links between these and businesses. Up to the end of 2007, 28 centres acting as intermediaries between business and research were supported, among which were 10 centres of excellence. Due to limited funds, however, the only projects relating to the development of business infrastructure which were undertaken were those for the establishment of industrial zones. Overall, 21 business zone projects were launched in 2005 via two public tenders[23]. Development of an innovative business environment was promoted by supporting 64 innovations and patents and supported research.

In the period from **2007 to 2013** Slovenia was allocated more than EUR 4 billion of Structural Funds and Cohesion Fund financing under the Convergence Objective 1, which were complemented by Slovenia's national contribution of EUR 724 million. Slovenian development priorities were implemented via three operational programmes. The Operational Programme (OP) for Strengthening Regional Development Potentials planned 402 million EUR for the Competitiveness and research excellence and EUR 396 million for the Economic development infrastructure.

The funding allocated to specific projects in Enterprise support and innovation amounted to just under EUR 1 billion, or around slightly less than 30% of the overall amount of ERDF and Cohesion Fund available. The larger part of the funding (over 85%) went to innovation and RTD projects. The evaluation indicated that Slovenia was standing out among the EU12[24] countries as allocating the largest share of funding to SME support (23% of the total). In consequence, the ERDF constituted the main source of financing for business support in the country and amounted to over 1% of total national investment (gross fixed capital formation). The 'Strengthening Regional Development Potential' OP allocated nearly half of its budget, EUR 785 million, to finance 13 policy instruments for supporting SME development and innovation, with grants and loan guarantees for R&D and investment mainly concentrated on new and growing businesses[25]. In enterprise support and innovation traditional measures were complemented in 2009 and 2010 with innovative measures, such as support for technological investment in companies related to their R&D activities, the establishment of new creative centres and 'Research vouchers'[26]. During the 2007-2013 period, the funding of Financial Instruments (FIs) was limited to about EUR 105 million (11% of the total ERDF allocation for enterprise support) with a small national co-financing rate (15%) and no private co-financing. FIs were managed by the Slovene Enterprise Fund and were prevalently in the form of guarantees while loans and, to a limited

[23] Applica-Ismeri-wiiw (2006) Ex Post Evaluation of Cohesion Policy Programmes 2000-2006 financed by the European Regional Development Fund in Objective 1 and 2 regions Work package 1: Coordination, analysis and synthesis Source: https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2006/wp1_tsk4_slovenia.pdf

[24] EU-12 comprises EU Member States: Bulgaria, Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Romania, Slovenia and Slovakia.

[25] Applica, Ismeri Europa and Cambridge Economic Associates (2016) Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF), Country Report Slovenia, Source: https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2013/wp1_sl_report_en.pdf

[26] Applica, Ismeri Europa and Cambridge Economic Associates (2016) Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF), Country Report Slovenia, Source: https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2013/wp1_sl_report_en.pdf

extent, venture capital[27]. Overall, the measures co-financed over the period led directly to the creation of 5.860 jobs. This was achieved in part through the support given to 655 RTD projects and to 3.101 projects to help firms to finance investment[28].

In the period **2014-2020** Slovenia planned to implement the cohesion policy through the priority axis "International competitiveness of research, innovation and technological development in line with smart specialisation for enhanced competitiveness and greening of the economy" defined in the National Operational Programme of European Cohesion Policy. With this priority Slovenia intended to focus on target markets and develop less fragmented scientific research and technological development. The National Operational Programme aimed to strengthen efforts particularly in the area of research and development, boost the innovation potentials of SMEs, promote resource efficiency and reduce environmental pressures, further develop the transport sector, boost the growth of employment rates and reduce the number of people at risk of poverty and social exclusion[29]. Slovenia's Smart Specialisation Strategy was developed with the goal to support further development of public and business R&D potential in chosen areas and thus to enable Slovenia to become a technology leader in its priority fields[30].

Slovenia is ranked 19th out of EU-28 Member States in **Horizon 2020**, while its success rate in budget share ranking is 18th out of 28 member states. 346,9 million EUR was received, or 0.61% of the EU total in funding by the project participants after deduction of their linked third-party funding.

Mapping of the support instruments in Slovenia listed 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 and several private institutions. 9 of the innovation support instruments were selected for further analysis through case studies. These case studies show lack of evaluation of each instrument that would assess to what extent the aims of the instrument were achieved. As a result, the amendments of the instruments appear to be done on ad hoc basis as there is no clear evidence why they were necessary. Moreover, while the authorities in charge are in regular touch with some beneficiaries and have their feedback, there is no consistent feedback and follow-up from all the beneficiaries. To achieve improved performance of financed projects and improved performance of beneficiaries after the co-financing, constant monitoring of performance of beneficiaries is needed. To further improve the implementation of the instruments, close cooperation with stakeholders is needed to understand the merits behind observed behaviour of beneficiaries.

When financially planning the instruments, the long-term availability of the instruments is needed. This should be reflected in the development of the culture of application "when needed" rather than accumulating funding when possible (e.g., vouchers). In addition, the stability of innovation instruments plays an important role in the development even in financial crisis or budget shortages. The trends in R&D

[27] Ibid.

[28] Ibid.

[29] Euro Access, call: Implementation of EU Cohesion Policy Slovenia 2014-2020. Accessed via https://www.euro-access.eu/calls/implementation_of_eu_cohesion_policy_slovenia

[30] IPP (2021) Targeting priority areas/sectors. Source: http://www.innovationpolicyplatform.org/www.innovationpolicyplatform.org/content/slovenia/index.html

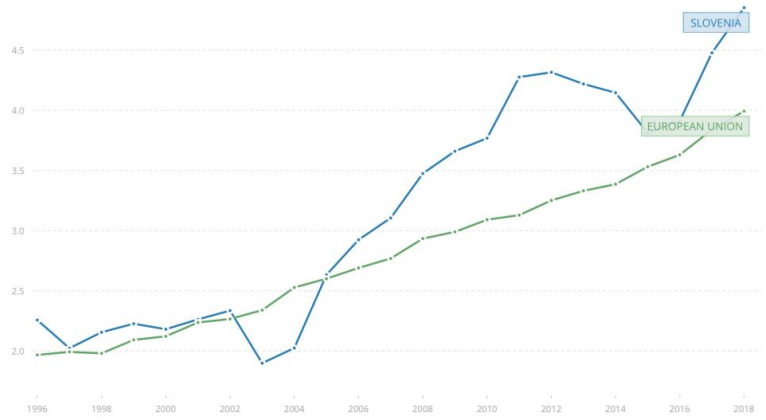
expenditure as a share of GDP over the last decade show well the difference between stable environments of Israel and Austria and more volatile cases of Slovenia and Estonia, both new EU Member States that are catching up in terms of opportunities of research exchange, Single Market and protection of intellectual property rights. **The instability of funding is also linked to the cyclical nature of ERDF funding, which forms a larger part of the overall RTDI funding in the two countries, given the smaller national budgets.**

More effort is required to address the lack of sharing of knowledge on project preparation and knowledge gained in the co-financed projects. Beneficiaries of the instruments suggest contracting with larger flexibility in terms of project implementation, but strict commitment to results or indicators. A complex and detailed financial and content control system for payment claims is still causing delays and additional workload.

Performance

Slovenia performs close to the EU average in international scientific co-publications with the index of 147.7 relative to the EU in 2019, while in most cited publications the value of the index is 73.3. According to WIPO Slovenia performed better in innovation inputs than innovation outputs in 2020[31]. **Slovenia has had above EU average number of researchers in research and development per million people for years; the number declined between 2012 and 2016 when the funding for researchers in research and development was lower, however it has picked up since. On the other hand, Slovenia has a below average number of patent applications with the European Patent Office per million inhabitants in comparison to EU-28.**

Figure 2 - Researchers in research and development per million people



Source: World Bank

When discussing product development and life cycle, survey respondents in this study see the weakest point of the Slovenian research and development process in its inability to develop and sustain partnerships for innovation and development (65%). The interviewees for this study point out that Slovenian innovation ecosystem did

[31] WIPO (2020) Global innovation index – Slovenia. Source: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2018-profile43.pdf

not develop a sufficient number of instruments specifically focused on the needs or specific potential of:

- target specific groups (researchers, students, youth and other),
- focus on specific stage of the product/service/process life cycle (research, linking research to market, seed and development, start-up, growth and establishment, expansion, maturity, decline stage), and
- be distinguished by the type of intervention (business problem, regional specifics, transformation needs).

When evaluating the effect of the selected instruments[32] on the supported beneficiaries of the instruments we can state that **there is no significant impact of support of beneficiaries on turnover.** The most probable explanation for the result could be that firms had not been selected for funding based on criteria which was used for the database for the calculations (e.g. risk investment, patents, SKD sub-sectors of specific importance etc.) but rather **based on criteria not observable in the database**. On the basis of the above and with the data available we may conclude that, on average, companies could not improve their performance in terms of enhanced turnover after they were funded. This may lead to further exploration of the results and further studying of the data which was restricted in this study due to limitations in the database.

Another conclusion from comparison of beneficiary (funded) and non-beneficiary (ones without funding) companies is that fast-growing companies are not applying for the instruments, or they were not selected for funding. Only 97 companies out of all 5906 from the list of fast-growing companies received funding from the selected instruments between 2016 and 2019. The reason for this may be that they were not selected, or they did not apply[33].

The implementing bodies would benefit if the relevant beneficiary data could be collected before the start of implementation of the support instrument and again after the end of the supported project. The structure of the existing database could be further improved with data already available in reports and official databases available in the country (for example AJPES, tax authority). Data interoperability and quality assurance must be ensured.

The implementing bodies do not conduct **detailed reviews of implementation of a specific instrument** besides regular monitoring (of individual projects). **One may be chosen each year depending on the implementation** (availability of funds) **or changes in the needs of the target groups** (pandemic, economic changes, interest rate changes and similar).

<u>Barriers and Drivers</u>

Blockchain and AI are two examples of quality innovation taking place in Slovenia. Slovenia has **successfully conducted scientific research in artificial intelligence** since the early 1970s. In October 2020 official notification from UNESCO, confirming establishment of the

[32] VAV-2, P4D, RDI in value chains and networks - Lot 2 and SK75 2017

[33] Due to the lack of data the study team was not able to assess this dimension on enough detail.

first International Research Center for Artificial Intelligence under the auspices of UNESCO were completed and agreement on the establishment of IRCAI between the Government of the Republic of Slovenia and UNESCO officially entered into force[34]. 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[35] while it is to be seen how artificial intelligence research sector will assure cooperation with business and commercialization.

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. Academia-business linkages are particularly important for the successful translation of knowledge into innovation. In the second place, this leads to higher productivity for the industry and improved competitiveness performance of Slovenian economy. The Country Report Slovenia 2020[36] also indicates the **fourth industrial revolution as a challenge for the Slovenian research community and economic performance** in general. In particular, the technological disruption brought about by big data, the internet of things, artificial intelligence and robotics will have a **significant impact** on the Slovenian economy, its productivity and competitiveness as well as on the country's workforce. The development and implementation of digital technologies and new business models calls for increased research activities, improved engineering, mathematics and digital skills, efficient changes in public and private R&D as well as effective integration of all these aspects into the country's economy.

The support **institutions** in the innovation system **are not publicly financed based on their performance** but on equal basis through their eligible costs. This causes uneven performance which is also identified as a barrier for 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[37]. This study finds the missing elements of performance-based **financing among actors in the business support** ecosystem like SIO and SRIPs which are discussed in other parts of this report.

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[38]**. Crucially, the divide between the **government, public funded sector and other actors in the Quadruple helix is observed as a key barrier for development**. This causes weak policy responses being developed consisting of control mechanisms rather than enabling principles. The key weakness of the

[34] IRCAI (2020) The final act in the establishment of IRCAI. Source: https://ircai.org/

[35] 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

[36] Ibid.

[37] 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.

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

quadruple helix in Slovenia is formed by a lack of consultation and collaboration among all partners where the government should take the lead.

Collaboration with the **people, the society factor in quadruple helix, is the weakest point** in the system with limited collaboration noted. **Collaboration in the Quadruple Helix Model seems to be based on occasional informing where decision-makers inform stakeholders about the process of the decision making but decisions are only partly conditioned by the opinion of stakeholders.**

Lack of internal purchasing power for innovation is further caused by the practically non-existent venture capital (VC) market in Slovenia. This gap was slightly closed with instruments of the Slovene Enterprise Fund in the form of start-up incentives, seed capital, venture capital, microcredits, guaranties and special incentives and some selected instruments of other institutions. However, the gap in capital is larger than the country is being able to secure. **According to experts in the venture capital market interviewed for this study, the annual need for funding in Slovenia from VC is around EUR 70 million** while the country has a fragment of the funds ready to invest. In fact, the funding from private instruments is scarce.

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.

2 Objectives and Approach

2.1 Background

This document constitutes the report for Activity 2: Report on the current state of play in the Slovenian national innovation ecosystem under the contract REFORM/SC2020/100 – Strengthening the Innovation Ecosystem in Slovenia.

2.2 Methodology

The objective of this activity is to conduct a review of the current state of play in the national innovation ecosystem in Slovenia. It covers the core dimensions related to policies, programmes and their efficiency and effectiveness in the innovation ecosystem of the country. The analysis was performed through 7 associated tasks:

A. Collect information and perform an in-depth review of the regulatory and policy framework.

B. Collect information and analyse the interactions and cooperation between the actors in the innovation ecosystem.

C. Collect information and review innovation programmes and measures undertaken by different actors.

D. Conduct portfolio mapping of innovation instruments.

E. Conduct an in-depth functional review of a sample of innovation instruments focusing on priority areas.

F. Conduct a review of networks in the innovation ecosystem.

G. Conduct a comprehensive analysis of the state of play of the Slovenian national innovation ecosystem

In terms of the time horizon, the research methodology in this study is based on the cross-sectional approach because the study aims to describe the current state of play in the national innovation ecosystem in Slovenia. Where appropriate and possible, the study looks beyond the 'snapshot' time horizon in instances where similar studies were used to compare different time horizons on similar issues, as in the chapter Barriers and Drivers and in some chapters discussing performance (where performance was studied using quantitative research methods). Innovation support instruments are presented in the form of case studies.

The data for this study was collected through desk research, which provided the initial evidence base, and was then triangulated using qualitative (in depth interviews with stakeholders, coordinators of instruments, beneficiaries of the instruments) and quantitative methods (online survey and calculations of the performance of instruments based on secondary data obtained from beneficiaries and company business records), leading to the conclusions presented herein.

Where surveys were done, we used a larger number of units of analysis in the research, searched for and compared numerical data and focused on the relationships between

variables, which are characteristics of quantitative research. This approach was mostly used for network analysis and in the performance chapter.

For the network analysis and policy on-line survey, actors were sampled using the stratified accidental sampling method on a total of 311 units. The strata were formed according to the following: representatives of collaborative platforms and partnerships, political system, public sector research, beneficiaries/applicants/companies, education and infrastructure, financial institutions. The survey had a good response rate and we received 139 responses, not all of them complete as some of the respondents did not fill in the comments in the explanatory questions.

Table 1 - Regional response rate for the survey for context and network assessment

Region	% of answers
Pomurska region	0,75
Podravska region	9.77
Koroška region	2.26
Savinjska region	6.02
Zasavska region	2.26
Posavska region	0.00
Jugovzhodna Slovenija	7.52
Osrednjeslovenska region	48.87
Gorenjska region	8.27
Primorsko-notranjska region	2.26
Goriška region	9.02
Obalno-kraška region	1.50
No answer	1.50

Source: own

Over representation of the Osrednjeslovenska region comes in part from the larger number of companies located in the region and due to the larger response from this region. To improve the coverage the interviews were covering also other regions in Slovenia.

The second on-line survey used for in-depth review of instruments was based on simple accidental sampling, as all beneficiaries of the instruments that allowed their email addresses to be publicly available were included in the sample. The sampling was done on 211 units while the response rate to the survey was lower than expected. The survey received 69 responses, not all of them complete as some of the respondents did not fill in all the answers and the comments in the explanatory questions. Due to the response rate, the study used survey responses where higher (above 15%) response rate was achieved. As the study also involved performing interviews with coordinators of the instruments and beneficiaries of the instruments, the survey was used as a basis to develop conclusions. Nevertheless, the Beneficiary of this study may further study the performance of the instruments when and where necessary.

Table 2 - Coverage of the survey for context and network assessment by the type of organisations represented

Type of organization	Number of answers	% of answers
Partnership, platform (SRIP, joint projects, technology platform, cluster)	10	9,09
Public institution implementing policies and programs (ministries and agencies, funds)	11	10,00
Public research organization	12	10,91
Private research organization	6	5,45
Company	39	35,45
Educational organization (all levels and types)	16	14,55
Innovation and research infrastructure (technology park, incubator)	13	11,82
Financial institution	0	0,00
Innovation broker (TTO, private agents)	1	0,91
Regional development agency	2	1,82
No answer	0	0,00

Source: own

Table 3 - Coverage of the respondents of the survey per instrument applied for

Instrument	Number of answers	% of answers	Total cost of projects applied
Convertible loan for start-up of innovative companies in the amount of EUR 75,000	1	2,17%	635.000
VAV-2, Intellectual Property Protection Voucher	19	41,30%	1.005.247
P4D 2020 Incentives for the digital transformation of companies	4	8,70%	5.171.633
Beneficiaries of the SIO network	12	26,09%	1.184.475
RDI in value chains and networks - Lot 2: Incentives for research and development projects (TRL 6-9)	15	32,61%	161.731.309
P2 2021 - Incentives to start innovative companies	4	8,70%	2.160.000
VAV 14 - Prototyping voucher	4	8,70%	727.112

Source: own

Along with surveys and interviews the study team performed an evaluation of instruments based on State Aid data received from Beneficiary on funded beneficiaries for selected 6 instruments. The evaluation compared performance of the beneficiaries of the instruments with the control group. For the control group the data on fast growing companies from AJPES was used. The decision to take the fast-growing companies was based on the interest of the Beneficiary of this study if there are possibilities to develop credit or other financial recovery-based instruments. That is why we used better performers (fast-growing companies) as their control group. This decision, however, necessitates to restrict the observations on exactly this kind of enterprises, so that the funded companies and control

group companies originate from there in order to avoid a selection bias through superimposing matching variables that were unobserved.

To study the performance of the instruments we used the propensity score matching method with a subsequent arithmetic calculation of differences before and after in the funding and control groups plus a corresponding panel difference-in-difference model to see whether those findings are statistically significant. A control group analysis is used to estimate impacts in situations where impacts are not directly observable. This is a characteristic problem when an item has been supported from one point of time onwards (by anything like funding, consultancy etc.). In this situation it is only possible to measure a status with funding; it is not possible to compare it directly with the status of non-funded companies. This would necessitate a parallel existence of one item. The problem is solved by an approximation approach where an artificial benchmark of comparison is established to measure impact. This artificial benchmark is the control group - in our case the fast-growing companies. The use of a control group makes this approach quasi-experimental. The major requirement of a control group is a strong similarity (ideally an infinitesimally small difference) of the character of items with the only distinct exception that the control group items have not been funded (Bergs, 2012). More on the results may be found in the performance chapter.

Table 4 - Overview of methods

Group	Approach	Method used	Specific chapter were used
Research design	Cross-sectional	Desk research, online surveys, in-depth interviews	Whole study
	Longitudinal	Desk research, statistical data	Barriers and drivers, performance
	Quasi-experimental	Before and after analysis of beneficiary data	Performance of the selected instruments
Research strategy	Quantitative	Online surveys, before and after analysis of beneficiary data	Network analysis, performance, case studies on instruments
	Qualitative	In-depth interviews for context, in-depth interviews for instruments review	Whole study
Data collection methods	Primary data	Online surveys, in-depth Interviews, data on State aid	Network analysis, performance, case studies on instruments
	Secondary data	Documents, surveys, and other materials	Whole study

Source: own

2.3 Timing of the study

Implementation of tasks started in December 2020 with the drafting of the inception report and with collection, selection and review of the relevant legal and policy documents containing other information. In close cooperation with the Beneficiary, activities were implemented by the end of March and the draft report titled Review of the Current State of Play in the Slovenian National Innovation Ecosystem was delivered on the 5th of April.

2.4 Uncertainties, assumptions, and challenges

The challenges indicated in the inception report related to the lack of engagement from programme owners and cooperation from stakeholders proved to be lesser than expected. The Beneficiary engaged on the implementation of the tasks planned in each discussion and provided support during desk research, development of online surveys and data collection, while other stakeholders remained open and available for discussion.

The part of the study related to end users of state aid is based on the data received from the Beneficiary. The data received has limited information necessary to understand performance of the innovation system. The develop better base for the performance review the data was additionally compiled with official business registry data AJPES on fast growing enterprises. The data needed for the online survey with end users of the innovation instruments the data was purchased.

Concerning stakeholder consultations about innovation, stakeholders were open for discussion and the study team was able to collect a lot of data through stakeholder consultations. The data obtained from stakeholder consultations could not be obtained through desk research, so the study team remained focused on the consultations as a crucial element of the task. Over 50 interviews were conducted during task implementation, together with two online surveys, which provided valuable data for discussion, research, and triangulation of results of the study.

2.5 The report

The report contains the review of national and international literature, it synthesises the outcomes of wide-ranging consultations with key actors from all aspects of the Innovation system. This is used to present understanding of the current innovation system and key actors' relationship. Finally, the report outlines drivers and barriers, displaying an acute understanding of needs to successfully address challenges in practical terms. The report is structured in chapters. **Chapter 1** presents the methodology and background of the survey and how it was conducted. **Chapter 2** describes the socio-economic context of Slovenia, to set the scene for the review. This chapter presents the situation in the country from different angles using the innovation scoreboard, digital economy and society indexes and the state of play in business. **Chapter 3** presents the Slovenian national innovation system, while **Chapter 4** presents the actors and governance in the system using network analysis and discusses the actors in the innovation ecosystem and their roles. **Chapter 5** discusses the legal and policy framework and describes working relations in the innovation system. **Chapter 6** presents the financing instruments supporting innovation in Slovenia and selected case studies on instruments, showing dimensions of the financing possibilities in

Slovenia. Collaboration in the innovation system is presented in **Chapter 7**, while **Chapter 8** discusses performance of the system and instruments used to support innovation. **Chapter 9** closes the study with discussion on drivers and barriers in the innovation ecosystem in Slovenia. Literature and information sources used in this study are listed in the last part of the document.

The report when in the draft phase was internally reviewed to assure quality assurance. The report consists of 173 pages with annexes.

3 Socio-Economic context

The chapter presents the socio-economic context of Slovenia, describing economic circumstances of the country with the help of social and economic data and indicators. The following topics are presented:

- Overall economic circumstances: general economic situation is important as it can both drive innovation and vice versa, economy can build its competitiveness on innovation,
- State of the play in business: general characteristics which are important for innovation ecosystem and its functioning are presented,
- Skills and skill gaps: information on skills is important due to their impact on competence for innovation, entrepreneurship and knowledge-based economy,
- Digitalisation: current situation is presented by the Digital Economy and Society Index. Availability and accessibility of digital services can boost innovation,
- Innovation: it is presented with the information from the Innovation Scoreboard and International Property Rights Index. Property rights protection is an important motivator for innovation.

3.1 Overall economic circumstances

Already in 2019, before the hit of the COVID-19 pandemic, **Slovenia's economic growth decelerated considerably but remained robust**[39]. 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[40]. As the second quarter was more affected by lockdown restrictions, the decline in GDP was expected to be even steeper. The rise in unemployment was rather modest due to government support measures[41]. According to the forecasts, economic growth in Slovenia in 2021 will be at 4,6%[42]

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. Domestic demand remained the main driver of growth. Private consumption continued to rise, supported by a relatively strong increase in household disposable income.

[39] 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. Electronic source: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020SC0523&from=EN

[40] European Commission, (2020) ECFIN Forecasts. Electronic source: https://ec.europa.eu/economy_finance/forecasts/2020/summer/ecfin_forecast_summer_2020_si_en.pdf

[41] ibid

[42] UMAR (2021) Pomladanska napoved gospodarskih gibanj 2021. Electronic source: 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

3.2 State of the play in business

Productivity growth fell from 3.0% in the period 2000-2008 to 0.6% in the period 2009-2019 (or to 1.4% in the economic years 2014- 2019)[43], resulting in slower catching-up with more developed countries. Economic development was based mainly on increasing employment, however the possibility of further economic growth with higher employment will be limited due to demographic changes. Thus, **GDP growth can be achieved almost exclusively by increasing productivity**; for catching-up, the change would need to be significant[44]. Innovation can play an important role in boosting productivity, especially in terms of technological and organisational productivity.

Investment activity in the last ten years was significantly lower than before the financial and economic crisis in 2008. Until 2008, the ratio between investments in the corporate sector and GDP in Slovenia was significantly higher than the average of leading innovator countries. In the last ten years it has been lower, but the difference has gradually decreased. The ratio of government investment to GDP fluctuated due to the dynamics of drawing European funds, and in recent years has been lower than the average of leading innovators. Slovenia lags behind the average of leading innovators in terms of household investments (which traditionally invest the most in housing) [45].

The share of investments in intangible capital in the period 2010–2016 did not increase compared to the period 2000–2006[46]. **The period 2008-2018 is perceived as "a lost decade".** Micro data for the business sector show that in 2017 the share of intangible assets in total corporate investment in Slovenia was around 27%, while the EU average is 37% (over 40% in EU's leading innovators)[47]. A study at macro level shows that only intangible ICT capital (software and databases) has a statistically significant and direct impact on productivity growth and while the latest EIB index of readiness of companies for the digital age (EIBIS26) ranks Slovenia fifth in the EU, Slovenia has a lower share of investment in software and databases than leading innovators. This reduces the potential to increase labour productivity [48]. Moreover, Slovenia ranked 15th among the EU countries in terms of the share of intangible capital in total accumulated capital (6.4%). After 2010 most countries accelerated growth of investments in intangible capital, while Slovenia increased the share of R&D and economic competencies (such as research in advertising and marketing), but reduced the shares of other intellectual property (e.g. design) and software and databases[49].

As a small and open economy, Slovenia is highly integrated in global value chains (GVC). In general, GVC participation is higher in small economies as they usually do not have sufficient natural resources and are unable to exploit economies of scale due to limited

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

[44] Ibid

[45] Ibid.

[46] Ibid.

[47] Ibid.

[48] Ibid.

[49] Ibid.

size of the domestic market[50]. This is reflected in the market orientation of the businesses and large share of exports and imports. **In 2019 Slovenia's share of exports and imports in GDP** (84.4% and 75.3%, respectively) **was significantly higher than the comparable average figures for the European Economic Area (EEA)** (48% and 44.1%, respectively)[51].

Slovenia can benefit from the transformation of global value chains, however this can only be possible on the basis of a proactive development policy aimed at promoting innovation-driven growth and seizing opportunities within digital transition, low-carbon and circular economy[52]. So far Slovenia maintained relative comparative advantages in the field of (increasingly important knowledge) and intangible capital over competing countries and regions, but the advantages are gradually closing[53].

26% of existing jobs in Slovenia are technically endangered, making Slovenia one of the most exposed countries, but the actual impact on the labour market will depend on the digital transformation[54] as studies show a positive link between digitisation or robotics and employment - transformed companies accomplish faster growth and faster employment[55]. **In Slovenia, large companies are among the most successful in terms of digitalisation, while small and medium-sized enterprises lag behind, although they are still on the EU average.** A good quarter of companies show a high level of readiness for Industry 4.0, which is encouraging data, while processing companies are still strongly focused on traditional products; this indicates that Slovenian companies must significantly improve their management of existing 3.0 technologies before introducing 4.0 solutions. Acceleration of the level of innovation as well as deepening the digital transformation will be more reflected in increased revenues and digitalisation of products and services, introduction of digital mindset, digital business models, services, as well as more open organisational and business models[56].

The digital skills of adults and employees are improving but remain relatively weak on international scale, resulting in slower digital transformation of society and the economy[57]. While the citizens view the impact of digital technologies on the economy positively, the share of individuals who positively view the impact of technologies on society is the lowest among all EU countries. The key problem in the digitalisation of public services are services for companies, which is also reflected in the use of e-government solutions[58].

Slovenia has slipped below the EU average and is much lower than the leading innovators due to declining investment in R&D. The total R&D expenditure shrank in the period 2012–2017, but in 2018 it rose to 1.95% of GDP. In the public sector R&D investments decreased by EUR 117 million until 2016 or about 40% compared to 2011 due

[50] Banka Slovenije (2020) Analiza učinkov COVID-19 na slovensko gospodarstvo. Banka Sovenije, marec 2020, p 14.

[51] Ibid

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

[53] Ibid

[54] Ibid

[55] Ibid

[56] Ibid.

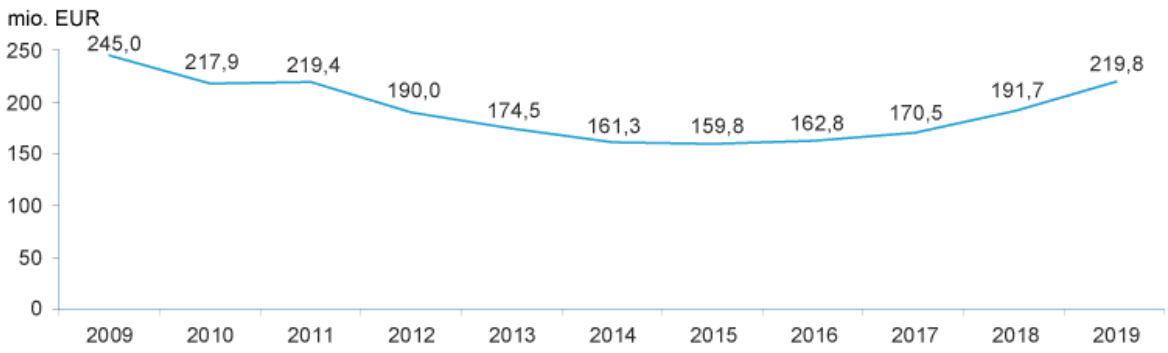
[57] Ibid.

[58] Ibid.

to fiscal consolidation in this period; about 40% of this decline has already been recovered in the last two years. The business sector invests the most in R&D and until 2015 it represented a significant source of growth in R&D investments. However, the investments of the private sector decreased in 2015-2017 due to several factors such as lower volume of European funds between 2013-2014, late and slow absorption of European funds since the implementation of the new financial perspective 2014-2020 and lower volume of tax reliefs for R&D after 2015.

Both the public and the private sector finance R&D investments mainly within their own sector, thus lower volume of European funding also reduced the incentives for cooperation and knowledge transfer between the research and business sectors. Self-financing rate is an indicator that measures the extent to which the investments of an entity could be financed by its gross savings and is calculated by dividing gross savings with gross fixed capital formation (GFCF). The self-financing rate of the business sector increased from 93% to 97% between 2008 and 2017, while in the public sector it decreased from 88% to 80% in the public sector, with the remaining public sector funds being used to finance R&D in the business sector[59]. The peak of R&D funding from the national budget for R&D was in 2009, followed by decreasing funding from 2010 to 2016 when funding started to grow gradually, however it still has not reached pre-2010 level.

Figure 3 - State budget funding of R&D (realised budget)



Source: SURS, 2021[60]

Innovation activity in companies dropped between 2010-2016, but the trend has turned and in the period 2016-2018 their innovation activity has managed to approach the level before 2010. Innovation activity (share of companies that introduced innovations) increased from 39.8% in 2014-2016, when it was the lowest, to 48.6% in the period 2016-2018, while before 2010 approximately half (50%) of companies were active in innovation. The increase was also related to the implementation of the Slovenian Smart Specialization Strategy (S4), and in 2016-2018 period 87 public tenders and programs with a total value of EUR 983 million were implemented and almost half of these funds were allocated to research programs, development and innovation[61].

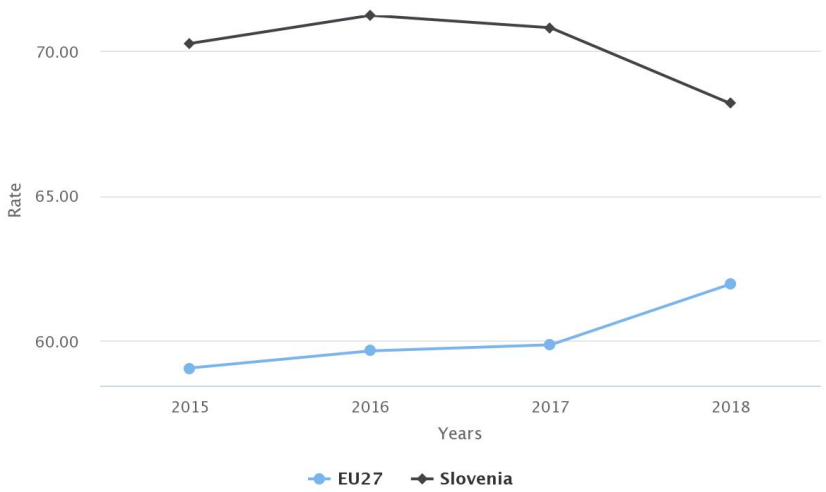
[59] Ibid.

[60] SURS (2021) Proračunsko financiranje raziskovalno-razvojne dejavnosti v 2019 preseglo 200 milijonov EUR, Source: https://www.stat.si/StatWeb/News/Index/9082

[61] Ibid.

The Advanced Technologies for Industry (ATI) project has been set up to inform the EU's industrial policy by providing statistical data and analyses measures a variety of indicators, including start-ups survival rate. The start-ups survival rate (calculated for 3-year period) in Slovenia is higher than the EU average, however it dropped since 2016, when the rate was above 71,23, to 68,18 in 2018[62], while the EU average rose from 59,64 to 61,95 in the same time period. This shows that a larger share of new enterprises survives beyond initial three years of operation in Slovenia compared to EU average, however it does not consider the level of innovation or share of innovative enterprises. Another KETs Observatory indicator shows that Slovenia is lagging behind in this field: in 2016 Slovenia had 23,10% of enterprises with innovation while the EU average was 27,60%[63].

Figure 4 - Start-up survival rate – non technology specific



Source: KETs Observatory, 2021[64]

An encouraging statistic is that the percentage of the companies with ICT training in 2018 was higher (29%) than EU average (22%) and follows the EU average improvement rates[65]. This may be linked to some mechanisms where public and EU funding was used to offset unemployment (lack of work) with training.

The Ministry of Economic Development and Technology issued a call for Demo/Pilot projects in 2018 funded from EU funds in the amount of EUR 73 million, which are allocated to projects planning the use of blockchain technology and AI and other converging technologies (IoT, big data, ML, predictive analytics, AR, VR, MR, 3D and so forth). The

[62] KETs Observatory (2021) Enterprises survival rate. Source: https://ati.ec.europa.eu/data-dashboard/country?filter[technology]=non_technology_specific&filter[geo]=EU27,SV&filter[year]=2018,2017,2016,2015&filter[dimension]=entrepreneurship&filter[indicator]=Survival_rate

[63] KETs Observatory (2021) Enterprises with innovations 2016. Source: https://ati.ec.europa.eu/data-dashboard/country?filter[technology]=non_technology_specific&filter[geo]=EU27,SV&filter[year]=2016&filter[dimension]=innovation&filter[indicator]=Enterprises_innovation

[64] KETs Observatory (2021) Enterprises survival rate. Source: https://ati.ec.europa.eu/data-dashboard/country?filter[technology]=non_technology_specific&filter[geo]=EU27,SV&filter[year]=2018,2017,2016,2015&filter[dimension]=entrepreneurship&filter[indicator]=Survival_rate

[65] KETs Observatory (2021) Firms with ICT training. Source: https://ati.ec.europa.eu/data-dashboard/country?filter[technology]=non_technology_specific&filter[geo]=EU27,SV&filter[year]=2018,2017,2016,2015&filter[dimension]=skills&filter[indicator]=Firms_ICT_training

success of Slovenian blockchain companies is well recognized while Slovenia joined the Group of Friends on Digital Technologies coordinated by the United Nations. The European Commission recognized Slovenia as a reliable partner to be hosting the first pilot project – the regional investment fund for AI and Blockchain start-ups in Europe. Slovenia shows evidence of growth of the use of emerging key enabling technologies, which is an important factor, and shows that the pace of technological development today is exceptional and the fastest it has ever been in human history.[66]

3.3 Skills and skills gaps

To illustrate the skills and skill gaps necessary for competitive economy, the OECD Skills Strategy Diagnostic Report - Slovenia 2017[67] was used. **Developing young people's skills will be essential for Slovenia to become an innovative society with a high value-added, green economy.** Results of the Programme for International Student Assessment for Slovenia show that at the age of 15, students perform relatively well overall in science, reading and mathematics, but that migrants and vocational students do much worse. There is legacy workforce lacking tertiary education. While the share of young adults in Slovenia with tertiary education is growing, completion rates in tertiary education are low, and many recent graduates lack strong cognitive and socio-emotional skills as measured by the Survey of Adult Skills (PIAAC). Co-operation between higher education institutions and employers is relatively weak and could be expanded, e.g. through work-based learning.

One-third of 16– to 65-year-olds in Slovenia – almost 400,000 adults – have low levels of literacy and/or numeracy. While Slovenia is actively seeking to involve more low-skilled adults in learning, most of them are not interested in adult learning and do not choose to participate in it. Some low-skilled adults would be willing to participate, but lack the financial resources and time to do so[68].

Society and economy lose when adults are not fully using their skills. According to OECD, about one-third of working-age adults[69] in Slovenia are either unemployed or not participating in the labour market[70]. According to the data of Statistical Office for the last quarter of 2020[71], almost 85% of population (1,783 million in) is capable of work, of which 867.000 are employed, 53.000 unemployed and 747.000 are inactive. **Retaining and attracting talented people from Slovenia and abroad can help Slovenia meet its skill needs and infuse new knowledge, technology and innovations into the economy.** A relatively small share of Slovenia's foreign-born population is highly educated. At the same time, a small but growing number of tertiary-educated Slovenians are emigrating, and this is not being matched by inflows of tertiary-educated adults. High-skilled workers have a

[66] Government of the Republic of Slovenia (2019) Slovenia launches national test blockchain infrastructure and Slovenian Blockchain partnership Source: https://www.gov.si/en/news/slovenia-launches-national-test-blockchain-infrastructure-and-slovenian-blockchain-partnership/

[67] OECD (2017) OECD Skills Strategy Diagnostic Report - Slovenia 2017, OECD, OECD Directorate for Education and Skills and Special Advisor to the Secretary-General on Education Policy.

[68] Ibid.

[69] According to OECD data, 65,3% of population is of working age. Source: https://data.oecd.org/pop/working-age-population.htm

[70] OECD (2017) OECD Skills Strategy Diagnostic Report - Slovenia 2017, OECD, OECD Directorate for Education and Skills and Special Advisor to the Secretary-General on Education Policy.

[71] https://pxweb.stat.si/SiStatData/pxweb/sl/Data/-/0762001S.px

relatively low potential for earnings in Slovenia, partially due to relatively high social security contributions[72] and the escalating taxation system for employees with higher salaries.

Slovenia could partially offset the impact on productivity of the relatively low skill levels of its adult population through better use of available skills. Slovenia's skill use performance is average, but well below top-performing countries. The skills of relatively highly skilled young workers and less educated workers, who most need on-the-job learning, are used relatively infrequently. Relatively few Slovenian firms have adopted High-Performance Work Practices (HPWP) (teamwork, autonomy, mentoring, job rotation, incentive pay, flexibility in working hours etc.) that are the main driver of skills use in workplaces. In contrast to trends in the OECD generally, larger firms in Slovenia use workers' skills and adopt HPWP less frequently than smaller firms. Labour regulations and offshoring practices may also be affecting skills use[73]. In terms of labour market mismatch, employers have given feedback that they cannot find labour for simple labour-intensive manufacturing and construction. Insufficient technological restructuring of Slovenian industry might be one of the explaining factors, as well as problems in science-industry cooperation. Such mismatch between demand and supply of labour is not so explicit for highly skilled labour, except in the ICT sector.[74]

Highly skilled people are central to Slovenia's innovation system and entrepreneurial success, particularly in strategic industries like green technology. The innovation performance of universities and public research institutions is characterised by relatively high publication rates but low international collaboration[75]. Anecdotal evidence from the interviews performed during this project shows relatively good cooperation in Horizon 2020 and similar programmes, however additional research of this issue should be done to provide more detailed evidence. According to the OECD, the relatively weak contribution of the higher education sector to innovation may be explained by comparatively low higher education expenditure on R&D, unfriendly remuneration, publication-focused evaluation systems, and institutional fragmentation[76].

The skills system needs to be reinforced. Ministries are not collaborating to their full potential, while the existing mechanisms for stakeholder engagement are not successfully motivating the stakeholders to support decisions and appear to be undermined by citizens' low levels of policy knowledge and confidence in government[77].

Nowadays Slovenia has relatively low skills mismatches, however it will become increasingly difficult to keep them low as digitalisation, technological change and globalisation continue to transform the world of work. Effectively assessing, anticipating and disseminating information on the changing needs for skills can help

[72] OECD (2017) OECD Skills Strategy Diagnostic Report - Slovenia 2017, OECD, OECD Directorate for Education and Skills and Special Advisor to the Secretary-General on Education Policy.

[73] Ibid

[74] European Commission (2017), RIO Country Report 2017: Slovenia, Joint Research Centre.

[75] OECD (2017) OECD Skills Strategy Diagnostic Report - Slovenia 2017, OECD, OECD Directorate for Education and Skills and Special Advisor to the Secretary-General on Education Policy.

[76] Ibid

[77] Ibid

countries minimise mismatches. Slovenia lacks a comprehensive skills assessment and anticipation system[78].

According to the OECD, Slovenia overall spends less on education per student and in terms of share of national wealth than the OECD average. **Vocational students in particular are disadvantaged by relatively low funding at the upper secondary and tertiary levels.** Public debt and the ageing of the population will make financing of the skills more challenging. The financial returns on tertiary education in Slovenia are amongst the highest in the OECD for individuals and government. Yet individuals in Slovenia contribute less to their tertiary education than in three-quarters of OECD countries[79]. As full-time tertiary education is free, students are less likely to choose a study subject that would assure better salaries.

Slovenia is part of the European Commission Pilot Action on industrial transition as the country needs to face challenges associated with a lack of an appropriate skills-base, high unit labour costs and deindustrialisation. This pilot will help to test new approaches to industrial transition and provide the European Commission with evidence to underpin post-2020 policies and programmes[80].

3.4 Digitalisation

The Digital Economy and Society Index (DESI), an index used by the European Commission for monitoring Member States' digital progress, can illustrate the current situation in terms of digitalisation and use of digital services. DESI combines sub-indicators in five dimensions: connectivity, human capital, use of internet services, integration of digital technology and digital public services. Slovenia **has improved its Digital Economy and Society Index 2020[81] and now ranks 16th** out of 28 EU Member States. Based on data prior to the Covid-19 pandemic, Slovenia has improved its score in all five dimensions of the index, but advanced in the ranking only in the integration of digital technology. In the human capital dimension, its score has risen from 46,3 to 48,3 and is now close to the EU average score of 49,3. While the score for use of internet also rose from 49,8 to 51,7, Slovenia continues to lag the EU average score of 58,0.

In the **connectivity dimension Slovenia improved its score from 48,6 to 50,2 and is now just above the EU average score of 50,1, but has nevertheless lost several places in the ranking**. Connectivity dimension assesses several factors, of which overall fixed broadband take-up (83%), Fixed Very High Capacity Network (VHCN) coverage (66%) and 4G coverage (99%) are quite above EU average (78%, 44% and 96% respectively), while the following factors are below average: at least 100 Mbps fixed broadband take-up (21%, EU average 26%), mobile broadband take-up (81 subscriptions per 100 people, EU average 100) and 5G readiness (0%, EU average 21%). In the integration of digital technology, Slovenia improved its score from 39,1 to 40,9, coming very close to the average EU score of 41,4; the only factor of this dimension where Slovenia is above EU average is % of SMEs

[78] Ibid

[79] Ibid

[80] EC (2021) Pilot action: Regions in industrial transition. Source: https://ec.europa.eu/regional_policy/en/information/publications/factsheets/2018/pilot-action-regions-in-industrial-transition

[81] European Commission, (2020d) Digital Economy and Society Index (DESI) 2020 Slovenia. Electronic source: https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=66929

selling online cross-border (12%, EU average 8%). The score in the digital public services dimension immensely improved from 64,5 to 70,8, just slightly below the EU average score of 72,0. In this dimension, Slovenia is above EU average in pre-filled forms (a score of 64, compared to EU average of 59) and open data (75%, EU average 66%) while it is below EU average in e-government users (59%, EU average 67%) and digital public services for businesses (a score of 77, EU average 88). Despite improvements achieved in the past years, national challenges have negatively impacted Slovenia's connectivity ranking[82]. Slovenia could speed up the rollout of its publicly funded projects[83] by greater collaboration between all public stakeholders and industry, especially in establishing the appropriate regulatory environment to boost private investment and competition, and in by adopting the radio spectrum management strategy[84].

In the human capital dimension, Slovenia remains 15th among the 28 EU Member States, with basic digital skills levels and use of internet services in Slovenia below the EU average. As regards the **integration of digital technology in businesses**, **Slovenia ranks 15th among EU countries**[85]; Slovenian enterprises are taking advantage of electronic information sharing and the use of social media and are also close to the EU average in the use of big data, cloud services, SMEs online selling and e-commerce turnover.

In **digital public services, Slovenia now ranks 17th among EU countries**[86]. The country performs well in the open data indicator, for which it ranks 10th, however Only 59% of Slovenian internet users actively engage with e-government services, compared to EU average of 67%. The use of online services by businesses is lower than the EU average. Low trust and the absence of unique and secure identifiers may be the reasons for the lower uptake. While Slovenia has substantially improved in all indicators in the digital public services dimension in nominal terms, it has not advanced in terms of its ranking[87].

[82] Ibid

[83] Ibid

[84] Ibid

[85] Ibid

[86] Ibid

[87] Ibid

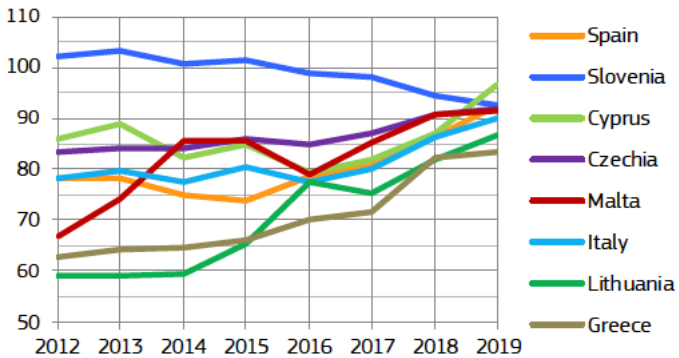
3.5 Innovation

3.5.1 Innovation Scoreboard

European innovation scoreboard is used by the European Commission for a comparative analysis of innovation performance in EU countries, other European countries, and regional neighbours in order to identify relative strengths and weaknesses as well as areas the Member States need to address. According to the **European Innovation Scoreboard 2020**[88], since 2012 innovation performance increased in 24 EU Member States and decreased in only three. Performance has increased the most in Lithuania, Latvia, Portugal and Greece, and decreased the most in Slovenia and Romania. The performance of Slovenia, as well as Croatia, Cyprus, Czechia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Slovakia and Spain is below the EU average[89].

Slovenia now belongs to the group of **Moderate Innovators** as its performance declined relative to that of the EU in 2012. The decrease starting in 2018 is explained by worsened performance for new doctorate graduates and the indicators using CIS data. The index of new doctorate graduates fell from 249,5 (well above EU average) to 110,3 (slightly above EU average)[90] The number is still high, also in international perspective: in comparison, Israel had 1.570 PhD students per 9 million population when Slovenia had 461 PhD students per 2 million population in 2018[91]. The indicators using CIS (Community Innovation Survey) data that place Slovenia among moderate innovators are: Non-R&D innovation expenditures (percentage of turnover) percentage of SMEs introducing product or process innovations; percentage of SMEs introducing marketing or organisational innovations; percentage of SMEs innovating in-house; percentage of innovative SMEs collaborating with others; and sales of new-to-market and new-to-firm innovations (percentage of turnover)[92].

Figure 5 - Performance of Moderate Innovators



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

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

[90] Ibid

[91] OECD, Statistic: Graduates by field. Accessed via: https://stats.oecd.org/Index.aspx?DataSetCode=EDU_GRAD_FIELD

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

Source: EC, 2020[93]

In terms of progress between 2012 and 2019 as shown by individual indicators, Slovenia shows the highest positive difference (i.e. the biggest progress) to the EU in **average annual change in GDP**, **employment share in manufacturing** and **turnover share SMEs**, and the biggest negative difference (i.e. the biggest decline) in **top R&D spending enterprises**, **enterprise births** and **government procurement of advanced technology products**[94].

Table 5 - Strongest to weakest innovation dimensions for Slovenia according to European Innovation Scoreboard 2020

Strongest innovation dimensions	High innovation dimensions	Low scoring innovation dimensions	Weakest innovation dimensions
	Human resources	Attractive research systems	Finance and support
	Firm investments	Innovation-friendly environment	
	Linkages	Innovators	
	Employment impacts	Intellectual assets	
	Sales impacts		

Source: EC, 2020[95]

Slovenia does not perform strongly in any of the innovation dimensions:

- **performance in Human Resources for Slovenia** (-53.6%), Romania (-33.0%), Hungary (-3.7%), Denmark (-3.1%), Sweden (-2.3%) and Latvia (-1.6%) **has decreased between 2012 and 2019**, while the EU average increased by 15.2%. Compared to 2018, performance has improved for 14 Member States, and **declined for 13 Member States, with the strongest declines for Slovenia** (-47.8%, due to a strong decline in Doctorate graduates) and Denmark (-10.6%). The EU average increased by 2.5% between 2018 and 2019 [96].
- Performance in **Innovation-Friendly Environment has improved between 2012 and 2019** for 25 Member States**, while it decreased for Belgium (-21.9%) and Slovenia (-24.5%)**[97]**.**
- P**erformance in Finance and Support** increased at the highest rate between 2012 and 2019 for Malta (85.8%), Latvia (81.2%), and Cyprus (57.4%), however it **has decreased**

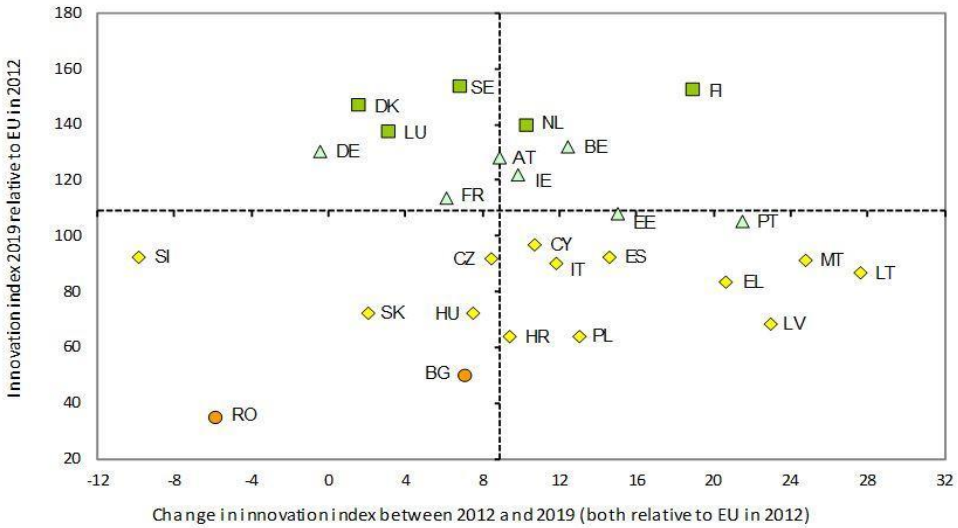
[93] Ibid
[94] Ibid
[95] Ibid
[96] Ibid
[97] Ibid

for nine Member States, in particular for Bulgaria (-49.4%), Ireland (-34.1%) and Slovenia (-19.4%). The EU average increased by 15.5% between 2012 and 2019[98].

- Performance in the **Innovators** dimension **declined for 15 Member States, in particular for Germany (-36.1%), Romania (-26.7%) and Slovenia (-25.6%).** The EU average decreased by 10.6% between 2012 and 2019[99].
- performance in **Linkages** has increased most in Greece (43.4%), Austria and Estonia (for both a 25.8% increase) and has **declined for 15 Member States, in particular for Cyprus (-34.4%), Hungary (-23.0%) and Slovenia (-22.2%).** The EU average increased by 3.0 % between 2012 and 2019[100].

The chart below shows the changes in innovation index for Slovenia relative to the EU in 2012 and relative to EU between 2012 and 2019. The vertical axis shows Member States' performance in 2019 relative to that of the EU in 2012. The horizontal axis shows the change in performance between 2012 and 2019 relative to that of the EU in 2012. The dashed lines show the respective scores for the EU[101].

Figure 6 - Change in Member States' innovation performance since 2012



Source: European Innovation Scoreboard 2020[102]

3.5.2 Property rights protection

International Property Rights Index (IPRI) is the only index in the world that is entirely dedicated to the measurement of intellectual and physical property rights. With the score of 6,149 in 2020 Slovenia ranked 48th in out of 129 countries in the listing, i.e. one rank higher than China. While the score of the index is increasing since 2014 when it dropped to the lowest point (5,185) in the decade, the ranking oscillates between 47th and 48th place

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

[99] Ibid

[100] Ibid

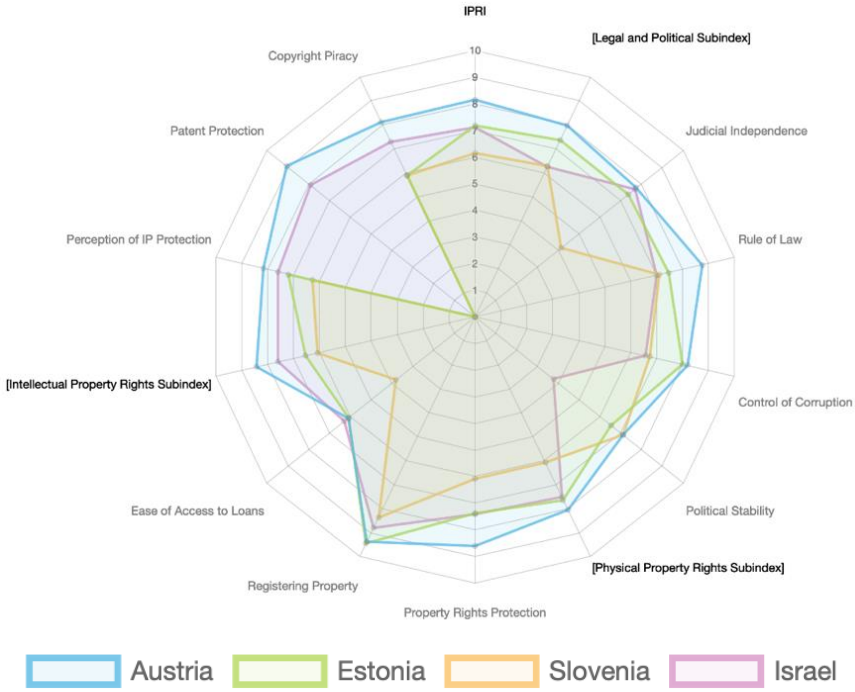
[101] https://ec.europa.eu/commission/presscorner/detail/en/QANDA_20_1150

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

among the countries, indicating improvements in IPRI in other countries, too. In comparison with the several other EU member states with strong protection regimes (such as the Netherlands, the Nordic States, Austria or Germany), protection of intellectual property in Slovenia can be considered underdeveloped[103].

When comparing Slovenia in terms of intellectual property system with Austria, Estonia and Israel, Slovenia scored lower in all three sub-indicators of the IPRI which measure the underlining institutions of a strong property rights regime, i.e. the legal and political subindex, physical property rights subindex and intellectual property rights subindex. In terms of individual elements of IPRI, there are only two elements where Slovenia scores above any of the countries taken for comparison: in terms of political stability as one of the factors influencing the property rights systems Slovenia ranked on par with Austria and above Israel and Estonia, while in terms of control of corruption was ranked slightly above Israel, but below Austria and Estonia. Slovenia's intellectual property system scores particularly low when it comes to judicial independence (element of legal and political subindex) and ease of access to loans (element of legal and political subindex), meaning that protecting and financing the IPR is relatively complex issue in the country, affecting confidence and willingness of businesses when innovating. Slovenia also performs poorly among compared countries in property rights protection (Figure 1).

Figure 7 - Intellectual Property Rights Index (IPRI) 2020 compared to Austria and Estonia



Source: Property Rights Alliance, International Property Rights Index, 2020

[103] Property Rights Alliance (2020) International Property Rights Index, 2020. Source: https://internationalpropertyrightsindex.org/compare/country?id=1,7,112,24

According to the World Intellectual Property Organization, Slovenia performed better in innovation inputs[104] than innovation outputs[105] in 2020. Slovenia ranked 29th in innovation inputs, higher than in 2019 and in 2018. For innovation outputs Slovenia ranked 39th in 2020 lower than in 2019 and lower compared to 2018[106]. The innovation outputs ranking is based on a set of indicators for two pillars - knowledge and technology output indicators that indicate knowledge creation (patents, utility models, scientific & technical articles, citable documents), knowledge impact (growth rate of PPP$ GDP/worker, computer software spending, etc.) and knowledge diffusion (e.g. intellectual property receipts) as well as creative output indicators that show intangible assets (e.g. trademarks, ICT & business model creation), creative goods and services (e.g. cultural & creative services exports in % total trade, printing & other media in % manufacturing) and online creativity (generic top-level domains (TLDs), country-code TLDs, wikipedia edits, mobile app creation). The innovation inputs ranking is based on a set of indicators for five pillars: institutions (political environment, regulatory environment, business environment), human capital & research (education, tertiary education, research & development (R&D)), infrastructure (information & communication technologies (ICTs), general infrastructure, ecological sustainability), market sophistication (credit, investment, trade, competition, & market scale) and business sophistication (knowledge workers, innovation linkages, knowledge absorption)[107].

[104] Innovation Input Sub-Index has five enabler pillars: Institutions, Human capital and research, Infrastructure, Market sophistication, and Business sophistication.

[105] Innovation outputs are the results of innovative activities within an economy. The Output Sub-Index includes two pillars - Knowledge and technology outputs and Creative outputs.

[106] WIPO (2020) Global innovation index – Slovenia. Source: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2018-profile43.pdf

[107] WIPO (2021) About the Global Innovation Index. https://www.globalinnovationindex.org/about-gii#framework [access 7 June 2021]

4 The Slovenian National Innovation System

The chapter describes National Innovation System presenting the actors and their roles in the system. The chapter also describes the state of Slovenia's national innovation ecosystem in terms of cooperation among stakeholders in the quadruple helix.

The OECD considers the national government to be primarily responsible for providing a stable investment framework and support structure for private investments and making local firms fit for the future[108]. Over the years Slovenia has developed a somewhat complex set of institutions for R&D and innovation policy implementation, to match expectations and live up to blueprints[109]. These institutions were established based on proven concepts of Slovenian twinning partners in Austria, Ireland and Germany, and elsewhere.

The institutional set up for R&D and innovation policy implementation was frequently changing over the years and is still in the process of development. Among stakeholders this is considered as one of the barriers to stabilisation of the innovation ecosystem and networks and consistent development of support aimed at achieving policy goals. Different sub-systems of the Innovation system may be systematically grouped according to their origin.

The **political sub-system** is required to develop and maintain cross-sector coordination and consultation processes when developing the policies and action plans. This sub-system shapes the hard (legislation, regulations) and soft (ethics, social norms) principles which are framing the innovation system. The political sub-system includes institutions such as the Parliament and its bodies related to R&D and innovation, Government and ministries preparing, coordinating policies and their implementation. As a part of the political system, we may also consider implementing/intermediary agencies forming grounds for the policy measures to be developed and implemented such as SPIRIT, Slovenian Research Agency, Slovene Enterprise Fund, Slovene Regional Development Fund.

The **Education and research sub-system** has a two-fold role in the innovation system: one is that of providers of knowledgeable and skilled people, and the other is to act as centres of research and development which supply the market with ideas, products, and processes. It provides the whole innovation ecosystem with education and research programmes and procedures and with soft (ethics, social norms) principles framing the innovation system. This sub-system includes institutions of higher education with universities, independent faculties and higher education institutions, public and private research institutes and laboratories and professional training and skills institutions.

The innovation eco-system also includes the **industrial sub-system** consisting of inputs, processes, and outputs to convert them to finished products forming value chains towrds markets. The sub-system consists of large companies and SMEs, scale-ups, start-ups and similar business entities.

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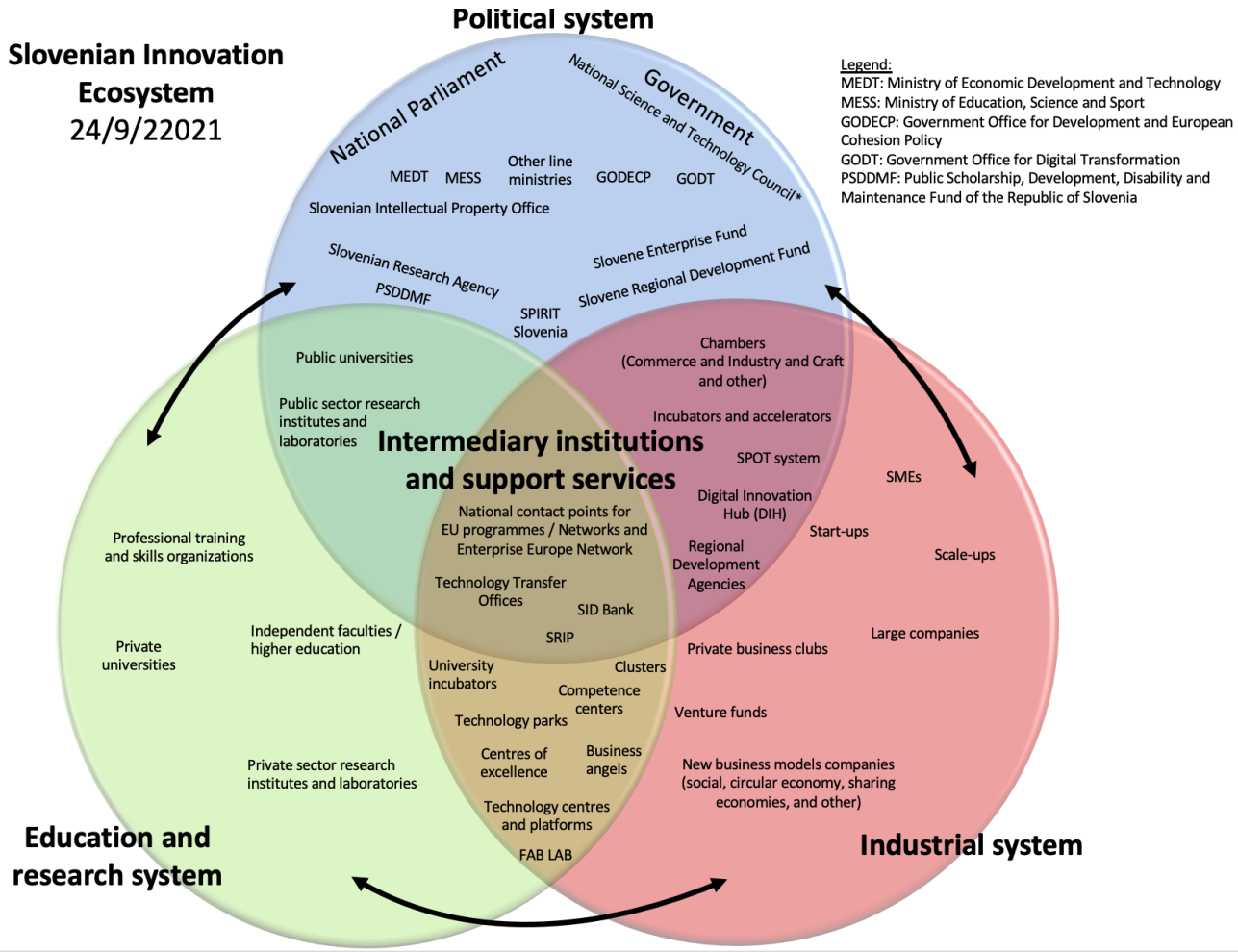
[108] Gebhardt C. and Stanovnik P. (2016) European innovation policy concepts and the governance of innovation Slovenia and the struggle for organizational readiness at the national level. INDUSTRY & HIGHER EDUCATION Vol 30, No 1, February 2016, pp 53–66.
[109] Ibid.

The above sub-sistems are interconnected by **intermediary institutions and support services** being designed to form links among all actors in the innonvatiion ecosystem by creating favourable conditions for the development of products and enterprises. They specialise around particular activities and aims by devellping support measures and tools. They are here to improve connectedness within a ecosystem by creating new possibilities and dynamism within a system[110]. The instituions in this sub-system whicih may also incude some of the actors that may be more related or dependent on one of the above mentioned sub-systems; like chambers, business clubs, TTOs, university incubators, National contact points for EU programmes / Networks and Enterprise Europe Network and others.

[110] Howells J. (2006) Intermediation and the role of intermediaries in innovation. ESRC Centre for Research in Innovation and Competition (CRIC), Institute of Innovation Research, University of Manchester. 2006 Elsevier

Figure 8 - Slovenian National Innovation System (list of institutions is non-exhaustive)



Source: Own research and consultations with national authorities (final version 24.9.2021)

* The Government of the Republic of Slovenia has adopted the Research and Innovation Activity Act which introduces the Development Council of the Republic of Slovenia into the system which will replace the Council for Science and Technology.

Formats of collaboration between R&D and business evolved and changed due to changes in financing and strategic set up. Some collaborative formats remined stable even after the change of the funding mechanisms or the policy changes which seems to be due to the stronger links and better developed services they are providing to their members.

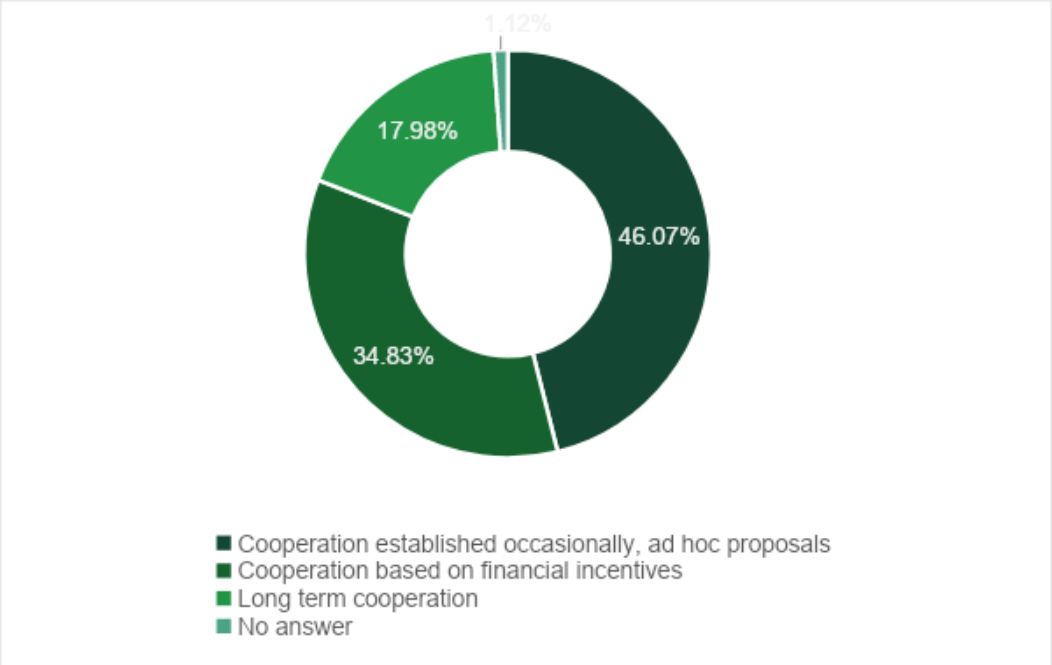
Different definitions of the **Quadruple Helix Model** recognise similar actors of the innovation systems looking at science or knowledge institutions, policy makers or government structure, industry or business sector and society. The Smart Specialisation Strategy of Slovenia represents the possibility to strengthen the collaborative approach to innovation and may be seen as a governance framework to organize quadruple helix interactions. To utilise the possibilities of the **Quadruple Helix Model,** all stakeholders in the **helix need to** be strongly involved while the coordination among partners is crucial for efficiency. Respondents of the survey listed the Ministry of Economic Development and Technology, universities, and the Institute Josef Stefan as the strongest decision-making actors in the system, followed by others.

Figure 9 - User centric Innovation System

Source: based on Lafley (2008)

The survey in this study provided some insights in interaction of the actors of the Slovenian innovation ecosystem. It revealed that most respondents (46%) believe that quadruple helix partners in Slovenia establish cooperation occasionally based on ad hoc proposals, another 35% believe that cooperation is established due to financial incentives, while 18% believe that this cooperation is well established, well thought out and exists in the long term (n=89). The stakeholders in the Slovenian innovation system are aware of the importance and the priorities of the country and are certain that a more open and collaborative approach to hard principles (legislation, regulations) and soft principles (ethics, social norms) in the innovation system would be beneficial for everyone in the innovation ecosystem.

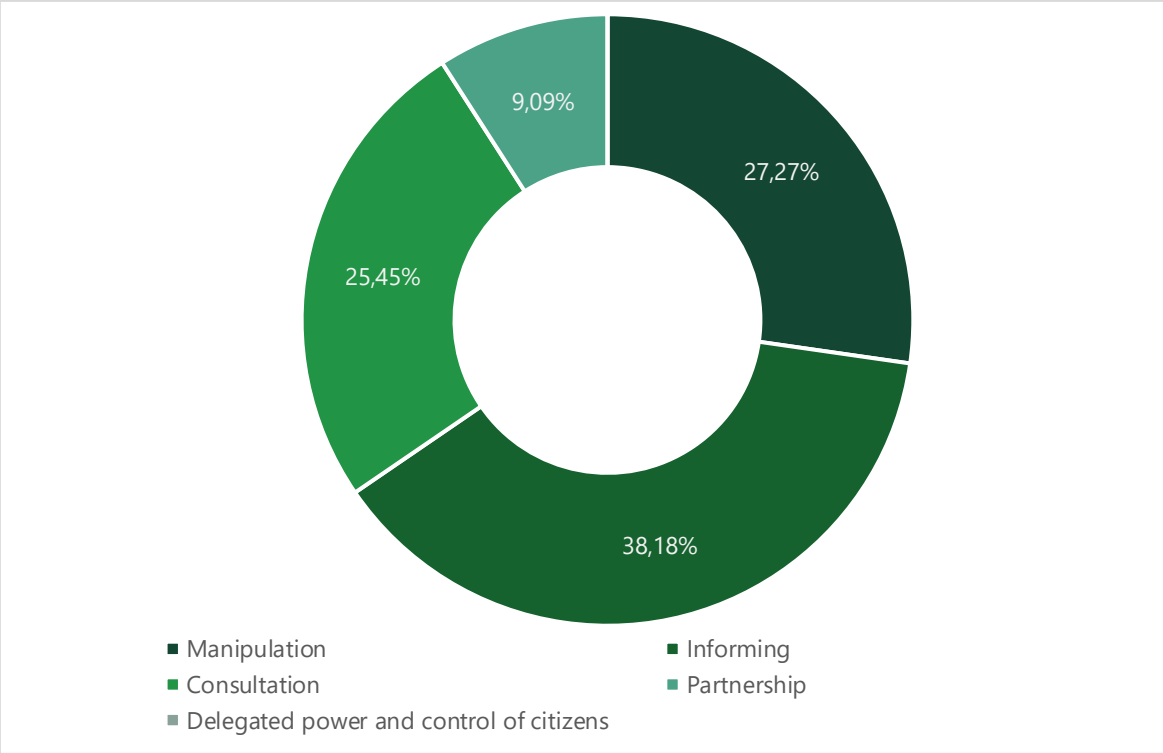
Figure 10 - Reasons to build the cooperation among quadruple helix partners



Source: own research

The majority of stakeholders surveyed for this study understand that collaboration in the Quadruple Helix Model is based on occasional dissemination of information (38%) through which decision-makers inform the stakeholders about the decision-making process. Another large part of stakeholders believes that collaboration is based on consultation (25%) and that decisions are only partly influenced by stakeholder opinions. Only a smaller part of surveyed stakeholders (9%) thinks their involvement is openly used to develop quality strategies in the form of a partnership (n=55).

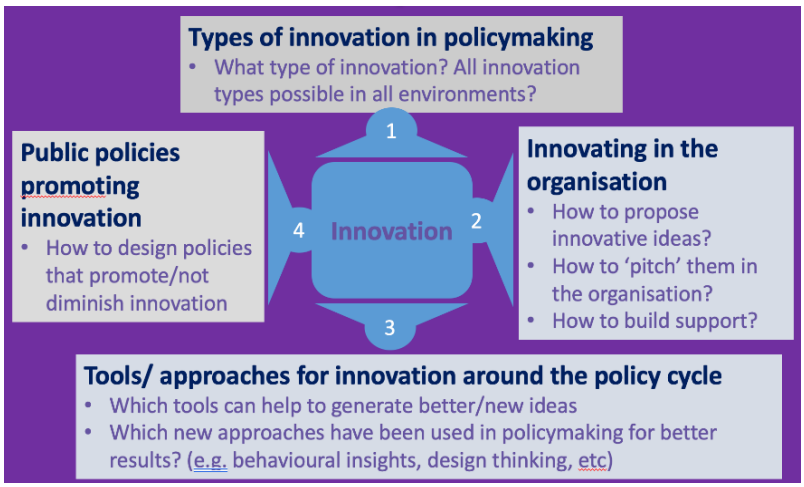
Figure 11 - Collaboration formats in policy making



Source: own research

A collaborative approach to coordination in the innovation system must be built to develop new types of innovation in policymaking and explore existing types. Streamlining of the system, deciding on a number of networks and mechanisms, concentrating funding must be addressed in the evolving innovation system and enable innovation within the institutions in the innovation system. This then improves and further develops tools for innovation concerning policies and strategies and promotes innovation at all levels, which in turn positively impacts collaboration across policy areas, improves the communication and engagement of stakeholders/citizens, improves the use of evidence and strengthens the support for policies to be decided.

Figure 12 - Innovation processes to improve the internal processes



Source: EU Policymaking HUB – INNOVATION in EU policymaking (2019)

For example, the Programme for Development of the Innovation Ecosystem[111] sets up 3 pillars to strengthen the response to challenges, ranging from the coordination of support environment to supporting businesses at international cooperation to provision of financial incentives (see chapter 7.2). The programme intends to provide an umbrella for the stakeholders of the innovation system and provide a 'one stop shop' for the innovation ecosystem. The preparation of the Programme was initiated to strengthen the cooperation and information sharing among different stakeholders in the ecosystem which should be further strengthened. Some of the operational objectives planned in the programme, such as preparation of an umbrella inventory of the innovation system, listing of research equipment, establishing a link between users and equipment owners, indicates that the programme does not only provide a purely enabling setup, but also foresees a level of control over the ecosystem. Lack of consultation during programme preparation (as indicated in the stakeholder interviews) and the content of the programme indicate that, while it includes the establishment of a single Ecosystem Coordination Point carrying out monthly meetings and events, the programme is not focused on collaborative analytics and joint preparation of action plans within the Quadruple Helix Model. As presented by the beneficiary of this project the "bottom-up" information will be used in next stages of the development of the innovation ecosystem.

A wide set of collaborative and open innovation tools may be used to further explore the consultation and collaborative processes in the innovation system in Slovenia. This would facilitate innovation in policymaking and positively impact all participants in the quadruple helix with opportunities for collaboration. Fundamental shifts (Table 6) are discussed in the Smart Specialisation Strategy of Slovenia and collaboration in the innovation ecosystem should switch to a new collaboration paradigm where discipline will be replaced by adaptiveness, planning by discovery, and control by values and leadership.

Table 6 – Fundamental shifts

Old paradigm	New principles
Discipline	Adaptiveness
Planning	Discovery
Hard assets	Knowledge
Structure	Process
Controls	Values
Inside-Out	Outside-In
Size	Speed
Management	Leadership

Source: Pietersen, 2010

Implementation of the **Smart Specialisation Strategy of Slovenia is a contributing factor for more direct participation of actors and their greater engagement in the development of policies**. As discussed with several interviewees, the Smart Specialisation

[111] SPIRIT (2020) Program razvoja inovacijske dejavnosti, verzija 1/2020. Javna agencija Republike Slovenije za spodbujanje podjetništva, internacionalizacije, tujih investicij in tehnologije, Ljubljana, 21. 8. 2020. English version: SPIRIT (2020) Programme for Development of the Innovation Ecosystem, Version 1/2020. Public Agency for Entrepreneurship, Internationalization, Foreign Investments and Technology, Ljubljana, 21 August 2020

Strategy was successful in integrating fairly large number of entrepreneurs, businesses, and public research organisations in the process. Building and operation of a SRIP network is seen as an efficient tool by several stakeholders that are members of the SRIPs, but the perception detected in a limited number of interviews is that selection of nine priority areas[112] for Smart Specialisation is too many for Slovenia. The argument goes that the country should act toward further prioritisation and selection of areas where more advantage could be captured. In comparison, Austria selected eight, Estonia selected seven, Flanders selected ten priority areas and Germany five areas for smart specialisation.

Overall, Slovenia has many strong points to its innovation ecosystem, for example strong tax relief, human capital, and good education innovation across a number of topics, such as health. However, the system is faced with many challenges. These include, but are not limited to, an unsynchronised and rigid public administration (including local administration), high reduction of taxes and contributions levied on salaries of highly qualified employees, lack of emphasis on creativity and innovativeness in the education system, complex tax procedures and unstable legislation.

[112] Digital: Smart cities and communities, Smart buildings and home with a wooden chain; Circular: Networks for the transition to a circular economy; Sustainable food; Sustainable tourism; Industry 4.0: Factories of the future; Health-medicine; Mobility; Materials as final products.

5 Actors and Governance

The chapter contains the synthesis analysis of the review of the strength and weaknesses of collaboration among stakeholders in the innovation ecosystem in Slovenia. It also presents driving factors behind the strengths and weaknesses identified. The chapter builds on the network analysis carried out by the study to understand innovation ecosystem stakeholder behaviour and interlinkages between actors. A detailed mapping of the individual actors in the system can be found in Annex 3.

The analysis confirms what was stated in interviews, that the vertical principle of coordination lacks coordination among several strategies and policies that are being developed. **Coordination between the two verticals are a key factor of success**, made more important as research and innovation policy is increasingly being embedded horizontally into other policy areas, such as environment, climate change, social and health policy, regional policy, education, training, and skills policy. In Slovenia, this process lacks appropriate pace and motivation.

5.1 Analysis of overall performance

The actors listed in the table below are the ones listed by the survey respondents as the most influential and/or powerful actors in Slovenian innovation ecosystem. The analysis of the results underneath adds texture to the survey results and draws some conclusions.

Table 7 - Most important organisations in the innovation ecosystem in Slovenia as identified in the survey

Type of actors	Actors of the innovation ecosystem	Number of actors ranking the importance			Particularly mentioned
		Most	2nd	3rd	
Intermediary institutions and support services	Chamber of Commerce and Industry of Slovenia	**3**	**9**	2	
	Chamber of Craft and Entrepreneurship of Slovenia			2	
	SRIPs	2	**6**	2	TECES (1), Circular Economy (1)
	SID Bank		1	1	
	Competence Centres		1		
	Digital Innovation Hub Slovenia			2	
	Ustvarjalnik			1	
	MCRUK			1	
	CorpoHub	1	1		
	PODIM Conference			1	

	Incubators	**3**	**1**	**11**	LUI (2), Katapult (5), Kibla (1)
	Technology parks	1	1	4	Ljubljana Technology Park (1)
	Local development agencies	1			
Education and research system	Universities and research institutions	**14**	**19**	**11**	Jožef Stefan Institute (15), University of Ljubljana (6), University of Maribor (1), National Institute of Chemistry (7), National Institute of Biology (1)
Political system	Ministry of Economic Development and Technology	**15**	**4**	**2**	
	SPIRIT	4	**10**	**7**	
	Slovene Enterprise Fund	3	6	2	
	Slovenian Research Agency	2		4	
	Ministry of Education, Science and Sport		2	4	
	Government Office for Cohesion Policy		2		
	Ministry of Defence			1	
Industrial system	large companies with international markets and R&D	**8**	**1**	3	Krka (4), Lek (2), Pipistrel (4), ETI (1)
	innovative and hi-tech companies	**3**	**4**	2	Akrapovič (3), Domel (2), Dewesoft (2), Cosylab (2), Elaphe (1)
	SMEs	1	1		
	State companies	1			

Source: Survey for context and network assessment for this study

Two institutions that are part of **political system** are perceived as the most important actors in the field of innovation, MEDT and SPIRIT. MEDT is perceived as the most important actor. This is because the Ministry, in addition to being the policy maker, provides incentives for innovation cooperation, runs several co-financing programs and is the decision maker for the granting of state aid that promotes innovation. On the other hand, this role comes with a dose of criticism regarding the level of professionality and cooperation with the other

government institutions and relevant stakeholders. The exception is the Government Office for Cohesion Policy which is seen as the policy maker and coordinator. Overall, the evidence indicates that the functionality of institutions of the political system is focused on providing access to finance; their function in market formation is not clear as their policy making is not well known or perceived as unclear or outdated. SPIRIT is seen as mainly policy maker and funding source and is perceived as influential, but not necessarily the strongest institution which is aware of the importance of linking the businesses and research sector and of the management of financial incentives. It has performed quite well with the level of autonomy is currently has, and there is an argument for greater autonomy to take some pressure off the ministry in terms of administration of instruments. Other institutions are perceived to have smaller role and mostly recognised as the source of funding, especially the Slovene Enterprise Fund.

The analysis of actors revealed that the Chamber of Commerce and Industry of Slovenia are perceived as the more important among the **intermediary institutions** than the SRIPs. SRIPs were pointed out mainly by actors that are already linked to their activities. This indicates that SRIPs are not well known beyond their own partnerships, although they are gaining new members. The Chamber of Commerce and Industry of Slovenia is by contrast well-known due to its awareness-raising and educational activities, as well as networking and systematic approach to building an innovation culture in companies, supported by an awards system. However, its links to actors other than businesses/industry are weak.

While important, **innovation infrastructure** could be more active in terms of developing communities of users around their institutions. Both Technology Parks and Incubators support innovation activities particularly of small start-ups, helping them to generate ideas and provide coworking space and support activities. However, their occupants can often be quite transient.

Education and research system is seen as having a strong role in the innovation ecosystem, particularly Jožef Stefan Institute, University of Ljubljana and the National Institute of Chemistry. The Jožef Stefan Institute is involved in numerous projects and leads two SRIPs out of nine, it was found to be strong in terms of research and innovation and cooperates with the industry. However, it could further strengthen different kinds of partnerships with more open and stronger involvement.

The **transparency of cooperation and work of public research institutions** is questionable, information about the projects is often lacking and their presentation can be seen as "ad hoc" i.e., set up to finance short-term employment, not long-term goals.

5.1.1 Accessibility of Innovation infrastructure

The ability of all social and economic groups to **access research and innovation infrastructure** is an important factor of cooperation and successful innovation. Our analysis revealed that the majority of stakeholders do not feel that research and innovation infrastructure is accessible to all. However, Universities, particularly their technical faculties, do provide good accessibility to external users. Stakeholders provide specific examples of the National Institute of Chemistry, Jožef Stefan Institute and Ljubljana University Incubator being open and accessible. The analysis revealed that knowledge institutions involved in SRIPs were seem as providing access to other SRIP members but not the wider ecosystem.

Slovenia's innovation infrastructure is characterised by a lack of information and knowledge about the existence and potential application use for its infrastructure. This is linked also to unclear advertisement of the infrastructure or organisation of trainings for its use, such as boot camps. This means that the infrastructure operates as a closed loop of cooperation with the usual professional contacts and acquaintances on a personal level, leading to a cycle of unclear procedures for opening its use up to potential new parties. Some of this may be overcome by creating a clear overview of existing innovation infrastructure through a digital platform with information about type of infrastructure, its accessibility, conditions for its use etc. This may result in turn result the confirmation of an overall perception within the system: The duplication of underused infrastructure within public universities and public research institutions, fuelled by inefficient bargaining and competition with companies.

The innovation infrastructure located at universities and institutes in Slovenia is prioritised for pure research, with companies looking to use it for applied research facing financial barriers, which strains collaboration. This situation is exacerbated by restrictions on the use of infrastructure within calls for proposals for funding to either public or private applicants. For example, renting out the equipment purchased with public funds to the industry is not permitted.

Adequacy of **geographical distribution** of innovation infrastructure was one of the aspects entailed in the survey as this may affect physical accessibility. A preliminary case study on best practices has revealed that countries with higher RDI index:

1. Tend to have innovation infrastructure spread evenly among regions, as this is the case in Austria with RDI infrastructure spread in 3 major regional hubs.
2. Delegate as many RDI related activities to the respective regions, as this is the case in the autonomous region of Flanders in Belgium.

Research and innovation infrastructure is predominantly located in the Western Cohesion Region where most knowledge institutions, technology parks and similar are located. Ljubljana is the main centre with some other cities (Maribor, Novo mesto, Koper, Nova Gorica, Murska Sobota) acting as smaller centres. In Slovenia, geographical imbalance is somewhat countered by the small size of the country and the gradual shift towards the Eastern Cohesion Region due to Cohesion Policy support.

Anecdotal evidence suggests that public institutions in regions may need further support to increase the efficiency of their business models and better align them to the needs of businesses, at present these gaps are filled by privately owned infrastructure.

In Slovenia, because of its size, there is a more delicate balance to be struck with regards to the even distribution of infrastructure. Quick access to infrastructure and equipment and local connectivity would unleash the innovation potential of SMEs more effectively and increase the competition of various institutions, however proximity does not equal productivity. The overarching question that determines this balance, therefore, is the role of connectivity of infrastructure. The importance of physical location is diminished by clear information and guidance regarding infrastructure, targeting innovative companies through online tools and platforms and also making them aware of how to physically find the equipment and engage with it, should it be suitable.

This question is important to address in particular considering any potential refinement of clusters and the need to achieve critical mass of innovation through concentration of resources. The emphasis should be on the quality of research infrastructure, human resources, researchers and companies that are able to absorb new technologies and ideas and market them. Connectivity (good quality internet access) and flexible forms of work are important.

5.2 Analysis of innovation ecosystem actor groups

5.2.1 Political system actors and their roles

Actors in the political system are seen on two levels, i.e., the Government with its ministries and the other bodies implementing the national policies, such as the Slovenian Research Agency, SPIRIT Slovenia and SEF. Slovenia's public administration is characterised as a centralised state, as the country does not have regions in the administrative sense. The central government holds the competences for the innovation and research policy, as well as for science, technology policy, industrial policy and higher education policy. With the adoption of RIS3, structural funds were released to co-finance the measures planned in Operational Programme 2014-2020. The most important among these measures was support of EUR 74m till 2022 provided to enterprises for the implementation of their R&R projects, with specific focus on technology level 6-9.[113]

Although there has been a general trend over the past decade for OECD countries to, at least in part, coordinate RTDI policy via the offices of prime ministers or similar central cabinets, this analysis has found that **Slovenia does not have a central coordination of innovation, research, and development.**

In Slovenia, the **Government Office for Development and European Cohesion Policy** acts as a Managing Authority for the implementation of the Slovenian Cohesion policy, including implementation of the Slovenian Smart Specialisation Strategy (S3). **The Council for Science and Technology of the Republic of Slovenia is a governmental advisory body, and its competence is divided between the ministries.**

The newly formed **Office of the Government of the Republic of Slovenia for Digital Transformation** monitors and analyses the process of digital transformation at the state level and in individual regions, draws up strategic national documents and policies related to digital transformation, and coordinates and monitors their implementation. Other tasks include preparing and coordinating the measures of institutions at the national level related to the digital transformation policy, as well as monitoring and coordinating their implementation, and preparing and implementing key national projects in accordance with the national digitalisation strategy to improve digital indicators.[114]

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[113] European Commission (2017), RIO Country Report 2017: Slovenia, Joint Research Centre.

[114] GODT (2021): https://www.gov.si/en/state-authorities/government-offices/government-office-for-digital-transformation/about-the-office/

The **Slovenian Research Agency**[115] ARRS is an independent public funding organisation performing tasks relating to the National Research and Development Programme and creation of European Research Area. The Slovenian Research Agency ARRS focuses on early-stage research and development which can be described as projects where basic principles are observed and technology is still being formulated - basic/fundamental and applied research. The support is also focused on experimental proof of concept and technology that is validated in lab or in the relevant industrial environment.

The **Public Agency for Entrepreneurship, Internationalization, Foreign Investments and Technology** (**SPIRIT Slovenia**, hereafter referred to as SPIRIT), acts as a support agency for Entrepreneurship and Technology Promotion, as a Financial Incentives body and Internationalisation Promotion agency. The **Slovenian Enterprise Fund (SEF)** is acting towards improved access to finance for micro, small and medium-sized enterprises in Slovenia. Both agencies, SPIRIT and SEF, together with MEDT address the later development phases in which technological readiness is above 4. This implies their instruments are focused on technology that is validated or demonstrated in lab or in relevant industry environment. The instruments also support prototype demonstration for the completion and actual proven products for manufacturing.

The **Slovenian Regional Development Fund** (**SRDF)** promotes projects in entrepreneurship with incentives for priority areas of regional policy in order to reduce growth disparities, increase competitiveness and increase or maintain number of employees. As a result, the focus of the fund is the regional development priority areas and border problem areas while aiming at entrepreneurship, competitiveness, market orientation and technological development of companies. The fund has two strategic directions one being used by the as a policy tool for the grant management with the public tenders for loans and being a tool for the European development processes with functions of the certifying authority and as preparation and implementation of projects co-financed from the EU and outside the EU budget. The grant programmes are forms in the scope of entrepreneurship, agriculture and forestry, financing of municipalities, prefinancing of the EU funded projects, incentives to projects with in the areas of the Italian and Hungarian minorities while the fund also acts as a guarantees provider for approved bank loans for entities of various legal and organizational forms.

The Slovenian Intellectual Property Office is an autonomous body within the Ministry of Economic Development and Technology. It is responsible for the field of industrial property and copyright. SIPO grants protection for the following industrial property rights: patents, supplementary protection certificates, industrial designs, trademarks, topographies of integrated circuits and geographical indications, with exception of agricultural products and foodstuffs.

It issues permits to collecting societies of authors and holders of related rights for collective administration of their rights and supervises the functioning of collecting societies. It

[115] ARRS (2021) http://www.arrs.si/en/index.asp

prepares intellectual property legislation, carries out documentation activities and provides services to the public. [116]

The Public Scholarship, Development, Disability and Maintenance Fund of the Republic of Slovenia is the central national management institution for scholarships and development of human resources and offers scholarships for study and research, increases international mobility of students and researchers, provides financial incentives to employers for development of human resources, awards excellence as well as provides up-to-date information and helps build a network for minimising obstacles to mobility of students, researchers and employees. The Fund promotes employment of people with disabilities and the preservation of their jobs. The Fund ensures the rights of workers whose employment relationships have been terminated due to the insolvency of their employers or the employers' deletion from the court register. The Fund ensures children their right to maintenance replacement and is also the central forwarding and receiving authority in procedures of international recovery of maintenance.[117]

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 specialization 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, SRIPs and their networks). The Council for Science and Technology of the Republic of Slovenia is a governmental advisory body, and its competence is divided between the two before mentioned ministries.

The third vertical may be noticed within the scope of the Government Office for Development and European Cohesion Policy with the Smart Specialization Strategy coordination and interlocutor with the EC on the matters related to the S4. The network of SRIPs is closely linked to the Ministry of Economic Development and Technology due to direct financing and to SPIRIT due to the implementation arrangements.

While under the supervision of their parent ministries and the Ministry of Finance, implementing agencies have developed good autonomy with respect to preparation and implementation of instruments in support of innovation and development. **As a result, although vertical coordination is strong, the effectiveness of cross-sector coordination in the strategic planning process is questionable**. An overall observation from the interviews is that tools developed for the implementation of smart specialisation may facilitate better coordination between R&D and business, as well as integration of needs into policies. Further evidence that the coordination verticals do not effectively align can be seen in the proposed Law on RDI. While the original motivation was a joint text, regulating both the research and innovation activity in a coordinated and a coherent manner, stalled discussions on how to design the law let to MESS deciding to prepare a law addressing the research segment only in 2017.[118]

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[116] SIPO (2021): http://www.uil-sipo.si/sipo/office/tools/home/
[117] PSDDMF (2021): https://www.srips-rs.si/en/about-us
[118] European Commission (2017), RIO Country Report 2017: Slovenia, Joint Research Centre.

5.2.2 Knowledge institutions

Knowledge institutions include higher education institutions, research institutions and professional, training and skills institutions. Higher education institutions and public research institutions are the key research performers in Slovenia and Slovenia currently has 7 accredited universities and 40 accredited independent higher education institutions[119]. According to ARRS data, there were 16 public research institutions in Slovenia in 2019 and in total they received over 182 million EUR in funding.[120].

In Slovenia, one particular challenge is that research organisations from the academic environment are most interested in cooperating with another group of research organisations.[121] This includes higher ranking organisations, such as the University Clinical Centre Ljubljana, Institute Jožef Stefan and the Faculty of Medicine and Biotechnical Faculty, both at University of Ljubljana.

This analysis was supported by the responses to question about collaboration in the survey, the answers show that after joint projects are finished, collaboration is most often focused on joint preparation of scientific publishing (scientific articles, scientific monographs, etc.), while very rarely it continues to jointly develop and commercialise new products or services. Some of this comes from how research performers are programmed by funding and set up. In 2012, the OECD noted that the most important public research organisations (PROs) receive 79% of their funding from the national government through a combination of "institutional" funds, mainly research group grants, and project-based awards[122].

The report adds that most institutes and activities within the institutes mainly follow a scientific rationale; other goals, such as collaboration with industry, may be important but are secondary activities. Developments, with the Strategic Research and Innovation Partnerships (SRIPs) is changing this slowly, by bringing together representatives of the economy, knowledge institutions and the state in the target areas of the Smart Specialisation Strategy (S4). However the SRIPs are not as widely known as they should be, and their role in supporting healthy competition within the system remains unproven for the most part.

5.2.3 Intermediary institutions and support services

All bodies are well recognised among the stakeholders, but the interviews in this study revealed a lack of trust in the agencies as they change implementation arrangements and implement short-term instruments (up to 2 years). One of the criticisms directed at the current set-up is that the closure of the Technology Agency (TIA),

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[119] NAKVIS (2021) Podatki o visokošolskih zavodih. Source: https://www.nakvis.si/analize-in-publikacije/porocila-strokovnjakov-in-odlocbe/

[120] ARRS (2020) ARRS / Poročilo o financiranju 2019. Source: http://www.arrs.si/Report/fin-por-2019.aspx#P3566b4e228ce432a89188bb2e06f1dc7_3_101iT0R0R0x0

[121] Lesjak D., Breznik K., Dermol V., Laporšek S., Likar B., Lipnik A., Skrbinjek V., Vodopivec M., Novak M., Mohorko J., Tadina T., Žitko T. (2021) Analiza učinkovitosti vlaganj v raziskovalno-razvojno dejavnost v Sloveniji (AUV-RRD-SLO) - zaključno poročilo. Univerza na Primorskem, Fakulteta za management (UP FM), Mednarodna fakulteta za družbene in poslovne študije (MFDPŠ). ARRS in MIZŠ, 2021

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

which operated in the area of technology, has led to a deterioration of the link between research and development and businesses. Furthermore, international scale-up and commercialisation are perceived as missing from the innovation ecosystem in Slovenia, in spite of the Programme for Internationalisation, 2015–2020. The critical points pointed out in the interviews were long delays in the publication of calls for tenders and in practically closed and non-transparent planning of the calls for tenders. Addressing this issue would improve the planning of projects and their impact from applicants. Transparency is seen as better in the scope of the ARRS field of focus which may also be seen in transparent and analytical overview of financing, it is important to assess if any of these practices may be transferable to the innovation agency.

Slovene Export and Development Bank (SID Bank) promotes the development and export and is owned by the Republic of Slovenia. While the SID Bank doesn`t focus on the problems of use of the available funding and the absorbance capacity of companies to absorb the funding their key activities of the SID Bank are to recognise and finance projects identified as a funding market gaps and it was appointed as a manager of the Fund of Funds in 2017 with €253 million invested from the European Cohesion Funds to finance projects until 2023.[123] It remains too soon to assess the impact of this fund in macro-economic indicators, and there is a lack of published reviews of the impact at this time.

The research revealed that the Slovenian Regional Development Fund and the **Slovene Export and Development Bank are the least well-known of the policy actors in the system**.

SRIPs, Technology transfer offices, clusters and financial intermediaries like venture funds, business angels' associations and similar can be classified as intermediary institutions and support services. Generally speaking, countries with higher RDI index have reorganised the knowledge institutions in a way to raise the focus and funding on application-based research (business-oriented research). This in turn positively influences patent activities. For example, after year 2000 Austria has seen above-average growth in patents and is, in proportion to its number of inhabitants, clearly above EU average.

In order to facilitate exchange and cooperation among research and industry Slovenia engaged in 9 SRIPs, established to cover the priority areas of the Smart Specialization Strategy (full list is available in annex 3). According to SPIRIT data, SRIPs connect large numbers of industry representatives with the research arena[124].

As the SRIPs aim to link industry and research with the policy making, as evidenced through the possibility to discuss the operational programmes and create more active discussion platform with the Smart specialisation policy makers, the system has strong founding principles. An overall observation is the there is large potential for the SRIPs to act as a connection from the needs to policy making while the SRIPs platform needs to be further developed and the operational structure of the tools needs to be improved. A significant part, although not all, of the innovation ecosystem in Slovenia evolved on the basis of value chains, with support for development of various forms of cooperation, ranging from

[123] SID (2021) About SID Bank and Financing. Source: https://www.sid.si/en/about/about-sid-bank

[124] SPIRIT (2021) STRATEŠKO RAZVOJNO-INOVACIJSKA PARTNERSTVA – SRIP pregled področja

clusters to centres of excellence and competence and currently to SRIPs. Since pre-accession times it was mostly driven by the EU funding which was also evolving with its best practices and downsides. Analysis has indicated that platforms such as SRIPs require stability for at least ten years in order to evaluate its real efficiency and effectiveness, this was not the case for the SRIPs.

Technology transfer offices (TTOs) encourage a variety of collaboration opportunities, usually in the field(s) of the institution they are located in. Between 2017 and 2022, EUR 6 million has been made available via MESS to support the activities of TTOs.[125] The initial source of support was via ERDF funding, distributed by MESS through public call for proposals. In Slovenia, technology transfer offices are organised as part of various research institutions, e.g., University of Ljubljana with the Knowledge Transfer Office, University of Maribor with the Knowledge and Technology Transfer Office, Centre for Technology Transfer and Innovation at the Jožef Stefan Institute. There is also an Association of Technology Transfer Professionals of Slovenia, which was established to support these activities. The TTOs currently do not have the necessary funding, networks and, in some cases, knowledge to develop ideas to the level necessary to understand their commercialisation potential and present them to businesses. Although some TTOs have achieved significant results, their role and mechanisms need to be further developed. One further barrier is the current legislation, which prevents public universities from establishing spin-offs. This is for example an obstacle for closer cooperation between the TTO and SIO network. This problem is currently mitigated by means of licencing agreements, which allow at least some of the knowledge and research potential of the universities to be commercialised. The outstanding issues regarding spin-offs, while important, form just one part of activities associated with knowledge transfer. Other elements of knowledge transfer, for example, IPR and business support, piloting and demonstration facilities exist in Slovenia, however their output is suboptimal due to either lack of resources or coordination of industry interaction.

The **Start:up Slovenia** project was launched in 2004 when the Venture Factory Institute registered the Start:up Slovenia brand and in 2011, in collaboration with the Ministry of Economic Development and Technology and Technology park Ljubljana. Start:up Slovenia became an integral part of the P2 start-up incentive of the Slovene Enterprise Fund. This enables companies to take part in the Start:up Slovenia pre-selection procedure and acquire additional points for the P2 tender[126]. Private accelerators with small seed investments are present in Slovenia, but they operate with relatively infrequent and minor investments[127]. Nevertheless, this helps the development of the private-led start-up system in the country. To become more dynamically engaged in start-ups, several public universities in more developed ecosystems started their own start-up incubators[128], such as incubator of the University of Ljubljana (LUI), which they operate with various degrees of success.

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[125] European Commission (2017), RIO Country Report 2017: Slovenia, Joint Research Centre.

[126] Start:up Slovenia (2021) Start:up Slovenia Project. Source: https://www.startup.si/en-us/startup-slovenia-project

[127] ABC Accelerator, (2018) SOUTH-EAST EUROPE STARTUP REPORT 2018. Source: https://www.startup.si/en-us/strategy-and-goals/documents/southeast-europe-startup-report-2018

[128] Start:up Slovenia (2021) Start:up Slovenia Project. Source: https://www.startup.si/en-us/startup-slovenia-project

SPOT system is a one-stop-shop offering comprehensive support and free public services for business entities. SPOT brings together the institutions providing assistance, information and advice to companies and business entities. SPIRIT implemented a set of performance indicators for both SPOT and SIOs in 2019. However, in addition to monitoring their activities, the analysis found a need to better links existing networks together to create a system with more mutual reinforcement. These indicators should therefore be refined and expanded to other networks (SRIPs being the most obvious example).

Innovation infrastructure consists of **technology parks, business and university incubators, SPOT** and similar. In terms of new developments, from April 2021 the VEGA EuroHPC Supercomputer, part of a supercomputer centre, is operating at PETA scale level. The project has clear orientation towards research that includes fields of artificial intelligence, processing big data (smart cities, IoT...), medicine, new materials, mechanical engineering and other advanced science areas while it is to be seen how this will spill over to the business and commercialisation.

At a more general level, the Research Infrastructure Roadmap 2011-2020 (last updated 2016), noted the major challenge was as being depreciation of the investments of previous years, due to low levels of funding from both national and EU sources. Irrespective of this, Slovenia has been able to participate in a good number of infrastructure projects since 2011, for example CESSDA, PRACE, DARIAH, ESS, SHARE, CERIC, ELIXIR in EATRIS. The main challenge therefore is which models of funding and support could be used to sustain and augment this participation in the next period, given concerns regarding maintenance and depreciation of equipment.

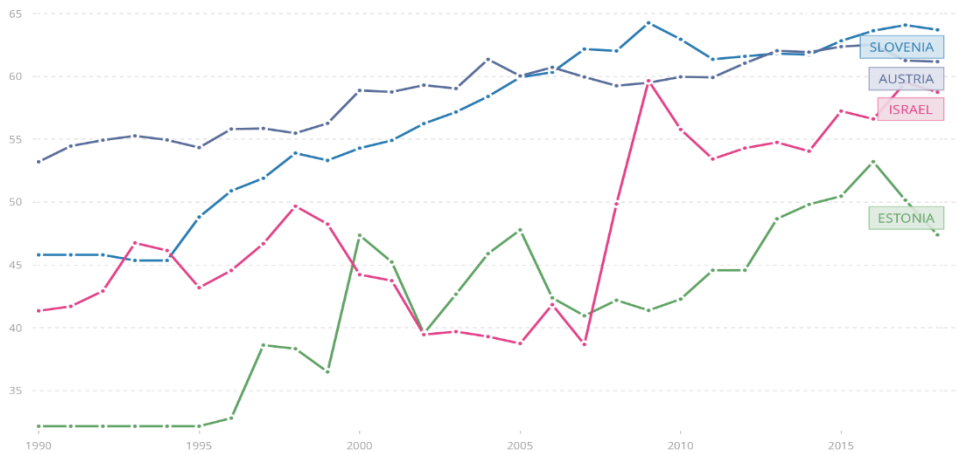
The **subjects of the innovative environment** (SIO) are entrepreneurial and university incubators, business accelerators, technology parks and others related organizations that promote the creation of new businesses, especially those that are important for greater competitiveness, higher added value, and more even regional development of entrepreneurship[129]. The SIO network has financed over 500 businesses cases in 2020, representing a major management and implementation task. More generally in Slovenia, technology parks and incubators in the country have issues related to ownership, financing, and management. Some infrastructure is owned by municipalities or other bodies and technology parks and incubators often must pay rent or repay the loans used for construction. This may hinder their ability to actively pursue their core business of supporting start-ups and technology development. A number of technology parks and incubators have sold most of their premises to fund projects. Their management is often focused on financial management of institutions rather than developing communities around support services and their branding. There is a third possibility where incubators and accelerators are developed from private funds. Overall technology parks and incubators, depending on location, may lack critical mass for local engagement as they note different rates of business creation and lower potential for businesses to employ skilled personnel. A more nuanced system, including different management and financing mechanisms should be made available for the SIO network to function, which should include consideration of regional disparities *via a vis* expected performance.

[129] SPIRIT (2020) Predstavitev Subjektov inovativnega okolja (SIO) in uspešnih podjetniških zgodb, ki so prejeli podporo od slednjih. SPIRIT, Ljubljana.

5.2.4 Industrial system - business

Of the total **23,590 researchers in Slovenia, 14,356 were employed in the business sector**[130]. The European Innovation Scoreboard[131] reveals that Slovenia performed well in the category of Firm Investments, but still lagged behind the strong Innovators. Performance in the Innovators dimension declined by 25.6%. When looking at Medium and high-tech exports as a percentage of manufactured exports, Slovenia performed well in comparison to Estonia, Austria, Israel.

Figure 13 - Medium and high-tech exports as a % manufactured exports



Source: World bank[132]

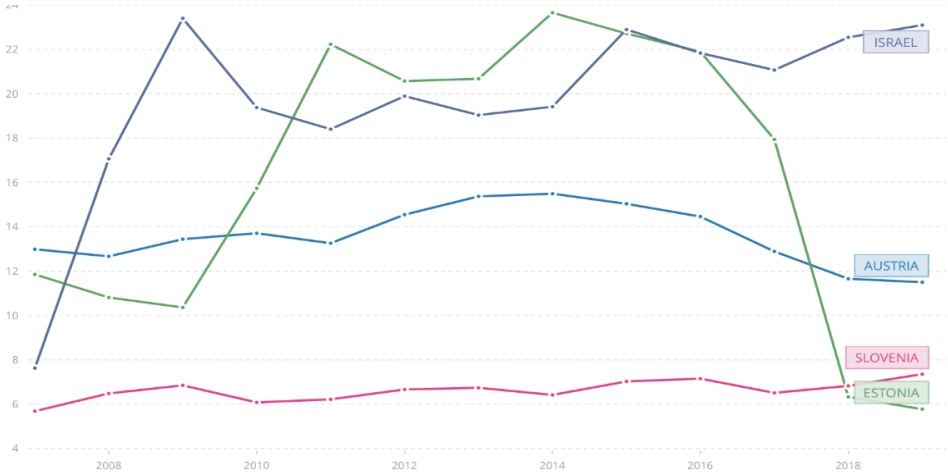
Slovenian performance in high tech export as a percentage of manufactured exports shows a different picture then compared to overall medium and high-tech exports as a percentage of manufactured exports. Here the performance of Slovenia is weak also when compared to Austria and Israel while Estonian performance dropped significantly in 2016/2017 and is even lower than Slovenian performance in 2018.

[130] SURS (2019) In 2018 gross domestic expenditure on research and development in Slovenia amounted to 2.0% of GDP. Source: https://www.stat.si/StatWeb/en/news/Index/8441

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

[132] World bank (2021) Medium and high-tech exports as % manufactured exports. Source: https://data.worldbank.org/indicator/TX.MNF.TECH.ZS.UN?end=2018&locations=SI-EE-AT-IL&start=1990&view=chart

Figure 14 - High-technology exports as a % manufactured exports



Source: World bank[133]

Slovene companies (particularly the large ones) have lower value-added in the global value chains than seen from the country. For example, the production of motor vehicles and metal products represents a high share of GVC integration [134], with lower added value. This results in businesses lacking capacity to invest in research and innovation. The business sector invests the most in research and development, and until 2015 this was a significant source of research and development investment growth (see chapter 3.2).

The analysis conducted by the Chamber of Commerce and Industry of Slovenia[135] shows that more innovative companies innovate more openly than others and that they actively cooperate with various stakeholders in the innovation ecosystem. Continuous innovation processes are still at the forefront in the business sector. One positive development is that more than one third of product/service sales in the last three years resulted from in-house development and innovation in companies. Many companies have innovation strategies and many employ internal innovation systems based on different methods and approaches. **However, there is still the perception that companies, regardless of size, lack knowledge about structuring their in-house innovation strategies, models and processes.** The same applies to researchers, who have strong expert knowledge, but lack entrepreneurial skills, and this makes collaboration between businesses and researchers more difficult. Public higher education institutions continue to provide formal courses that seldom include entrepreneurship or any other subjects relevant for start-ups[136]. SPIRIT is working on providing support for sustainable business strategic transformation of companies, and cooperates with Chamber of Commerce to promote it.

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[133] World bank (2021) High-technology exports as % manufactured exports. Source: https://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS?locations=AT-EE-IL-SI

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

[135] Chamber of Commerce and Industry of Slovenia (2020) Takšno je dejansko stanje inovativnosti v slovenskem gospodarstvu. Glas gospodrastva, december 2020. Source: https://www.gzs.si/Portals/SN-informacije-Pomoc/Vsebine/GG/2020/December/gg_12_lores.pdf

[136] ABC Accelerator, (2018) SOUTH-EAST EUROPE STARTUP REPORT 2018. Source: https://www.startup.si/en-us/strategy-and-goals/documents/southeast-europe-startup-report-2018

6 Collaboration

The chapter contextualises the instruments and cooperation among actors in the innovation ecosystem referring to connections in the process. It presents the analysis of structures of collaboration and observed behaviour among actors.

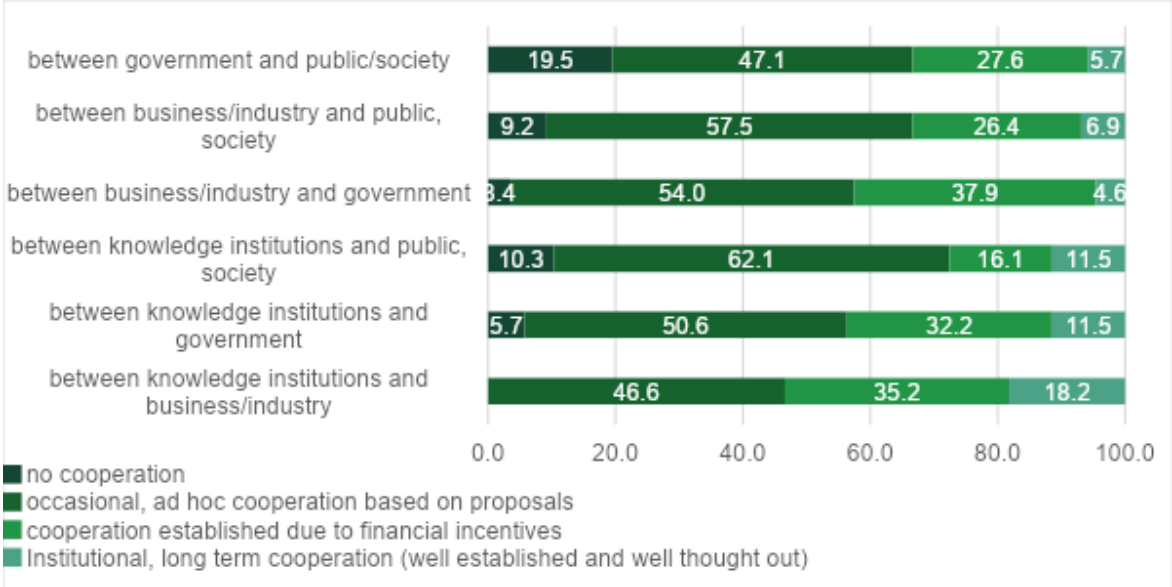
Through their interactions actors in the innovation system create a vast network that is the basis of the innovation ecosystem. Their interactions and cooperation depend on their functionality and common interests. In terms of international collaboration, it should be emphasised that Slovenia has been an active country in building RIS3 interregional collaborations in key themes (e.g. energy). In particular, in 2017 it was regarded as a leading country for the two Industrial Modernisation S3 partnerships: "Digitalisation and Safety for Tourism" and "SME integration to Industry 4.0". Slovenia has actively approached some additional partnerships that have stemmed out of the pilot actions of the Vanguard Initiative as well.[137] Therefore, feedback in terms of how it uses international networks is on the whole positive, the questions is more to do with whether this activity has produced concrete results in terms of an investment pipeline.

A survey for context and network assessment performed for this study among a variety of randomly selected actors has shown that according to the respondents, **well-established long-term cooperation is rare and that it is most common between knowledge institutions and industry**, as shown in the figure below. According to the comments of survey respondents, as well as selected interviews, cooperation is not set up in a systematic way but depends on matching interests and continuous good cooperation experience and results.

In the opinion of around half of the respondents of the survey the cooperation between different types of actors is occasional, set up ad hoc based on individual proposals or initiatives; most pronounced is such ad hoc cooperation between the knowledge institutions and society and between the companies and society. Another third of the respondents is of the opinion that cooperation is established mainly due to common interest for financial incentives available for partnerships. One of the respondents commented that the financial incentives are decoupled from priorities essential for the development of the country.

[137] European Commission (2017), RIO Country Report 2017: Slovenia, Joint Research Centre.

Figure 15 - Level of cooperation between different types of actors of innovation ecosystem in Slovenia



Source: Survey for context and network assessment for this study

On the other hand, complete **absence of cooperation was rare, although the responses show that there is lack of systematic cooperation for all types of actors, in particular the government sector** (almost a fifth of the respondents are of this opinion) **with the general public and civil society**. This indicates that the innovation ecosystem is rather separated from the civil society. Respondents have commented that the extent and quality of cooperation of government sector with other actors has declined in recent years and that it is **limited to informational campaigns and done on ad hoc basis**, but that there are also informal connections of public administration with civil initiatives, associations and various associations. **There was an indication that cooperation with the public administration lacks mechanisms to liaise with other actors of innovation ecosystem and that the public administration does not communicate its activities well. Therefore, other actors are unfamiliar with its operational activities and have the impression that it lacks interest and time for cooperation.**

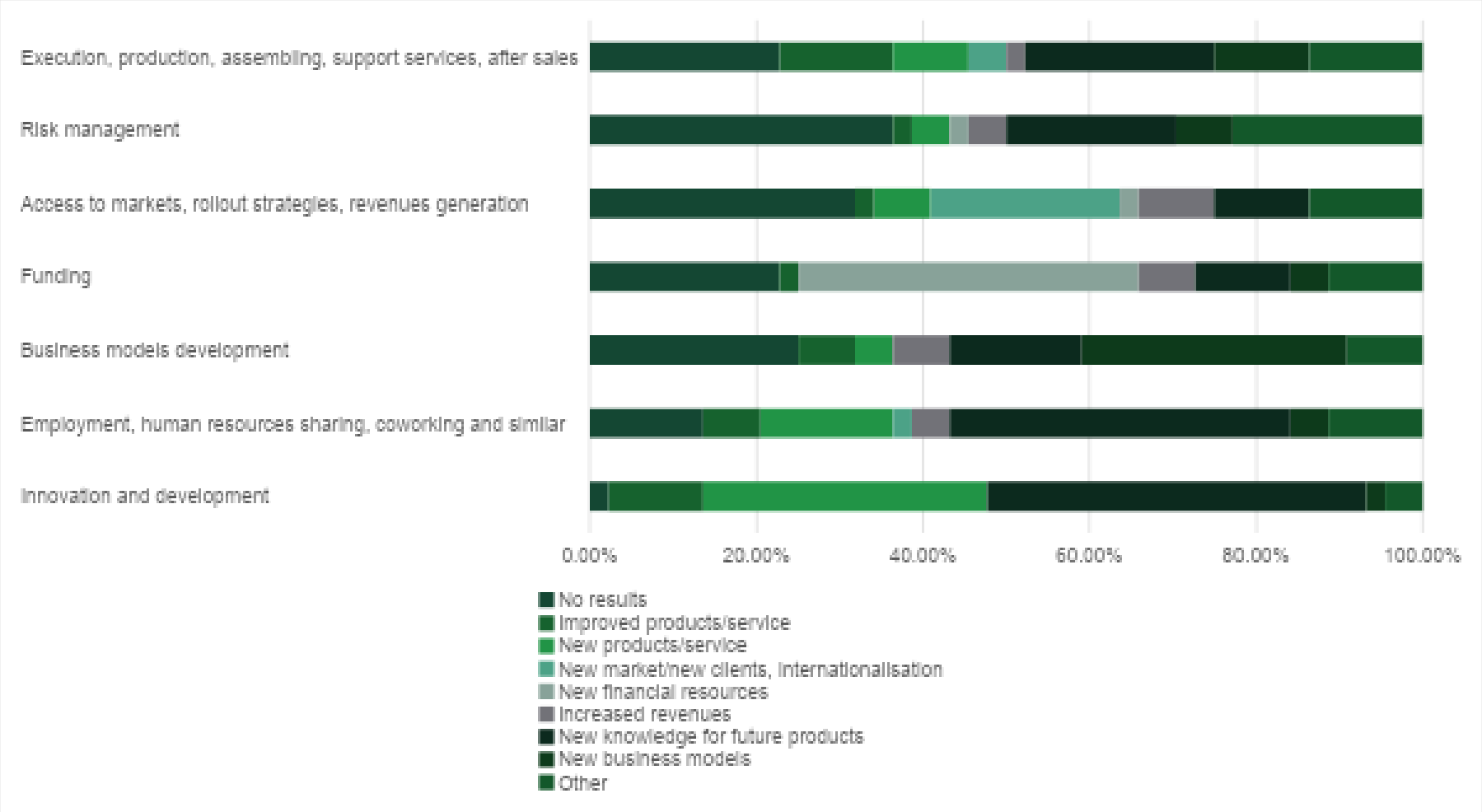
6.1 Purpose and results of collaboration

The survey for context and network assessment provided insights into the **purpose and results of their cooperation with different types of actors**; the results are shown in Annex 2. Over three quarters of the respondents cooperate with various businesses (46), with universities and other institutions of higher education (44) and public research institutes (42) and only about a third with Intermediary institutions and support services (18) and regional development agencies (19) (n=54). Comparison showed that cooperation with educational institutions on all levels (including vocational training and higher education) as well as all types of research institutions is likely less results-oriented and often yields no results. This is in spite of the view that it is focused on innovation and research for new products or services and new knowledge for future products.

Cooperation with infrastructure organisations, universities, vocational training institutions and research institutions less often results in new markets/new clients, internationalisation, new financial resources and increased revenues, but more often yields new knowledge for future products. According to the survey results, cooperation with public institutions implementing policies and programmes rarely results in improved products/service or new products/service. Further comparison between results of cooperation with companies and cooperation with universities and research institutions showed that:

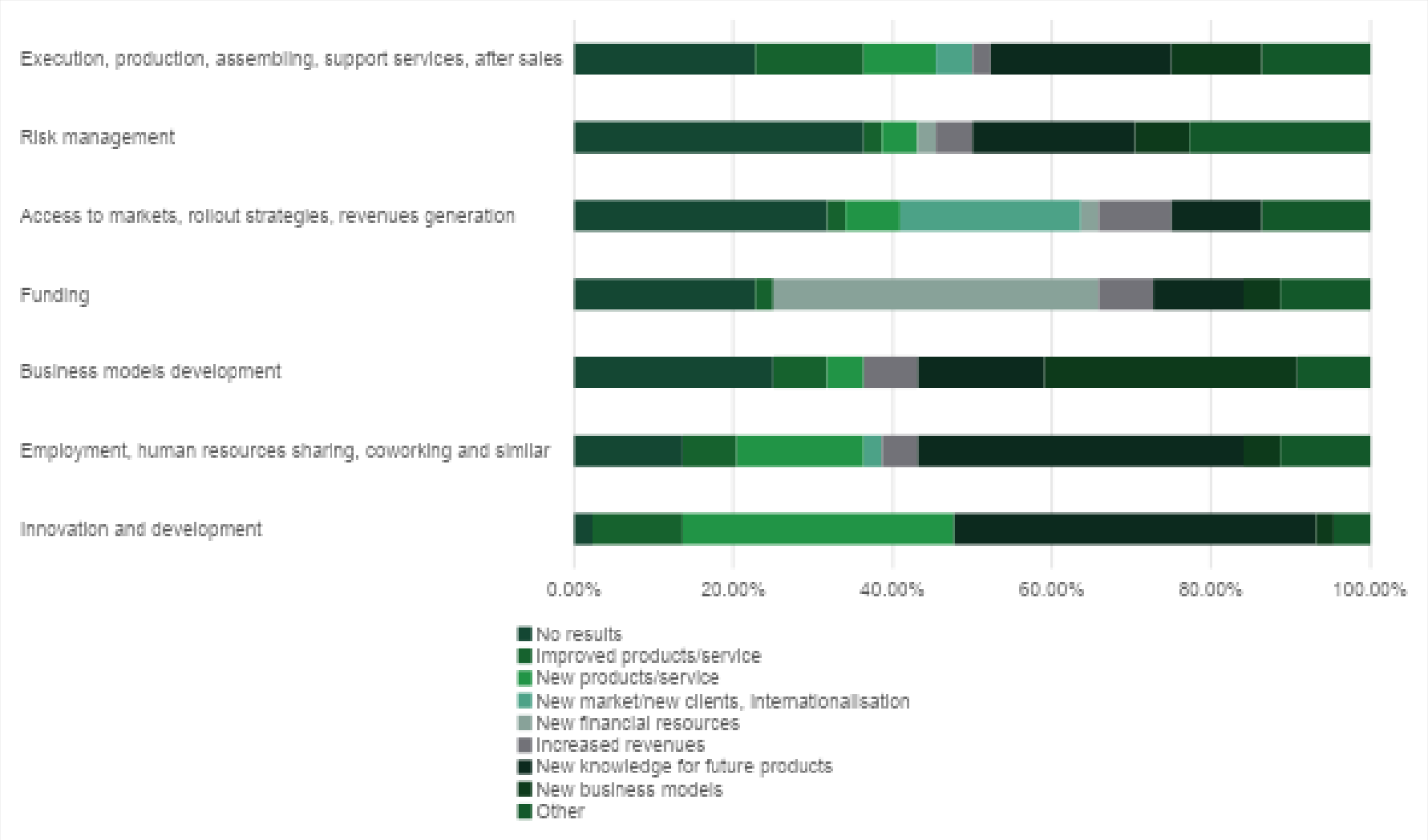
- When companies cooperate with each other with the focus on access to markets, market rollout strategies and revenue generation, the results are usually achieved as they reach to new clients and internationalises while cooperation also increases revenues. Cooperation with universities and research institutions for the purpose of stronger market roll out cooperation yields no results in approximately a third of the cases.
- Cooperation with companies for funding yields results more often and more often results in access to new markets, new clients and internationalisation, as well as increased revenues. Cooperation of companies with universities and research institution for funding leads more often to improved knowledge for future products.
- Cooperation of companies and research institutions results also in new financial resources and in case of research institutions also in increased revenues.

Figure 16 - Results of cooperation of survey respondents with companies by purpose



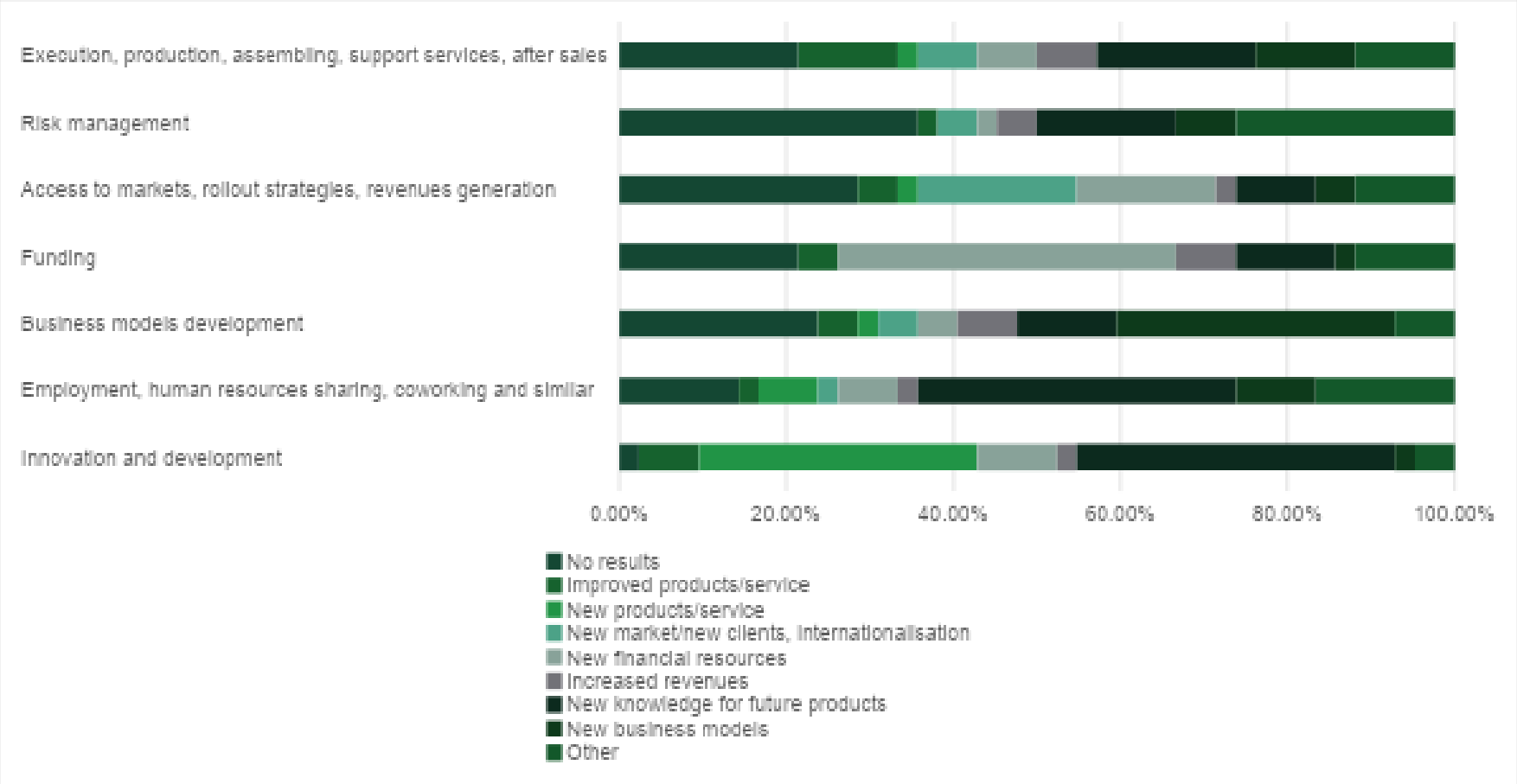
Source: Survey for context and network assessment for this study

Figure 17 - Results of cooperation of survey respondents with universities and other institutions of higher education by purpose



Source: Survey for context and network assessment for this study

Figure 18 - Results of cooperation of survey respondents with research institutions by purpose



Source: Survey for context and network assessment for this study

Survey respondents provided an interesting insight into sharing of the results of the projects. Over 40% of those who answered the question (17 out of 41) share their results with the organisations who funded the project, while a quarter (10) shares the results with local knowledge and development institutions and gladly exchanges experiences and knowledge with them. Among the comments the respondents noted that they present the results to the target groups of the project, as well as general public. Instructions for sharing of the results internally and with public were pointed out, presumably set up in the documentation of the funding source. One of the respondents pointed out that cooperation, information, networking is their task and role in the innovation ecosystem.

Survey respondents mainly cooperate within Slovenia, as two thirds (33 out of 52) answered that their innovation collaboration partners are located in Slovenia; additional 15 collaborate equally with partners from Slovenia and abroad. Only four respondents collaborate for innovation purely with foreign actors, of which two respondents focus on EU, while the other two have innovation collaboration worldwide. International cooperation is supported by various sectoral institutions, such as MEDT, MESS, Ministry of Foreign Affairs, SPIRIT and Chamber of Commerce and Industry of Slovenia as well as various government policies. For example, good international R&D cooperation is also one of the objectives of the Strategy for Internationalisation of Slovenian Higher Education 2016-2020[138].

6.2 Functionality of collaboration in the innovation ecosystem

The actors in Slovenian innovation ecosystem have different roles that drive further ecosystem development. The functions of the broad groups outlined in Section 5.2 are summarised with examples in the table below, based on the survey, i.e. on the basis of activities, strength (see chapter 6.1) and functions of actors as seen by their counterparts that participated in the survey.

Table 8 - Functionalities of a sample of actors in Slovenian innovation ecosystem

Supports / Supported by	Knowledge generation and sharing	Market formation	Access to financing
Intermediary institutions and support services	SRIPs and any partnerships with SRIPs take care of knowledge sharing among partners but are not well known beyond their partnerships.	SRIPS mostly help partners to engage in international networks and projects, formation of markets less obvious.	Project development and search co-financing. Weak development of the consumer-oriented business models that generate own revenue. Low engagement of

[138] Center RS za mobilnost in evropske programe izobraževanja (2016) Strategija internacionalizacije slovenskega visokega šolstva 2016–2020, Ljubljana, November 2016

	Chamber of Commerce and Industry strongly promotes networking and exchange of knowledge and experience.		venture capital and similar funding actors. TTO well positioned while further development needed.
Education and research system	Universities and research instructions are at the centre, however cooperation is mostly done within projects not with the long-term partnerships.	Low focus on market needs. Marketable products need some time to scale up. Lack of applied research aiming at marketable products/services. Slow pace of operations compared to business.	Focus on public calls for proposals with lack of business models for commercialisation despite proximity of some intermediary institutions (TTOs).
Political system	Support for knowledge generation of other actors but lack of dissemination and sharing of results. Weak strategic planning and evaluation culture and lack of focus on performance.	Support within instruments. Weak internationalisation and scale-up support. Push for performance of beneficiaries needed.	A palette of instruments not focused on selected targets to improve outcome. Lack of links to private instruments. Separation of instruments for R&D and development and private and public sector. Weak support to formation of various sources of financing. Instruments established are too rigid and slow for the product life cycle and fast market changes.
Infrastructure	Actors share knowledge among partners/users and provide support.	Support provided while scale up and internationalisation not in focus. Weak networking and matching beyond local/regional networks.	Low engagement of venture capital and similar funding actors to improve performance.

Industrial system	Strong partnerships with reliable partners. Networking for new partnerships, also through intermediary institutions and support services such as SRIPS and Chamber of Commerce and Industry. Still lack of knowledge on innovation processes and methodologies.	The only group in innovation system strongly focused on market. Not used for business model generation.	Project co-financing generally does not improve performance.

Source: own research, based on and adapted from Botta[139]

Several conclusions can be drawn from the analysis presented above. Firstly, it may be concluded from the table above that institutional, long term cooperation is low. Most of cooperation between the actors of innovation ecosystem is set up on an ad hoc basis or on the basis of matching interest for applications for funding sources. Secondly, **public administration is deemed to communicate poorly with the public**, thus its innovation policies, strategies, incentives as well as results and good practice are largely unknown to the broader public.

Crucially, political system and its institutions are geared more towards promoting and managing financial incentives for innovation, not the innovation system per se. Their policy-making role is less clear, which links to the previous finding on poor communication of the public administration with the public. **As a result, actors dealing with financing and their role are not well known among the actors** of Slovene innovation ecosystem. Venture Capital funds and business angels associations operate quite differently from the government institutions supporting innovation.

As outlined above, SRIPs are not recognised as strong innovation drivers as they are known to a limited number of actors, possibly those that are their members or cooperate closely with their members. **Universities and institutes are strongly involved in innovation, but the cooperation with other actors varies** across faculties and/or departments. They provide a backbone for innovation projects, however are sometimes too closed for initiatives by other actors.

It should be recalled that there are several **companies that are highly recognised as important drivers of innovation** in the country. These are mainly in hi-tech, pharmaceutical and automotive sectors. The main focus which comes from the above collaboration analysis therefore is the challenge of connecting other actors in the system with these companies, as well as companies that have the potential to be highly innovative. On this topic, collaboration is further analysed through the lens of the practical application of instruments in chapters 8 and 9.

[139] Botta E., McCormick C., Eis J. (2015) A Guide to Innovation System Analysis for Green Growth. Global Green Growth Institute, Seoul, Korea

7 Legal and Policy Framework

The review of the Legal and Policy Framework is based on the review of the key policy and legal documents to set the frame for the review of the innovation ecosystem. A detailed review in Annex 4, presents key policy and legal documents in Slovenia and describes objectives set in the policies, strategies and regulations and understands the tools used to achieve the objectives planned. More general legislation has not been outlined, for example the Public Finance Act, which is used whenever public money is used and does not specifically address innovation.

Overall, as has been observed by stakeholders, international organisations, and actors in the system, it seems that investment in science and technology is not seen as strategically important for sustainable economic growth in the long-term.[140] This is despite substantial efforts to coordinate the ecosystem (for example, the 2015-2020 internationalisation strategy). This is a crucial contextual reality that the legal and policy framework must be seen through, and also something that must be seen as a pre-requisite for significant renovation of the innovation ecosystem.

7.1 Analysis of the legal and policy framework

The Supportive Environment for Entrepreneurship Act, introduced in 2007, has been improved several times, with the most recent changes done in 2018. In the lead up to this latest amendment, **cluster organisations argued for a larger focus and financial provisions**.[141] The Chamber of Commerce and Industry of Slovenia and the Chamber of Craft and Entrepreneurship of Slovenia, with their network of regional or regional chambers, also play an important role in achieving the objectives of the act.

The replacement of the Promotion of Foreign Direct Investment and the Internationalisation of Enterprises Act in 2018 by Investment Promotion Act redefined the forms of investment incentives, conditions, criteria and procedure for granting investment incentives, as well as activities for investment promotion and internationalization of companies. It includes, among others, provisions for a Public Agency for promotion of investment and internationalisation and activities for internationalisation, including the possibility to open an office of the Public Agency abroad and the obligation of preparation of a 5-year programme of promotion of the internationalisation of companies. It is too soon to make an assessment of the effectiveness of this new act.

With regards to the policy framework, the Report on the Implementation of the Resolution on the Research and Innovation Strategy of Slovenia for the period 2015-2017[142] finds that a **lack of coordination** and relative inefficiency of the Slovenian innovation system,

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[140] European Commission (2017), RIO Country Report 2017: Slovenia, Joint Research Centre.

[141] TECEC, (2016), Slovenian Clusters Presented Joint Position to the Draft of Supportive Environment for Entrepreneurship Regulation Act in Slovenia, press release. Accessed via: http://intranet.teces.si/prikazi.asp?vsebina=info%2Fobvestilo.asp&id=234&jezik=1033

[142] Government of the Republic of Slovenia (2019) Poročilo o uresničevanju Resolucije o raziskovalni in inovacijski strategiji Slovenije za obdobje 2015–2017. Source: https://www.gov.si/assets/ministrstva/MIZS/Dokumenti/ZNANOST/Strategije/Porocilo-o-uresnicevanju-Resolucije-o-raziskovalni-in-inovacijski-RS-20152017.pdf

remained constant in the period 2015-2017 and adds the system of research and innovation in Slovenia **remains insufficient and poor.**

According to the report, the autonomy and responsibility of public research organisations (PROs) did not increase in the period 2015-2017, as the legislative and other normative frameworks of R&D of the operation of public research organizations did not change. It states that Slovenia has an outdated PRO model, which requires a comprehensive reform based on the national strategies – Research and Innovation Strategy of Slovenia 2011-2020 and National Higher Education Programme 2011-2020[143]. Implementation of the strategy was hampered by the fact that actors, including PROs, were # adjusting to the drop in public funding of RTDI which culminated in 2016 (from 0.68% of GDP in 2009 to 0.40% of GDP in 2016.). PROs, for example, have not yet adjusted other competitive models.

Knowledge transfer from research organisations to companies did not increase or improve the efficiency of the knowledge transfer system during the period of the implementation of the strategy. Of great concern is the large drop in the volume of applied research projects. On the other hand, the launch and funding of S4 instruments and the operation of SRIPs, which in 2017 brought together more than 400 dynamic companies and close to 100 key research organisations, innovation support institutions, NGOs and other entities, contribute to creating a supportive environment. **R&D cooperation in the EU** and in the internationally was targeted and of high quality. The quality and scope of Slovenia's international R&D cooperation is increasing, but "internationalisation at home" still presents the weakness of the country[144].

The goal of achieving high investment in R&D activity is one of the worst achieved goals of the resolution. The relatively large number of different instruments, which often leads to fragmentation and reduce the efficiency of the funds invested, was not changed during the strategy period[145].

Slovenia is still above the European Union average in the field of human resources in R&D activities, especially due to the high share of new doctoral students and the achieved level of higher education. Slovenia's attractiveness for foreign researchers, especially for doctoral students, is small and represents a major obstacle to the internationalisation of science at home and its integration into European scientific processes. The results and effects of the measures implemented under the S4 strategy will only be visible in the next reporting period[146].

The key sectoral objective, which requires a strong, modern, well-exploited and internationally integrated research infrastructure, has improved in the period 2015-2017, especially in international integration and the establishment of joint international research infrastructures. But since 2015, there have been no funds from the national budget

[143] Ibid.

[144] Ibid.

[145] Ibid.

[146] Ibid.

and Structural Funds for construction, maintenance and renovations of buildings the research infrastructure at PRO is getting older[147].

As concluded by the report the drawback of the business-innovation infrastructure is large fragmentation and inconsistency that often leads to inefficiencies. In Slovenia, large number of research organisations identify the need for high-performance computing power as the amount of digital data created and processed by researchers is growing rapidly. The high-performance computing power does not reach critical mass on a European or global scale[148].

Overall, there has been a generally slow rate of implementation of the Research and Innovation Strategy (RISS), adopted in 2011. According to the implementation report, by 2017 only 10 of the 69 measures planned have been implemented, while 41 were in the implementation process, and 18 had not been started.[149]

[147] Ibid.

[148] Ibid.

[149] European Commission (2017), RIO Country Report 2017: Slovenia, Joint Research Centre.

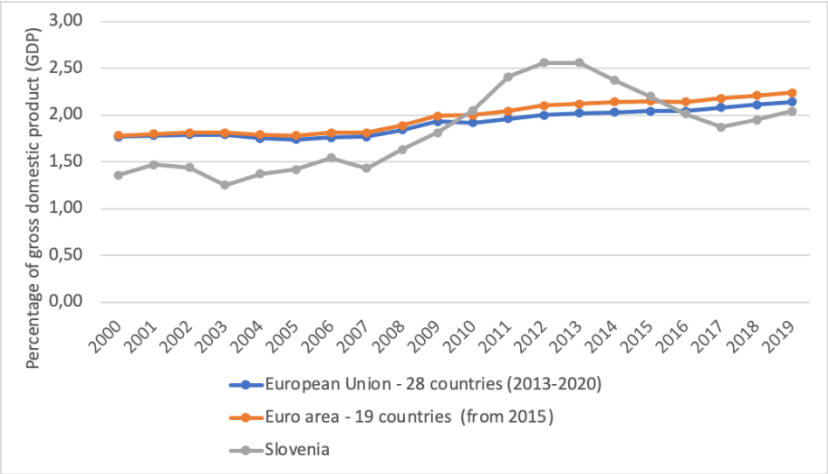
8 Financing

This chapter builds on the review of the programmes and individual measures by public and private actors to support the Slovenian innovation system. Based on the systematic mapping of instruments the chapter describes common characteristics of the innovation instruments and presents selected instruments from the portfolio of support in the form of short case studies.

8.1 Overall investments

Slovenia invests modestly in RTDI, compared with EU-27 and countries used for comparison in this study. In the EU accession process, Slovenia started to gradually approach the

Figure 19 - Gross domestic expenditure on R&D, in percentage of gross domestic product (GDP)



Source: EUROSTAT[150]

average R&D intensity and has surpassed the EU average in 2010, however it is again lagging behind[151]. The R&D intensity in the EU Member States in 2017 in terms of R&D expenditure as % of GDP was at 2.07% on average, while Slovenia hit a low point at 1.86% in that year[152].

The figure below shows R&D expenditure as a share of GDP for the three countries and how spending has developed over the past two decades. Like the three comparison countries, Slovenia has been increasing R&D expenditure as a share of GDP roughly since late 1990s, but has, contrary to Austria and Israel experienced sharp decline between 2013 and 2017 – similarly to Estonia where the decline started a year earlier and was overturned a year earlier[153].

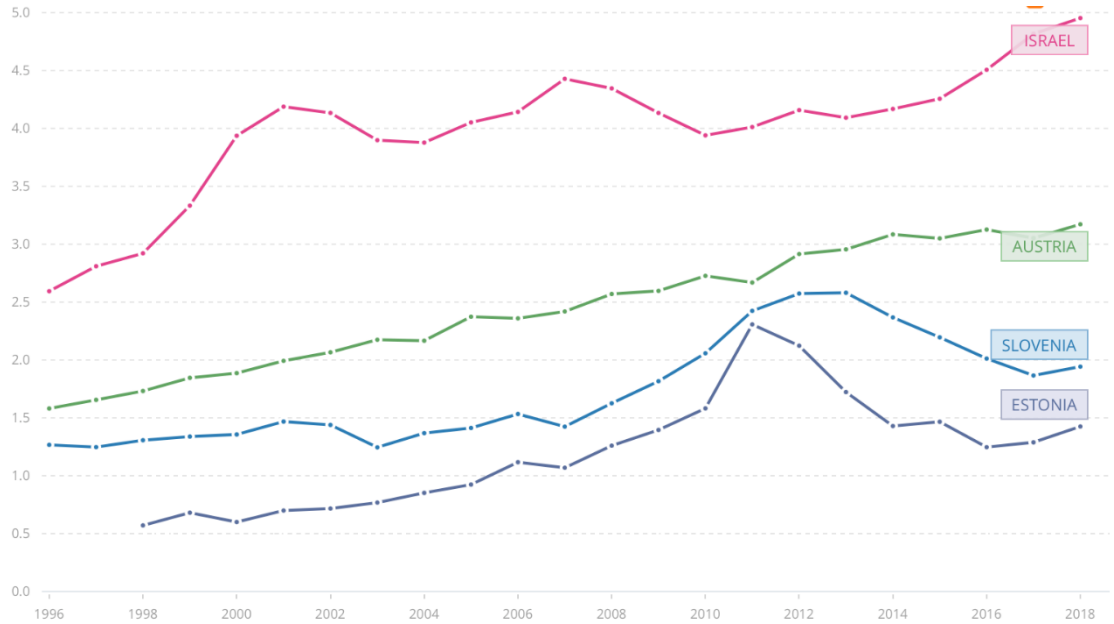
[150] Table [rd_e_gerdtot], ttp://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

[151] EUROSTAT, (2019) Newsrelease. January 2019. Source: https://ec.europa.eu/eurostat/documents/2995521/9483597/9-10012019-AP-EN.pdf/856ce1d3-b8a8-4fa6-bf00-a8ded6dd1cc1

[152] Maja Sever (November 2018), Research and Development Activity, Slovenia, 2017, Statistical Officer of the Republic of Slovenia. Accessed via: https://www.stat.si/StatWeb/en/News/Index/7765

[153] The World bank (2021) UNESCO Institute for Statistics. Source: World Development Indicators (WDI) Source: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?contextual=default&locations=SI-AT-EE-IL&name_desc=true

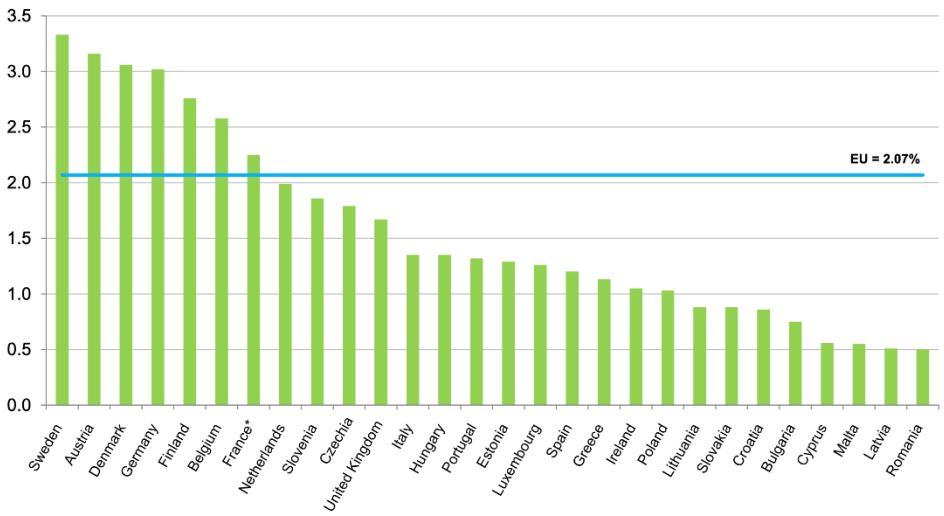
Figure 20 - R&D expenditure as a share of GDP (%) – Slovenia and comparison countries



Source: World Bank[154]

The R&D intensity in the EU Member States in 2017 in terms of R&D expenditure as % of GDP was at 2.07% on average. In Slovenia, the highest share of R&D spending was recorded in the business enterprise sector (75%) similar in Hungary (73%)[155].

Figure 21 - R&D intensity in the EU Member States, 2017, R&D expenditure % of GDP



Source: EUROSTAT, 2019[156]

[154] The World bank (2021) UNESCO Institute for Statistics. Source: World Development Indicators (WDI) Source: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?contextual=default&locations=SI-AT-EE-IL&name_desc=true

[155] EUROSTAT, (2019) Newsrelease. January 2019. Source: https://ec.europa.eu/eurostat/documents/2995521/9483597/9-10012019-AP-EN.pdf/856ce1d3-b8a8-4fa6-bf00-a8ded6dd1cc1

[156] EUROSTAT, (2019) Newsrelease. January 2019. Source: https://ec.europa.eu/eurostat/documents/2995521/9483597/9-10012019-AP-EN.pdf/856ce1d3-b8a8-4fa6-bf00-a8ded6dd1cc1

When exploring BERD spending per capita in Europe and with comparators, Slovenia ranks above Estonia but below other countries and below the EU average[157].

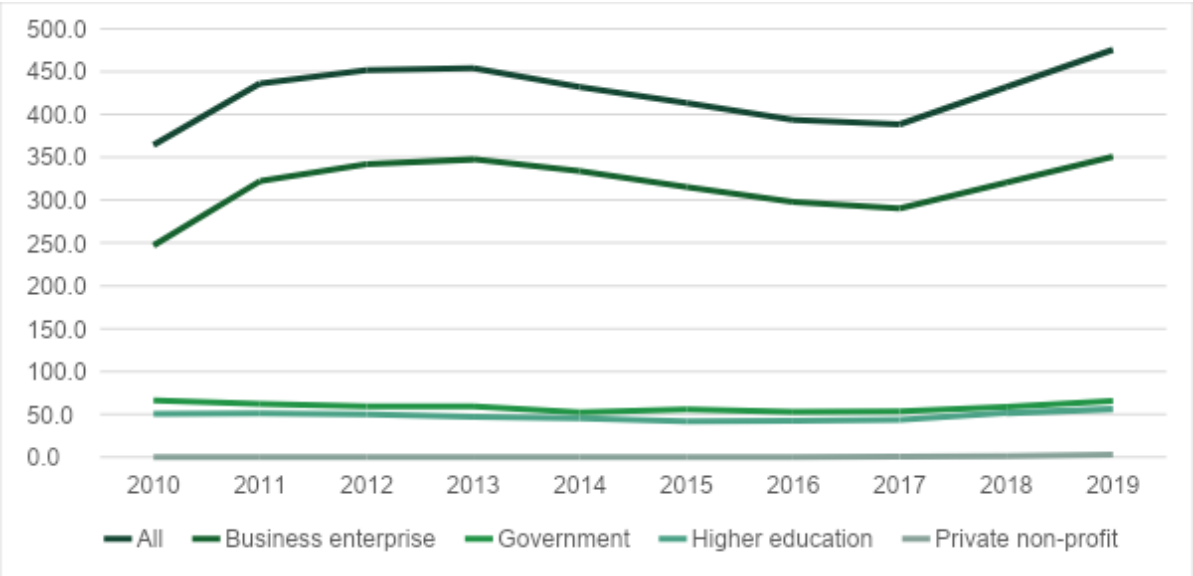
Table 9 - BERD spending per capita in Europe, comparation countries

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
European Union - 27 countries (from 2020)	304,2	327,6	341,2	349,5	360,4	377,2	391,4	419,1	438,8	456,7
European Union - 28 countries (2013-2020)	303,6	326,4	340,1	348,3	363,5	385,7	394,4	417,9	437,3	456,2
Estonia	87,6	182,6	165,3	117,9	94,9	106,1	105,8	109,2	117,4	182,3
Austria	661	679,7	777,9	802	860,9	873,4	899,3	899,2	959,1	1.000,8
Slovenia	**247,1**	**322,2**	**342,1**	**347,5**	**334,1**	**315,4**	**297,8**	**290,4**	**320,5**	**350,7**

Source: EUROSTAT, 2021[158]

Gross Domestic Expenditure on R&D by sector of performance shows to higher expenditure on R&D of business sector per capita followed by government, higher education and private non-profit sector.

Figure 22 - Gross Domestic Expenditure on R&D by sector of performance in EUR per capita



Source: EUROSTAT[159]

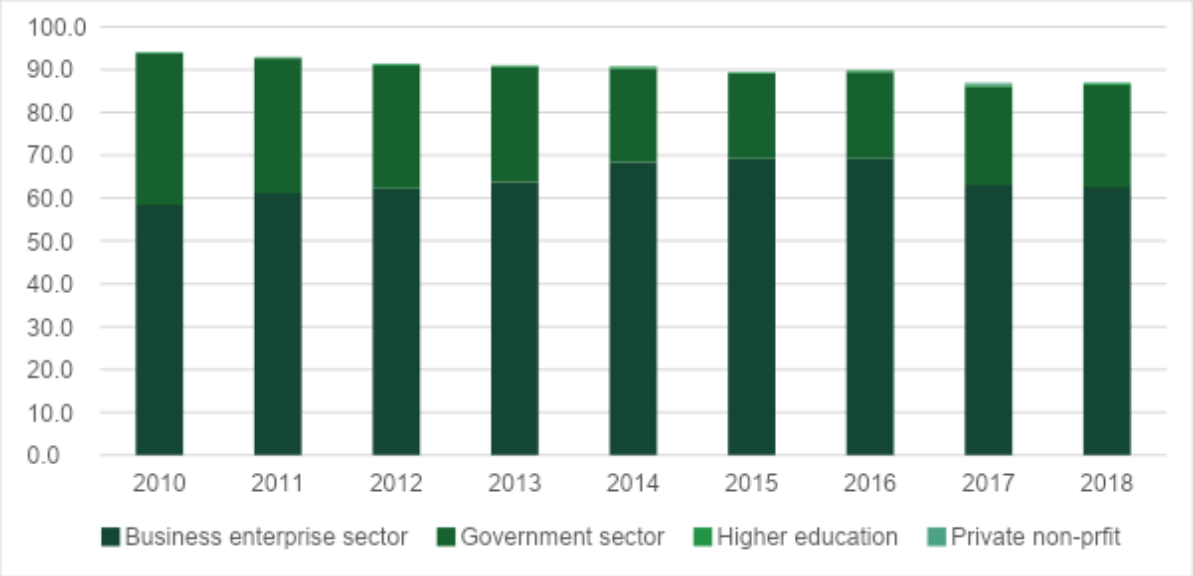
Similar may be seen in the data for the Gross Domestic Expenditure on R&D by sources of funds in percentage of total which shows funding from business sector is higher than from other sectors.

[157] EUROSTAT, (2021) BERD by NACE Rev. 2 activity [rd_e_berdindr2]. Source: http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

[158] Ibid.

[159] GERD by sector of performance. Accessed via: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_gerdtot&lang=en

Figure 23 - Gross Domestic Expenditure on R&D by sector as percentage of total



Source: EUROSTAT[160]

Business R&D intensity is relatively high, but public R&D expenditure is modest, the 3% R&D intensity target seems out of reach. R&D intensity was 1.95% of GDP in 2018 (EU average: 2.11%), returning to its 2010 level after peaking at 2.56% in 2013. This has been driven by business R&D expenditure which stood at 1.45% of GDP in 2018 (above the EU average of 1.41%), also returning to its 2010 level after peaking at 1.96% of GDP in 2013 [161]. Business expenditure on R&D in Slovenia is mainly concentrated in pharmaceuticals, machinery, computer technology and technologies related to electrical energy[162].

Table 10 - Gross domestic expenditure on R&D by source of funds, share, 2018

	Business enterprise sector	Government sector	Higher education sector	Private non-profit sector	Abroad
EU-27	58,9	29,8	1,2	1,1	9,2
Slovenia	62,6	23,7	0,5	0,2	13,1

Source: EUROSTAT[163]

Calculation of Government sector amount should be in principle based on instruments and include the funds transferred to national performers for each instrument. Funding from European sources should be included as well[164].

[160] GERD by source of funds. Accessed via: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_fundgerd&lang=en

[161] European Commission, (2020) 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.

[162] Ibid.

[163] R*D Expenditure by source of funds. Accessed via: https://ec.europa.eu/eurostat/statistics-explained/index.php/R_%26_D_expenditure#R_.26_D_expenditure_by_source_of_funds

[164] JRC (2017) Analysis of national public research funding (PREF). Handbook for Data Collection and indicators production. European Union, 2017

Interesting comparison is also seen from the data below showing to the source of funding per sector of performance of the R&D. High dependency in terms of funding of Higher education sector to government funding may be observed with lower dependency on business sector. This shows to potential for further improvement of cooperation among Business enterprise sector and Higher education sector actors.

Table 11 - Gross domestic expenditure on R&D (in EUR 1000) by sector of implementation and source of financing, Slovenia, annually

Sector of performance	Source of funding total and per source	2017	2018	2019
Business enterprise sector	**Total**	**599.976**	**662.441**	**731.256**
	Business enterprise sector	490.668	542.162	590.903
	Government sector	31.824	40.892	56.196
	Higher education sector	65	z	343
	Private non-profit sector	3.089	z	27
	Abroad	74.329	79.126	83.787
Government sector	**Total**	**110.681**	**120.932**	**136.638**
	Business enterprise sector	z	z	8.023
	Government sector	86.606	96.407	107.233
	Higher education sector	z	z	z
	Private non-profit sector	z	-	z
	Abroad	15.862	17.003	20.276
Higher education sector	**Total**	**89.885**	**106.369**	**116.736**
	Business enterprise sector	7.823	9.032	10.009
	Government sector	63.639	72.176	79.040
	Higher education sector	z	3.789	3.114
	Private non-profit sector	z	744	145
	Abroad	14.841	20.627	24.427
Private non-profit sector	**Total**	**1.748**	**2.981**	**6.069**
	Business enterprise sector	z	z	430
	Government sector	1.269	2.155	2.434
	Higher education sector	-	z	z
	Private non-profit sector	z	z	z
	Abroad	98	194	2938

Source: SURS[165] (z stands for statistically confidential data)

Slovenia is ranked 19th out of EU-28 Member States in **Horizon 2020**, while its success rate in budget share ranking is 18th out of 28 member states. The 3 top organizations to participate in Horizon 2020 funding are Institute Josef Stefan, University of Ljubljana and the Chemical institute[166]. 346,9 million EUR was received, or 0.61% of the EU total in funding by the project participants after deduction of their linked third-party funding and 315 or 23.53% of the country total participated in Horizon projects, where the number of SMEs

[165] SiStat, Gross domestic expenditure on R&D by sector and source of funding. Accessed via: https://pxweb.stat.si/SiStatData/pxweb/sl/Data/-/2364220S.px/table/tableViewLayout1/

[166] European Commission, (2018) HORIZON 2020 IN FULL SWING — Three Years On - Key facts and figures 2014-2016. Directorate-General for Research and Innovation. Source: https://ec.europa.eu/programmes/horizon2020/en/news/horizon-2020-full-swing-three-years

involved in H2020 projects is calculated as the number of times an SME participates in projects. SME Net EU contribution was 88.75 million EUR or 25.58% of country total Horizon funding, where the total funding received by SME participants is seen after deducting their linked third party funding (Horizon, 2020).

Sustainability of R&D&I funding is an issue for the Slovenian government, which planned a constant increase in the resources dedicated to R&D to achieve the Europe 2020 target of 3% of R&D intensity. Today, investment in R&D is growing at a rather low rate which is, according to the Country Report Slovenia 2020, is detrimental to the achievement of SDG 8 and 9[167].

The peak in 2013 followed the introduction of substantial R&D tax reliefs in 2010. The subsequent decline can be explained by stricter controls on business R&D reporting and the termination of financing of R&D in the centres of excellence, competence and development, which were co-financed by the EU. Business investment in R&D still represents about 75% of total R&D expenditure in the country, around 10 percentage more than the average in the EU [168].

Public expenditure on R&D is modest (0.5% of GDP), but in 2018 the government increased it, partly boosted by EU structural funds. In addition, the Slovenian government planned a gradual increase in public R&D investment for the period 2019-2021. However, the 3% of GDP R&D intensity target seems out of reach by 2020[169].

8.2 EU funds

In the period **2004-2006** the Structural Funds provided EUR 237.5 million out of a total budget of EUR 334.5 million for the implementation of the Single Programming Document in Slovenia.

The programme also including technical assistance measures, had 3 priorities.

- Priority 1: Promotion of the productive sector and competitiveness
- Priority 2: Knowledge, human resource development and employment
- Priority 3: Restructuring of agriculture, forestry and fisheries[170]

A total of 28 Cohesion Fund projects (including the former Instrument for Structural Policies for Pre-Accession projects) were implemented in the period 2000–2006. This includes 16 environmental projects, eight transport projects and four technical assistance projects. Substantial interest was evident among potential recipients of support as regards RTDI and centres of excellence.

Slovenia made large investments to promote the development of an innovative business environment by supporting 64 innovations and patents and supported research. In the

[167] European Commission, (2020) 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.

[168] Ibid.

[169] Ibid.

[170] European Commission, Slovenia: Objective 1 Programme, 2004-2006. Accessed via: https://ec.europa.eu/regional_policy/en/atlas/programmes/2000-2006/slovenia/objective-1-programme-2004-2006-5

period 2000–2006 almost 6,000 small and medium-sized enterprises received support. Support was mainly focused on the creation of networks of technology and centres of excellence and on promoting links between these and businesses. Up to the end of 2007, 28 centres acting as intermediaries between business and research were supported. Among which were 10 centres of excellence. Due to limited funds, however, the only projects relating to the development of business infrastructure which were undertaken were those for the establishment of industrial zones. Overall, 21 business zone projects were launched in 2005 via two public tenders[171].

In the period from **2007 to 2013** Slovenia was allocated more than EUR 4 billion of Structural Funds and Cohesion Fund financing under the Convergence Objective 1. To complement the EU investment, Slovenia's national contribution was expected to reach around EUR 724 million. Slovenian development priorities were implemented within three programmes: Strengthening Regional Development Potential with ERDF funding, Human Resources Development with ESF funding and Environmental and Transport Infrastructure Development with ERDF and the Cohesion Fund.

Table 12 - Funds planned per operational programme in 2007-2013

Operational programme	Fund	EU funds (in €, current prices)
Strengthening Regional Development Potentials	ERDF	1,709,749,422
Human Resources Development	ESF	755,699,370
Environmental and Transport Infrastructure Development	CF ERDF Altogether	1,411,569,858 224,029,886 1,635,599,744
Cross-border and interregional operational programmes	ERDF	96,941,042
Transnational operational programmes	ERDF	7.315.278
Total:		**4,205,304,956**

Source: Programming documents of the Republic of Slovenia – 2007-2013 programming period[172]

The Operational Programme (OP) for Strengthening Regional Development Potentials planned 402 million EUR for the Competitiveness and research excellence and EUR 396 million for the Economic development infrastructure.

Over EUR 1.1 billion, that is 28.5% of funds, were dedicated to investments in R&D and innovation. In relative terms, support for entrepreneurship and especially SMEs was among the highest in the Member States, at 17.6% of Fund allocations for Slovenia. Slovenia planned to invest some EUR 156 million in information and communication technologies (ICT) infrastructure and services. Priority was given to e-services for business and citizens and modernisation of broadband networks. Some EUR 77 million were earmarked for promoting the adaptability of companies and workers. The expected result was a 10% increase in the average duration of training given to people employed in enterprises supported. The ESF was supporting investments in continuous training to improve skills and knowledge, with EUR 318 million or 45% of the overall ESF investment. Increasing

[171] Applica-Ismeri-wiiw (2006) Ex Post Evaluation of Cohesion Policy Programmes 2000-2006 financed by the European Regional Development Fund in Objective 1 and 2 regions Work package 1: Coordination, analysis and synthesis Source: https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2006/wp1_tsk4_slovenia.pdf

[172] Programming documents of the Republic of Slovenia – 2007-2013 programming period, Source: http://www.eu-skladi.si/kohezija-do-2013/legislation-and-regulations/operational-programmes/2007-2013

participation in the labour market was one of the main investment priorities under the programme for 'Human Resources Development' with EUR 182 million set aside for this purpose and additional EUR 41 million were planned to address poverty and social inclusion. Slovenia aimed to include 6% of all education institutions in accessibility and equal opportunities programmes and ensure that 30.000 children with special needs benefit from these programmes.

As discussed by the Slovenia Country Report - Ex Post Evaluation of Cohesion Policy Programmes 2007-2013[173] in total, Slovenia was allocated EUR 3.3 billion from the ERDF and Cohesion Fund over the period under the Convergence Objective. This was equivalent to just over 1% of GDP and to around 25% of Government capital expenditure. Funding was used mainly to support innovation and RTD and environmental and transport infrastructure. The distribution of funding between policy areas changed relatively little over the period. However, a change in strategy was particularly evident for Enterprise support and innovation. Traditional measures to support innovation were complemented in 2009 and 2010 with innovative measures, such as support for technological investment in companies related to their R&D activities, the establishment of new creative centres and 'Research vouchers'[174]. Overall, the measures co-financed over the period led directly to the creation of 5.860 jobs, of which 887 were in tourism. This was achieved in part through the support given to 655 RTD projects and to 3.101 projects to help firms finance investment[175].

The funding allocated to specific projects in Enterprise support and innovation amounted to just under EUR 1 billion, or around slightly less than 30% of the overall amount of ERDF and Cohesion Fund available. The larger part of the funding (over 85%) went to innovation and RTD projects. The evaluation indicated that Slovenia was standing out among the EU12[176] countries as allocating the largest share of funding to SME support (23% of the total). In consequence, the ERDF constituted the main source of financing for business support in the country and amounted to over 1% of total national investment (gross fixed capital formation). The 'Strengthening Regional Development Potential' OP allocated nearly half of its budget, EUR 785 million, to finance 13 policy instruments for supporting SME development and innovation. Overall, grants and loan guarantees for R&D and investment were used to promote the development of SMEs, mainly concentrated on new and growing businesses[177].

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. The majority of the FIs were funded mainly by the ERDF with a small national co-financing rate (15%) and no private co-

[173] Applica, Ismeri Europa and Cambridge Economic Associates (2016) Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF), Country Report Slovenia, Source: https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2013/wp1_sl_report_en.pdf

[174] Applica, Ismeri Europa and Cambridge Economic Associates (2016) Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF), Country Report Slovenia, Source: https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2013/wp1_sl_report_en.pdf

[175] Ibid.

[176] EU-12 comprises EU Member States: Bulgaria, Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Romania, Slovenia and Slovakia.

[177] Applica, Ismeri Europa and Cambridge Economic Associates (2016) Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF), Country Report Slovenia, Source: https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2013/wp1_sl_report_en.pdf

financing. By the end of 2014, the funding allocated had been entirely paid into the respective funds and 81% had reached final recipients[178]. All the three funds were managed by the Slovene Enterprise Fund, a publicly owned fund established for the purpose of providing financial support to businesses. The prevalent form of support was guarantees while loans and, more especially, venture capital, were used to a limited extent[179].

In period **2014-2020** Slovenia planned to implement the cohesion policy with approach to priority axes international competitiveness of research, innovation and technological development in line with smart specialisation for enhanced competitiveness and greening of the economy. With this priority Slovenia intended to focus on target markets and develop less fragmented scientific research and technological development. This should improve the international competitiveness of research, innovation and technological development. Slovenia's Smart Specialisation Strategy was developed with the goal to support further development of public and business R&D potential in chosen areas and thus to enable Slovenia to become a technology leader in its priority fields[180].

This National Operational Programme focuses on encouraging economic development and ensuring prosperity for all citizens in Slovenia while taking into account the specific characteristics of the two less developed regions - Western Slovenia and Eastern Slovenia. It aims to strengthen efforts particularly in the area of research and development, boost the innovation potentials of SMEs, promote resource efficiency and reduce environmental pressures, further develop the transport sector, boost the growth of employment rates and reduce the number of people at risk of poverty and social exclusion. In order to achieve these objectives, the Programme is divided into the following Priority Axes (PA)[181].

Table 13 - Priorities and funds allocated

PA	Priority	In million €
1	International competitiveness of research, innovation and technological development in line with smart specialisation for enhanced competitiveness and greening of the economy	577.2
2	Enhancing access to, and use and quality of, information and communication technologies	796.5
3	Dynamic and competitive entrepreneurship for green economic growth	717.1
4	Sustainable consumption and production of energy and smart grids	332.9
5	Climate change adaptation	99.9
6	Improvements of the environment and biodiversity status	480.5
7	Infrastructure development and promotion of sustainable mobility	312
8	Promoting employment and supporting transnational labour mobility	368.9
9	Social inclusion and poverty reduction	275.4

178 Ibid.

179 Ibid.

180 IPP (2021) Targeting priority areas/sectors. Source: http://www.innovationpolicyplatform.org/www.innovationpolicyplatform.org/content/slovenia/index.html

181 https://www.euro-access.eu/calls/implementation_of_eu_cohesion_policy_slovenia

10	Knowledge, skills and lifelong learning to enhance employability	286.3
11	Rule of law, enhancing institutional capacity, efficient public administration and capacity building of NGOs and social partners	77.6

Source: National Operational Programme[182]

8.3 Mapping of instruments

Mapping of the support instruments in Slovenia listed 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 and several private institutions. Instruments were mapped based on information available on the implementing institutions' websites and the following data were collected:

- General data, including name of the intervention, original programme or strategy and responsible body; other data such as type of support, type of target beneficiary/recipient, data on phase of development in terms of product life cycle.
- Application requirements for beneficiaries, business plan details, guaranties required to apply, application processing.
- When reviewing the expected changes in beneficiaries' behaviour, the analysis focused on how the instruments prepared the beneficiaries to change their operations and what was expected in terms of business behaviour and knowledge management.
- Under funding, the analysis focused on the size and intensity of funding per applicant, total funding size and timing, to understand the impact of the instrument.
- Under learning, the analysis focused on reviewing the processes defined by the instrument when disseminating knowledge from the beneficiaries.

Mapping of instruments was used to develop a short list of innovation support instruments to be presented in case studies and to produce a general overview of the instrument, provided in the performance chapter. Selection of instruments also depends on the availability of data and the possibility to discuss the instruments with their coordinators. In the process of identification of instruments study team proposed 15 instruments to be able to collect the data and present case studies. The instruments were finally selected based on the Beneficiary preferences.

8.4 Case studies

Instruments presented in this chapter show a variety of possible dimensions of instruments provided to support the actors in the innovation ecosystem. The instruments show the focus of the instrument with understanding of the **aim** of the support, which may be seen in developing business models, access to markets, intensification of innovation development cycle, access to finance, development or change of the product or knowledge improvement or exchange. The other dimension is to show instruments requiring the beneficiary to make changes, the **impact** seen in changed management, better knowledge

[182] Ibid.

and employee management, intensification of collaboration with other companies and/or knowledge and research institutions. **Target groups** of the instrument are explored to capture different types of beneficiaries covered by the instruments, whether these are start-ups, students, innovators, researchers, mature business or other. By exploring **technology readiness**, we wanted to capture the instruments focused on different levels on the TRL list. With **size of funding,** we wanted to capture instruments by the size of funding per beneficiary or services offered. Selection of the instruments for the case study presentation was also a subject to availability of data.

Table 14 - Instruments presented with case studies

Instrument	Description of the selection	Funding in EUR		Implementation		Type of funding	Target group	Phase of the development	Knowledge sharing
		Per Beneficiary	Total per call	Technical	Content				
VAV-2 - Intellectual property protection voucher	Vouchers are understood as a very efficient and easy-to-use instrument that covers several stages of technological readiness of the product. They motivate the whole innovation and development cycle and are developed for the SMEs. Even if they cover a smaller amount of eligible costs, they do have positive effects on the beneficiaries. The two vouchers are focused on different targets, one on the intensification of the technological process and the other on changing the knowledge about intellectual property and its management.	500 to 3.000	200.000	SPS	MEDT	Grant	Micro and SME	Any stage	Not required, SIO network shares the knowledge
VAV 14 - Prototyping voucher		500 to 3.000	200.000	SPS	SPIRIT	Grant	Micro	Prototyping	Not required, SIO network shares the knowledge
Convertible loan for innovative company start-ups in the amount of EUR 75,000	This instrument is a credit line tailored to the needs of start-ups in their seed and development phase. It is implemented with a two-stage approval system with pre-selection and application for funding and offers substantial funding in the amount of 75,000 EUR per beneficiary.	Up to 75.000	750.000	SPS	SPS	Credit	Young micro and small enterprises	Seed And Development, Start-up	Not required, Start:up Slovenia, SIO network, entrepreneurs, expert council
RDI in value chains and networks - Lot 2: Incentives for research and development projects (TRL 6-9)	This instrument covers products of the technological readiness from 6-9 and is focused on S4 priority areas. The instrument was co-developed with two ministries (economy and science).	Up to 300.000	10.000.000	MEDT	MEDT	Grant	Companies or consortia in TRL 6-9	Development, innovation	Not required
Entities of the innovative	This is very important and broad instrument covering operations of actors in the ecosystem supporting SMEs. Total	500 to 5.000	10.000.000	SPIRIT	SPIRIT	Grant	Start-up and Scale-up	Development, innovation	Required by principles of

environment 2020-2022 SIO	funding of the instrument is substantial and covers very large group of beneficiaries.						entrepreneurs		community and knowledge sharing
Incentives for SMEs to develop and introduce new products in wood processing sector	Besides incentives in tourism this instrument is one of the rare examples of the sectoral specific instruments. The aim of the instrument was to accelerate processing of wood which addresses very low wood processing structure in Slovene wood industry where most of the timber is exported.	In most cases 50.000-300.000	8.200.000	SPS	MEDT	Grant	Sector specific – wood SME	Any stage	Not required
Research projects of the Target research program" Assure food for tomorrow"	The instrument comes from the research sphere covering basic research and thus financing research institutions and researchers. It is focused on one area of concern, namely food. Total funding for the instrument is rather low but this depends on the needs which we would like to explore.	Depends on the project	200.000	ARRS	ARRS	Grant	Research institutions with possible business partners	Research	Required with line ministries
Partnership for change – National cooperation platform	Is a blended private and public instrument for innovative cooperation between employees in the public and private sector aiming at transferring and using ideas, practices and useful solutions, and employee exchange.	No external funding costs paid	N/A	AmCham	AmCham	Project	Public bodies and business	Any stage	Among participants, potential for more intensive sharing
American Slovenian Education Foundation ASEF	ASEF is a foundation instrument supporting diverse community of highly talented, prospective international students to build a community of educators and leaders of excellence, character, and service. The instrument is focused on students and international cooperation.	Scholarship	N/A	ASEF	ASEF	Scholarship	Students	Student	Extensive promotion, exchange projects

8.4.1 VAV-2 - Intellectual Property Protection Voucher

The instrument encourages the micro and SME to protect intellectual property, which should contribute to the growth and reputation of the company and further strengthen its competitiveness and market position. The co-financing is available for **preparation** of patent application, design application, trademark, **registration, maintenance dissemination** of the application abroad and for the **translation** of the application.

The instrument originates in the innovation voucher which was one of the first attempts in this direction in the past. The voucher at that time was too wide and too large in funding while the expectation was to see the Property Protection as a basis for the market roll out. As the MEDT was not able to control and evaluate the real performance of the beneficiaries after they protected their property the instrument was changed to the more focused and functional instrument supporting preparation of patent application, design application, trademark, registration, maintenance dissemination of the application abroad and for the translation of the application depending on the needs of the applicant.

The MEDT is running strong consultation on the instrument with the intellectual property office, beneficiaries and the SIO network which help them to improve the instrument. Stakeholders confirm the value of the instrument and see it as good example of the support instrument even when compared to the EU based property protection mechanism which is too small in funding per entrepreneur and would not be suitable for several environments.

The instrument supports entrepreneurs when addressing very specific and niche problems where specific expertise is needed. The external intellectual property agents must be engaged to properly address specific issues and the instrument is helping the entrepreneurs to address the protection with right tools.

To address the administrative burden of the instrument implementation, the Slovene Enterprise Fund (which technically implements the instrument) and the MEDT evaluate the instrument and adjust it to better fit the needs and require as little administration as possible.

Since 2019 over 8.766 applications for vouchers were received while only since February 2021 when the calls for the voucher instruments were open over 2,500 applications for vouchers of all types were received. The current funding of the voucher instruments is not large enough for the needs identified in the calls and in the discussions with the stakeholders. Smaller number of applications for this instrument was observed in the time of COVID-19 pandemic however the interest is back.

The funds planned for the implementation of the latest public call in February 2021 for the instrument will be spent by the beginning of April 2021.

The respondents of the survey on the instruments suggest that the costs of consulting in the field of proving ownership, licensing and other forms of IPR protection abroad should be eligible while others suggest raising the eligibility cost intensity to 100%.

Table 15 - Summary of Instrument VAV-2

Instrument	Quality
Aim	Intensification of innovation development cycle, development or change of the product or knowledge improvement
Impact	Changed management
Target group	Micro and SME
Size of funding	500 to 3.000 EUR with large value for the enterprises
Knowledge sharing	Not required, SIO network shares the knowledge
Lessons learned	The focus and the aim of the instrument need to be carefully planned and evaluated to understand necessary improvements of the instrument. To achieve performance, constant discussions with stakeholders are needed. Specific focus of instruments requires detailed planning and understanding of needs and possible change.

8.4.2 VAV-14 - Prototyping voucher

The instrument provides micro enterprises with the possibility of developing the prototype (in physical or digital form) for the new product or service to be able to validate the business idea for the market or financial instruments like venture capital managers. The eligible costs of the instrument are focused on production of a physical or digital prototype while only external costs of the instrument beneficiary are eligible. Technically (publishing of the call and contracting) the instrument is implemented by the Slovene Enterprise Fund in cooperation with SPOT network supporting preparation of the applications for the call. SIO network is used to identify the need for the voucher, monitor the process and evaluate the results of the vouchers and to verify the costs. The Ministry of Economic Development and Technology and SPIRIT is responsible for the development of the content and evaluation of results.

The origins of the voucher date back to the Slovenia the Land of Start-ups Action Plan prepared in 2018 by the Start: Up Initiative in cooperation with the MEDT.

The instrument is focused on micro enterprises unable to apply for other means of support, particularly the P2 2021 - Incentives to start innovative companies instrument, which supports around 40 more developed applicants annually.

To improve the efficiency of the instrument the SIO network needs to validate the project idea and shadow the applicant in the whole process of the prototype development. Intensive finetuning process among SPIRIT, SIO network and MEDT was done to achieve improved management of this instrument and profile the responsibilities of the SIO

network who guard the system with their shadowing. As discussed with the representatives of the SIO network they understand the responsibility for the validation of the process and see importance of their role in the process.

The voucher system is limited to 6 months (in particular cases to 12 months) support with specific types of short-term support which should help entrepreneurs in specific issues and problems. Similarly, the Prototyping voucher supports entrepreneur to develop the prototype and test it as soon as possible; longer support would exit the frame of vouchers support.

When discussing prototyping voucher in interviews with venture capitalists, technology and start-up transfer centres and companies this is seen as one of the best and very simple and effective support measures in the innovation system.

The Prototyping voucher was launched in 2020 and is one of the latest vouchers to be launched. 300.000 EUR were planned since the start of the public call in February 2021; the funds for this instrument will be used by the end of April 2021.

Table 16 - Summary of Instrument VAV-14

Instrument	Quality
Aim	Access to markets, intensification of innovation development cycle
Impact	Changed management
Target group	Micro enterprises
Size of funding	500 to 3.000 with large value for the Micro enterprises
Knowledge sharing	Not required, SIO network shares the knowledge
Lessons learned	When the vouchers instrument was being developed the initial idea was to keep the vouchers available for the entrepreneurs when they need them rather than accumulating vouchers by Beneficiaries and then use them when/if necessary, depending on application. As the vouchers instrument was stopped in 2020 and opened again in February 2021 due to financial shortages of the national budget the user experience of the beneficiaries may be changed.

8.4.3 SK75 Convertible loan for innovative company start-ups in the amount of EUR 75,000

The Slovene Enterprise Fund implements this instrument to enable young companies with a potential to grow and create new jobs to obtain seed capital in the amount of EUR 75,000

in the form of a convertible loan, or venture investment in the amount of 200,000 EUR (currently 100,000 to 600,000 EUR). Potential beneficiaries:

- Micro and small enterprises organised as a limited liability company registered in Slovenia, with at least one full-time employed partner, provided that the company is not experiencing business difficulties;
- Company age: more than 12 months but less than 5 years (from the date of registration to the submission of the application),
- Fully developed product/service that has already been tested with new customers and produced the first sales revenues; must have its own innovative business and development model;
- To apply, the company must demonstrate a solid financial framework for the proposed project.

The instrument is looking to support companies with confirmed market need or problem, with a prototype at hand, looking for investments to test the functionality of the prototype on the market and to further develop the product.

As observed in the last 6 years since the start of the instrument, the key advantage of successful beneficiaries is a functional and dynamic team. This plays an important role in the selection process, where proposed projects may undergo pre-selection via the Start:up Slovenija platform (more on this at https://startup-plus.podjetniskisklad.si/en). This improves their chances of funding and successful market roll-out due to the knowledge gained and the collected pre-selection points. When the applicant applies for venture capital, the decision to allocate public investment funding is based on the merits of the private investor and their total pledged investment.

In comparison to the P2, this instrument is less interesting for entrepreneurs as SK 75 offers credit funding while the other one is developed in the form of a grant. Nevertheless, to date this instrument was used to support 90 companies with convertible loans and 3 with investments in company capital. The difference between these two instruments becomes apparent at the critical moment for the company when the development of the product/service/process is over and it needs to go to the market, when funding of the roll out is critical. Sometimes founders are not aware of the timing and the resources needed to achieve the planned market KPIs.

To support the companies during market entry and growth and to limit the risk exposure of public funds, the beneficiaries are given follow-up support through mentoring and knowledge transfer measures provided via public support mechanisms. Besides this, each beneficiary company is monitored by an expert council (consisting of the entrepreneur, SEF, mentor and a business consultant from the SIO network). The council monitors the implementation of the business strategy and agreed KPIs (revenues, number of employees). The traffic light system is used to signal the performance of the beneficiaries, along with their achieved KPIs.

The SK75 is a risky instrument, considering that businesses operate these investments based on their business idea and the team, which may sometimes prove not to be as successful as originally planned. Nevertheless, some successful companies were supported

with this instrument, such as mojmoster.si (home renovation platform), Lushna (wooden glamping resort), Fortronik (Buwizz Lego engine), NervTech d.o.o. (driving simulator), Chipolo (stuff tracking) and more.

The instrument is linked to the innovation support organisations' (SIO) network where they get a lot of information and start the development of their business idea. Besides, with networking they share their experiences and improve their prototype and the business model behind the planned product. As seen, mentoring support and the education element of support are equally important as the funding. As discussed before, the key to success are the teams behind the idea.

The origins of the instrument date back to 2014 and SEF is continuously developing the instruments according to lessons learned. The latest planned improvement was to support companies up to 7 years of age because this period is seen as important for the formation of the team and structure of the funded company. The proposal was not approved due to the conditions set up by the Fund for the Funds managed by the SID Bank. This study will not go into the details of this decision.

Instrument	Quality
Aim	Go to market
Impact	Changed team and management, improved knowledge, intensification of innovation and development process
Target group	Young micro and small enterprises with already tested product/service
Size of funding	Limited to 75.000 EUR, disbursed over a longer period with additional support through mentoring and knowledge transfer
Knowledge sharing	No obligation, Start:up Slovenia, SIO network, entrepreneurs, expert council
Lessons learned	Open (public-private) process of development of business projects and focus on people, knowledge and teams may be a decisive factor improving the quality and performance of instruments. Blending of support instruments, not only financial ones, further improves the results.

8.4.4 RDI in value chains and networks - Lot 2: Incentives for research and development projects (TRL 6-9)

The aim of the instrument is to support research, development and innovation activities in companies or consortia to develop new or improved products, processes or services in the priority areas of the Slovenian Smart Specialization Strategy. The instrument subsequently included tourism, but only few applications were received. The instrument was supporting the improvement of innovation processes, shortening of the idea-to-market time,

strengthening the competitive advantage of companies and their position in value chains and increasing private sector investments in research and innovation. The largest number of applications was received form the IT sector, probably due to the maturity of the market and readiness of the products; however, the number of applications may not be conclusive for the selection of priority sectors as the readiness of each sector may vary depending on several factors.

The push for the beneficiaries was to co-finance new product, process, or services that must enter the market not later than 24 months after the end of co-financing.

At the beginning the instrument was co-created with the Ministry of Science, Education and Sports for the earlier stages of technological readiness 3-6. The original idea was to strengthen the links between the two lots of the instrument with the set of entry requirements for beneficiaries to increase their chances of getting funded if they were financed under the TRL 3-6 part of the instrument. But this coordination was lost in the implementation of the instrument due to several legislative and operational reasons. Currently there is no data on the links between the two lots of the instrument.

The goal of the instrument was to co-finance up to 24 innovative research and development projects, but in the end the instrument supported 42 projects. The projects varied in size and content and it can be noted that companies with more established R&D departments were more successful. But on the other hand, several companies at least started to apply for R&D support and develop their R&D departments. Coordinators of this instrument observed that, at least until the COVID pandemic, the average value added, and the market share of beneficiaries has increased.

Implementation of projects is monitored by coordinators at the Ministry, with annual reporting of project status and business indicators. However, centralised monitoring and evaluation of the overall impact of the instrument would be beneficial for its further development based on lessons learned.

The selection process is carried out in two steps: first the verification of compliance with the entry requirements, followed by review of project applications by external assessors. This approach ensures informed decision-making in the sectors that require appropriate expertise. The review by external assessors is conducted via the SPIRIT network.

Beneficiaries of this instrument surveyed believe they improved the ability of the partners to continue investing in the development of the company and they were able to invested in their companies and services (56%), other believe they improved research and commercialization processes among partners, which is reflected in the number of new products/services/processes (44%), other 22% believe their market potential in global value chains has improved, which will lead to improved value added per employee in the companies (22%). On the other hand, over 77% of the respondents also believe the changes will be visible in 2-3 years, while we are still in the process of change (n=19, multiple answers were possible).

To improve the instrument and its control the beneficiaries suggest contracting with larger flexibility in terms of project implementation, but strict commitment to results or indicators. Other recommendation for the improvement of the instrument is to publish questions and answers with focus on project implementation.

Table 17 - Summary of Instrument RDI in value chains and networks - Lot2

Instrument	Quality
Aim	Intensification of the innovation development cycle, go to market, focus on priority areas of Slovenian Smart Specialization Strategy
Impact	Intensification of collaboration with other companies and/or knowledge and research institutions
Target group	Companies or consortia in TRL 6-9
Size of funding	Sizable with large impact to beneficiary
Knowledge sharing	Not required
Lessons learned	The instrument was co-created with two ministries to link 3-6 and 6-9 lots. This was not achieved due to legislative and operational reasons. Implementation of projects is monitored by coordinators, however centralised monitoring, and evaluation of the impact of the instrument would be beneficial. Part of the selection process was done with external assessors to achieve improved sector-specific decision making.

8.4.5 Entities of the innovative environment SIO (2020-2022)

With this instrument SPIRIT supports institutions in the innovation ecosystem (SIO) with organization and implementation of support services for start-up and scale-up entrepreneurs. Support is provided through promotion and motivation, information and counselling, thematic workshops, mentoring, provision of expert assistance. The support is organised in 3 phases:

- Support in processing the business idea (proof of concept), including validation of the business idea and preparation of a plan for its development;
- Support to growth and development of start-up companies – start-up;
- Support to growth and development of fast-growing companies- scale-up.

The entrepreneur and an SIO member screen the business idea and the associated business model, which represent the grounds for the SIO member to contract the mentor to support the entrepreneur in her/his business endeavour.

Representatives of the SIO network see this instrument as one of the most successful and valuable instruments in the innovation ecosystem to date. With this instrument they were able to develop local/regional communities, which serves to promote entrepreneurship. Some institutions in the network were able to develop well-functioning and user-friendly support systems. According to their experiences, the instrument could be improved with longer-term planning, considering that to date the instrument was only available for two years. The largest part of the funding is focused on end users – entrepreneurs and not on

the network, so longer-term planning would be beneficial for the stability of planned support. Building a community takes time and is subject to resource restraints, which forces several SIO members to finance development from other sources, mostly EU-funded projects.

Challenges noted by representatives of the SIO network can be grouped in two key groups:

- **knowledge and ability of the local/regional SIO** to support entrepreneurs that outgrow their initial location,
- handling **location-specific problems** such as lack of skilled and knowledgeable workforce for employment, communication gaps and similar issues which force start-ups and scale-ups to move to other locations.

Territorially Slovenia is not evenly covered with the SIO network. Due to local/regional pressures some locations have more supported SIO members than others and this is not always balanced with the critical mass needed for the SIO to function in the anticipated framework. This does not affect entrepreneurs as they may engage with any local/regional SIO community they choose. Depending on location, performance of SIO members varies as territorially peripheral ones do not operate with sufficient critical mass for business creation, skilled personnel and other factors.

To support the SIO network and ensure transfer of knowledge, SPIRIT maintains coordination within the network through periodical meetings and exchange of information. This practice produces good results and helps the network to work better and efficiently.

To improve the efficiency of the SIO network, SPIRIT now monitors the performance of the SIO network using the following indicators (of support to start-ups):

- number of new enterprises created,
- number of users supported,
- growth of start-ups (number, turnover, number of employees and GVA per employee),
- assessment of user satisfaction.

In terms of scale-up support, the number of promising new business contacts and business opportunities resulting from SIO support is used as an indicator.

SPIRIT foresees that this will improve the SIO network and create the foundations for performance-based financing and, on the other hand, that it will decrease the number of SIO members so that only the most dynamic and those with a developed community remain.

Depending on the location, the critical mass required for local engagement, rates of business creation and the potential for businesses to employ skilled personnel differ. Performance-based financing may be one of the options for the future, depending on the specifics of each region.

In the future some of the entrepreneurship support services will need to be handed over to the SPOT network as there is no need for SIO network to handle administrative activities and support self-employment.

When surveying the beneficiaries of the SIO network they see the possibility to get the mentor as a key benefit of the instrument (57.14%) while 14.29% of respondents believe they work better in production or assembly due to the support while same percentage of respondents believe they were able to introduce new processes in their operations. Due to the low response rate of the survey this needs to be further studied.

Table 18 - Summary of Instrument SIO

Instrument	Quality
Aim	Business models, access to markets, intensification of product development cycle, access to finances
Impact	Better knowledge, Intensification of collaboration with other companies
Target group	Start-up and Scale-up entrepreneurs
Size of funding	500 to 5.000 EUR, the value of support may be high
Knowledge sharing	Required by principles of community and knowledge sharing
Lessons learned	Territorial coverage of the SIO network does not necessary correspond to the innovation/business potential. Performance of SIO members varies due to their location and some performance KPIs will be necessary to improve the quality of services. Quality of the business/innovation community around SIO members is important for the success of the beneficiaries and the local/regional SIO network.

8.4.6 Incentives for SMEs to develop and introduce new products in the wood processing sector

Besides incentives in tourism, this instrument is one of the examples among selected instruments with sector-specific focus. The aim of the instrument was to accelerate the wood processing sector and address the very low wood processing structure in Slovene wood industry where most of the timber is exported. The beneficiaries and the ministry implementing the instrument believe the instrument was correctly set up to support the finalisation of the product development process and support the market roll out. The instrument supported 41 projects. Given the eligible size of funding per beneficiary (intensity 20-30%, in the case of Eastern cohesion region 45%) most projects were awarded around 50,000 EUR, while some received 500,000 EUR and 200,000 EUR. As noted by the coordinator of the instrument, the difference in the intensity of funding per cohesion region indirectly achieved its purpose because it fostered more applications from the region with a lack of business potential.

The limiting factor for the wood industry was old technology and lack of space in facilities that would allow entrepreneurs to introduce new technologies, which they addressed with this instrument to support the finalisation of products and market roll-out. But the sector

is characterised by severe internal competition for skilled workforce, which is deficient in the country. To address this, the ministry is preparing new financing for the Centre of Excellence for wood processing skills, to be developed based on experience in similar projects financed back in 2015-2017.

Forestry and timber production policy is coordinated by the Ministry of Agriculture, Forestry and Food, which also operates the Rural Development Plan with measures in forestry and wood processing and calls for coordination and joint planning of the instrument.

Due to small volume of available funding the instrument did not change the relations in the wood processing value chain and this calls for careful planning and addressing the sectoral approaches in the country. Besides, financial planning needs a long-term policy and activities necessary to address relationships in the value chain, and occasional funding gaps may lead to a loss of momentum and knowledge required for preparation and implementation of support instruments.

Table 19 - Summary of Instrument Wood Processing

Instrument	Quality
Aim	Access to markets, Intensification of product development cycle
Impact	Changed products
Target group	Sector specific – wood
Size of funding	50.000-300.000 in most of the cases
Knowledge sharing	Not required
Lessons learned	Sector specific instruments need to be very focused on target very speciffic niche issue sin the value chain or they will need large and long-term financial investments to change the relations in the value chains. The sector approach also requires cross-sector coordination to address all parts of the value chain and requires multi-sector tools like the ones planed in the Smart Specialisation Strategy.

8.4.7 Research projects of the target research programme "Assure food for tomorrow"

The target research programme Assure food for tomorrow falls into the group of instruments designed to support preparation and implementation of the sectoral strategies being coordinated by the line ministries. The instrument supports research in the form of:

- original experimental or theoretical research to gain new knowledge on basics phenomena and perceptual facts.
- applied projects with original research to acquire new knowledge with prime focus on practical purpose, goals, or use.

The instrument has been evolving over the last 20 years when the first target research programme was designed to support competitiveness of the country. The target research programme "Assure food for tomorrow" was started with request of the Ministry of agriculture, food and forestry in coordination with the Ministry of Education, Science and Sport 10 years ago.

The latest call for proposals inviting research institutions (alone or in partnerships) to present the proposals was aiming at 3 thematic sets and topics in two focuses:

Focus: Food security of Slovenia

- Thematic set: Animal health aim at Risks assessment of African swine fever virus in pig farming
- Thematic set: Water protection aiming at Pollution of rivers and the sea with plastic and microplastics.

Focus: Rural development

- Thematic set: Social aspects of rural development aiming at Intergenerational coexistence in rural areas, social exclusion and alleviation of social pressures in rural areas

The Slovene research agency received 6 applications on time and selected 3 applications one per each of the topics listed above. This comes as the call with lowest number of applications as usual number of applications for larger open calls (competitiveness with more focuses and titles) ranges from 50 to 100.

Assuring quality in terms of content is responsibility of line ministries in the process. They are monitoring the content and the quality of the research necessary for their policy making processes which is the overall objective of the target research programme. The Slovene research agency, on the other hand assures the research excellence of the projects financed.

At the end of each project, research partners present two reports; final report presenting the scientific excellence and contents while the other elaborate/study presents the value for research work for the policy maker or the line ministry.

Due to the high coordination and permanent monitoring of the content and the methodology of the research work by the line ministries and the agency no projects were negatively evaluated in the past. The line ministries are well connected to the projects to steer the process and the research work.

Due to the value of the instrument for the policy setting and implementation the number of cooperating ministries in the instrument (not only the food) is growing over the years. The line ministries see the value in studying their policies and their performance with the research excellence and methodologies used in experimental and theoretical research and within the tools for the applied research to acquire new knowledge.

Table 20 - Summary of Instrument Assured Food for Tomorrow

Instrument	Quality
Aim	Knowledge improvement or exchange.

Impact	Possible intensification of collaboration of companies and/or knowledge and research institutions.
Target group	Research institutions with possible business partners to address policy makers at national level
Size of funding	Considerable depending on the call
Knowledge sharing	Required with line ministries
Lessons learned	The value of the instrument for policy setting and implementation is seen in the application of the research excellence and methodologies to improve the quality of data and inputs to improve performance of policies. Policy coordination is done among line ministries and in the format of each project where close collaboration brings improved results of projects. Links to policy implementation (e.g. SRIPS) needs to be done at policy level when defining the focuses and thematic set.

8.4.8 Partnership for Change – the national cooperation platform

Partnership for Change is a national platform for collaboration, a program dedicated to innovative cooperation between the public and private sector with the aim of transferring of best practices, methods and principles and exchange of employees. It is one of the rare public-private blended programmes where both parties participate in the programme set up, planning and implementation. The platform is being managed and implemented by **AmCham Slovenia** and the Ministry of Public Administration. Origins of the platform date back to 2015 when Snežna kepa (snowball) think tank and then the minister of public administration searched for solutions for better integration of public administration and the economy and came up with the employee exchange. First exchange was launched with the participation of 27 employees, 23 companies and the Ministry of Public Administration cracking stereotypes on "lazy public administration". Besides employee exchange that takes place every year, Partnership for Change addressed several topics and solved several challenges that different stakeholders in Slovenia recognized as important. **To date Partnership for change connected over 180 Slovenian and international companies, over 30 ministries and other public bodies and over 500 employees from business and public administration[183].**

The success lies in the open and transparent approach to identification of a challenge to be addressed with open innovation methods, joint selection and design of the approach solution fining tools and co-working principles embedded in the process.

The Partnership for Change program has also received awards abroad. In 2016, the program received a Creative Network Award for Best Practice from the AmChams in Europe network, which connects 43 countries and 45 AmChams from Europe and Asia. In July 2016, Partnership for Change program also run in the OECD call for innovation in the public

[183] AmCham, (2021) Partnerstvo za spremembe - Nacionalna platforma sodelovanja. AmCham, Ljubljana, 2021

sector, where they are looking for globally interesting stories. Among more than 150 applications received, they managed to be shortlisted and presented at one of the largest annual government conferences in Dubai. In 2020 Partnership for Change was also part of the global OECD event "Governments after Shock" [184].

Partnership for Change and similar instruments have a potential to become a widely used exchange and learning tool for various topics which need to be addressed by the public administration and business and citizens. The instrument may be used to develop other platforms to be used in various topics and verticals and for the development of cooperation among quadruple helix partners.

Table 21 - Summary of Instrument Partnership for Change

Instrument	Quality
Aim	Intensification of innovation/development cycle, improvement, and exchange of knowledge
Impact	Changed management, better knowledge and employee management, Intensification of collaboration with others
Target group	Public administration and business
Size of funding	No funding per beneficiary, the value of the knowledge of high value, job rotation.
Knowledge sharing	Among participants, potential for more intensive sharing of co-working principles and tools
Lessons learned	There is a lot of space for the open innovation and co-working methods in blended public-private environments where new approaches to challenges may be developed for the benefit of all in the process.

8.4.9 American Slovenian Education Foundation ASEF

The American Slovenian Education Foundation supports a diverse community of highly talented, prospective students to build a community of educators and leaders of excellence. The Foundation aims at enhancing Slovenian education activities and uniting Slovenian scholars and educators across the globe to improve the mobility of Slovenian students. The Foundation offers a variety of high-impact grants and endowment programs, teaching and learning materials, as well as foreign exchange of students and faculty. The goal of the foundation is to provide business opportunities to students and business for invests [185].

[184] Ibid.

[185] See ASEF Website, accessed via: https://www.asef.net/

The instrument is privately funded while it is targeting scholars and students to rotate their location of study and research to improve knowledge and networks, they are able to work with.

ASEF initiative started in 2014 with 3 students and 2 professors working at 2 universities in the United States. By 2021, ASEF has supported 127 talented students from Slovenia, the United States, and Argentina. ASEF expanded the circle to 51 professors working at 44 universities (27 in the US, 6 in Canada, 4 in the UK, 3 in Australia, 2 in Austria, 1 in New Zealand, and 1 in Denmark) in 19 different research fields. Among universities, we can find the most prestigious institutions like Harvard University, Stanford University, UC Berkeley, University of Cambridge, and others.

The instrument is showing possible use of Slovene emigrants' network to go beyond cultural and historic ties exchange. The instrument is developing research and knowledge networks with the use of established people located in various knowledge institutions which in the end enable scholars to develop business ties necessary for development of products or further sharing of knowledge. The instrument is an example of possible different approaches in funding of Slovene expat network by adding value in knowledge and networks.

Table 22 - Summary of Instrument ASEF

Instrument	Quality
Aim	Improvement of the knowledge and exchange of knowledge with improved mobility
Impact	Better knowledge management, Intensification of collaboration with other knowledge and research institutions
Target group	Scholars, students
Size of funding	Scholarships, job rotation.
Knowledge sharing	Extensive promotion, exchange projects.
Lessons learned	Slovene emigrants are valuable for the research and business networks that go beyond cultural and historic ties exchange. Slovene emigrants occupy positions in various locations which may benefit for the improved research, knowledge and business networks but this needs to be addressed with more attention and cross sector approach.

8.5 Common learning on studied instruments

The focus and the aim of each instrument needs to be carefully planned and evaluated to understand necessary improvements of the instrument. To achieve improved performance of financed projects and improved performance of beneficiaries after the co-financing, constant monitoring of performance of beneficiaries is needed. To further improve the implementation of the instruments, close cooperation with stakeholders is needed to understand the merits behind observed behaviour of beneficiaries. Stakeholder discussions need to also address the risk management angle of the instrument where each stakeholder needs to take risks depending on the policy decision.

When financially planning the instruments, the long-term availability of the instruments is needed. This should be reflected in the development of the culture of application "when needed" rather than accumulating funding when possible (e.g. vouchers). In addition, the availability of innovation instruments plays an important role in the development even in financial crisis or budget shortages.

Sector specific instruments (e.g. wood, S4) need to be very focused on targeting very specific niche issue in the value chain or they need large and long-term financial investments to change the relations in the value chains. The sectoral approach also requires cross-sector coordination to address all parts of the value chain and requires multi-sector tools like the ones planned in the Smart Specialisation Strategy.

Some of the instruments used external assessors for the selection of applications to achieve improved sector-specific decision making (e.g. RDI in value chains and networks - Lot 2: Incentives for research and development projects and pre-selection in case of SK75). According to instrument coordinators this proved to improve the quality of decisions.

More effort is required to address sharing of knowledge on project preparation and knowledge gained in the co-financed projects. Instrument-implementing bodies need to build more active and knowledge-sharing business/innovation community around instruments in order to improve the success of the beneficiaries.

Beneficiaries of the instruments suggest contracting with larger flexibility in terms of project implementation, but strict commitment to results or indicators. A complex and detailed financial and content control system for payment claims is still causing delays. Simplified, possibly flat-rate (lump sum) instruments would be better suited to business projects that require fast and market-aligned actions. As discussed by the beneficiaries, further simplification could also be achieved by developing the standard costs for similar projects to improve the efficiency of the instrument.

Close monitoring and evaluation of the research/business excellence of the co-financed projects is provided in smaller number of instruments studies (e.g. target research programme). This improves the quality of results and quality of inputs for the improvement of policies. Links to policy implementation needs to be done at policy level when defining the focuses and thematic sets.

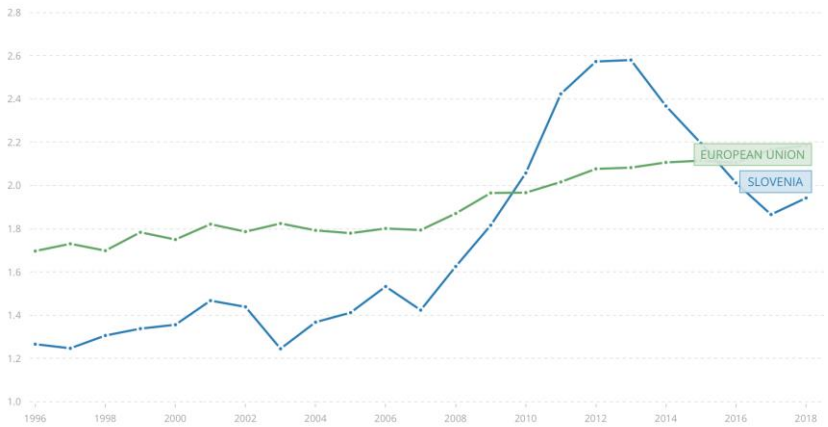
Currently instrument-implementing bodies prepare the proposals for the implementation of the instruments and discuss them with stakeholders. There is potential for stronger use of open innovation and co-working methods as well as blending public-private environments to address different implementing arrangements and promote the instruments among different stakeholders. This may in the long run also bring more private funding for the implementation of the instruments and it may evolve in blended public-private instruments.

9 Performance

The chapter presents qualitative and quantitative review of the performance of the innovation instruments and tools used in the innovation system in Slovenia. The chapter covers analysis of the innovation support instruments, results of the on-line survey on instruments and evaluates efficiency of the innovation tools such as networks and equipment.

When looking at research and development expenditure as a % of GDP Slovenia was performing better than EU average since 2010 until 2015 when the Slovenian research and development expenditure fell under EU average.

Figure 24 - Research and development expenditure as a % of GDP

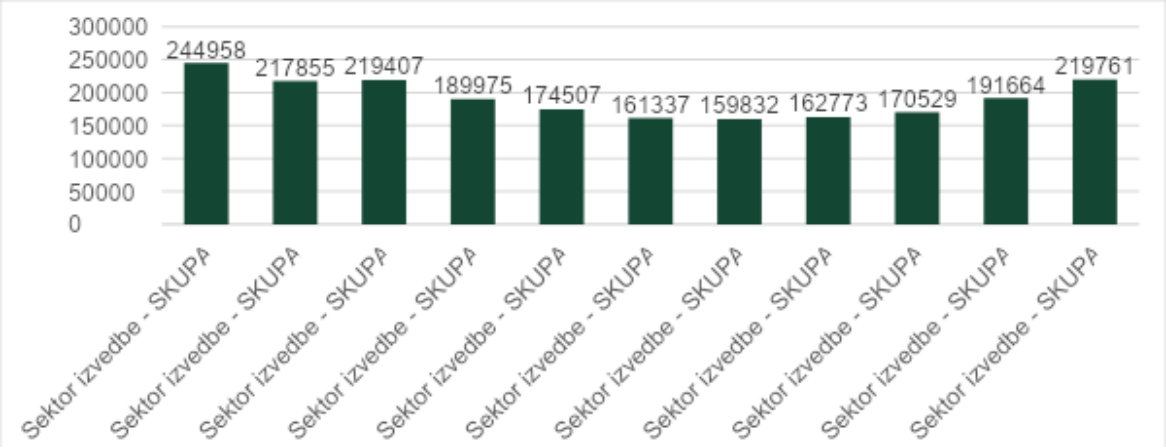


Source: World Bank[186]

In absolute figures national budget spending for R&D in 1000 EUR dropped significantly from 2013 to 2015 when it started picking up again.

[186] Accessed via: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=SI-EU

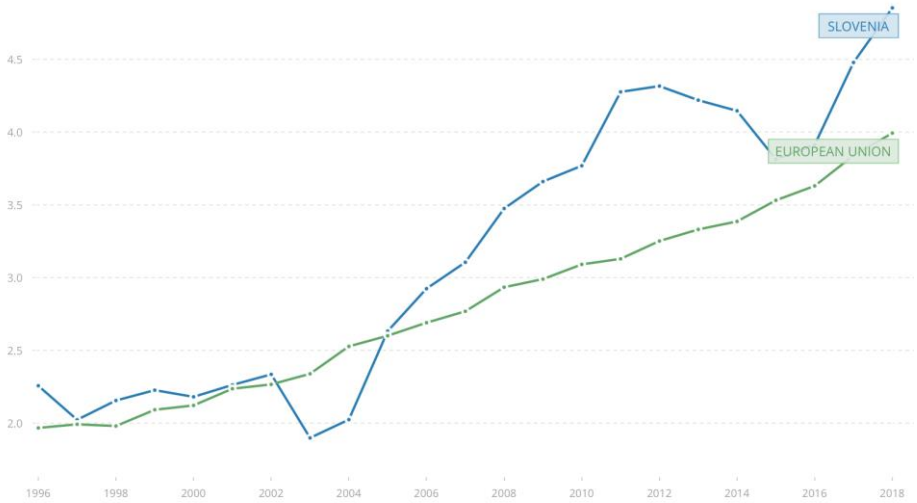
Figure 25 - National budget spending for R&D in 1000 EUR



Source: SURS[187]

Slovenia has above EU average number of researchers in research and development per million people for years while the number declined in years when the funding for researchers in research and development was lower.

Figure 26 - Researchers in research and development per million people



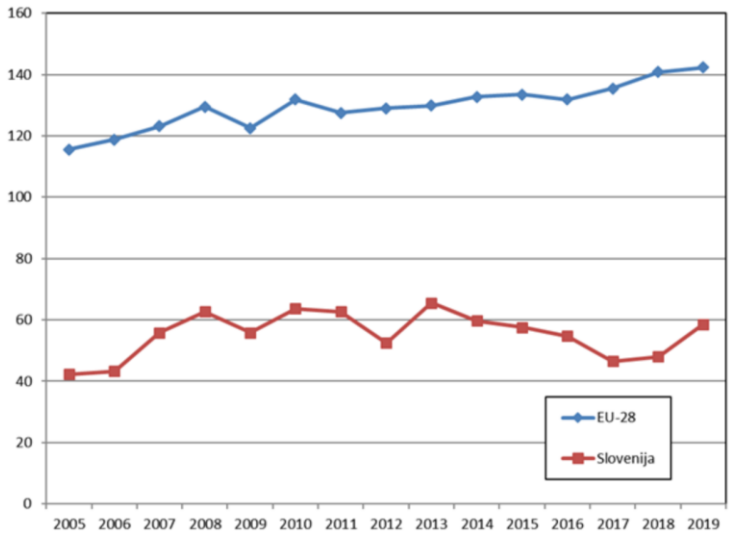
Source: World Bank[188]

Slovenia has a below average number of patent applications with the European Patent Office per million inhabitants in comparison to EU-28. While the growth of the patent application is observed two years after then the national budget spending for R&D has started to improve in 2015.

[187] Accessed via: https://pxweb.stat.si/SiStatData/pxweb/sl/Data/-/2364302S.px/table/tableViewLayout2/

[188] Accessed via: https://data.worldbank.org/indicator/SP.POP.SCIE.RD.P6?locations=SI-EU

Figure 27 - Number of patent applications with the European Patent Office per million inhabitants



Source: ARRS, 2021[189]

[189] Accessed via: https://www.arrs.si/sl/analize/odlicnost/patenti.asp

A patent is the right granted to a patent holder by a state, or by a regional office acting for several states, which allows the patent holder to exclude others from commercially exploiting their invention for a limited period without authorisation. By granting such rights, patents provide incentives for innovators, offering them recognition for their creativity and enabling them to appropriate the returns of their investment. A patent may be a powerful business tool allowing innovators to gain exclusivity over a new product or process, develop a strong market position and earn additional revenue through licensing[190].

Slovenia performs close to the EU average in international scientific co-publications with the index of 147.7 relative to the EU in 2019, while in most cited publications the value of the index is 73.3. As discussed in other parts of the study, according to WIPO Slovenia performed better in innovation inputs than innovation outputs in 2020[191].

When it comes to top performers according to the PCT list, big, mature business is seen as a top performer in the innovation scene and two PROs are also on the list.

Table 23 - Patent Cooperation Treaty Top Applicants

Applicant	2018	2019	2020
Krka, d.d.	1	3	5
University of Ljubljana	2	4	5
Kemijski institut	3	1	4
Titus d.o.o.	3	5	4
Bia separations d.o.o.			2
Gorenje gospodinjski aparati, d.d.	3	1	2
Hidria d.o.o.			2
Intech-les, razvojni center, d.o.o.			2
Lek pharmaceuticals d.d.			2
Plastoform blanca d.o.o.			2

Source: WIPO (2021)

The top-3 best performing countries include two Strong Innovators: Ireland, and Germany, followed by a Moderate Innovator: Slovakia. Strong Innovators are also dispersed, as France and Austria perform relatively close to the EU average while Estonia and Portugal are ranked well below the EU average. Slovenia performs below the EU average and belongs to the same group as Greece and Estonia[192].

[190] IRENA (2021) How patents encourage innovation in technological development and deployment. Source: https://www.irena.org/inspire/Intellectual-Property-Rights/Innovation

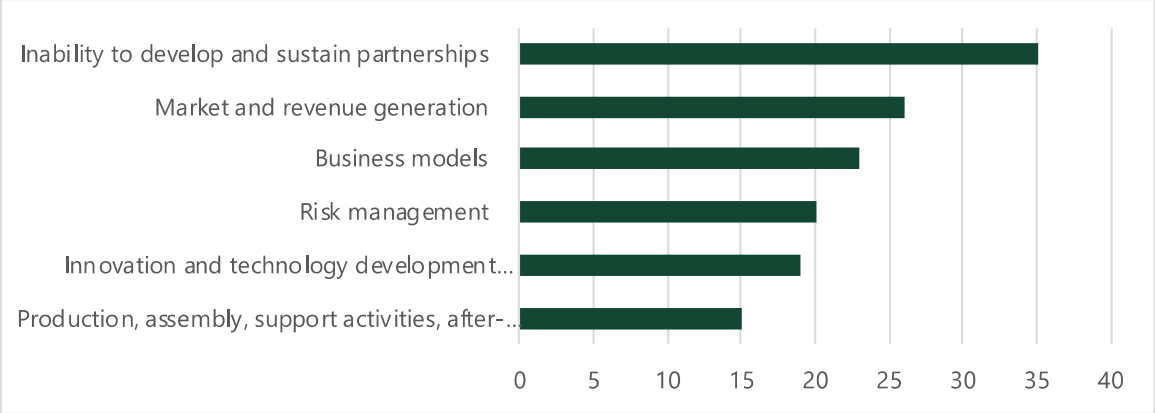
[191] WIPO (2020) Global innovation index – Slovenia. Source: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2018-profile43.pdf

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

9.1 Innovation support instruments

When discussing product development and life cycle, survey respondents in this study see the weakest point of the Slovenian research and development process in its inability to develop and sustain partnerships for innovation and development (65%), while the second weakest point seen by respondents are the market and revenue generation strategies (48%), followed by weak business models (43%) and weak risk management (37%). The innovation and technology development processes are at the bottom of this list (35%) with implementation or ability to organize production, assembly, support activities, after-sales activities (28%) (n=138, each respondent could select multiple answers).

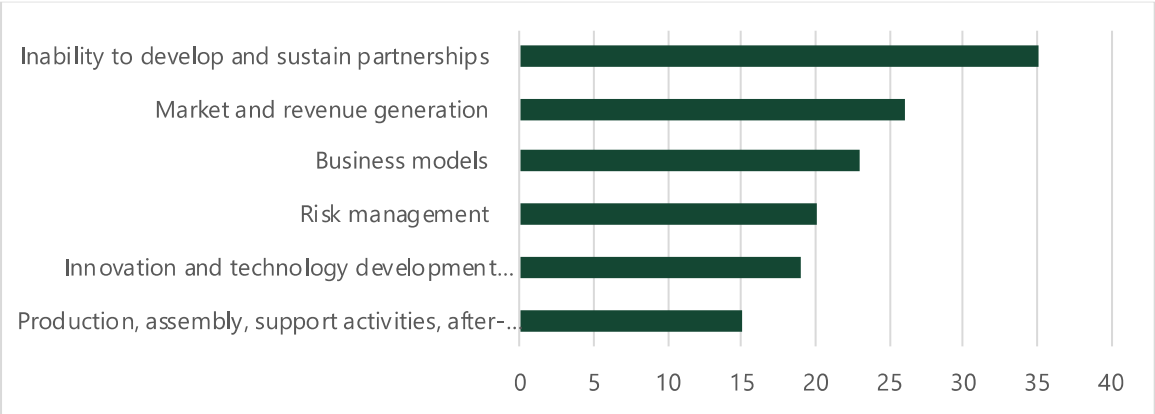
Figure 28 - Weakest points of the Slovenian research and development in the product development and life cycle



Source: own research

When discussing **motivation for applying for public co-funding**, survey respondents stated that financing and possibility of further product/service development was the strongest motivator (34%); long-term cooperation and the possibility of expanding cooperation with existing partners was a motivator for 32% of respondents; starting new cooperation with partners and the possibility of developing new products/services (15%) (n=41).

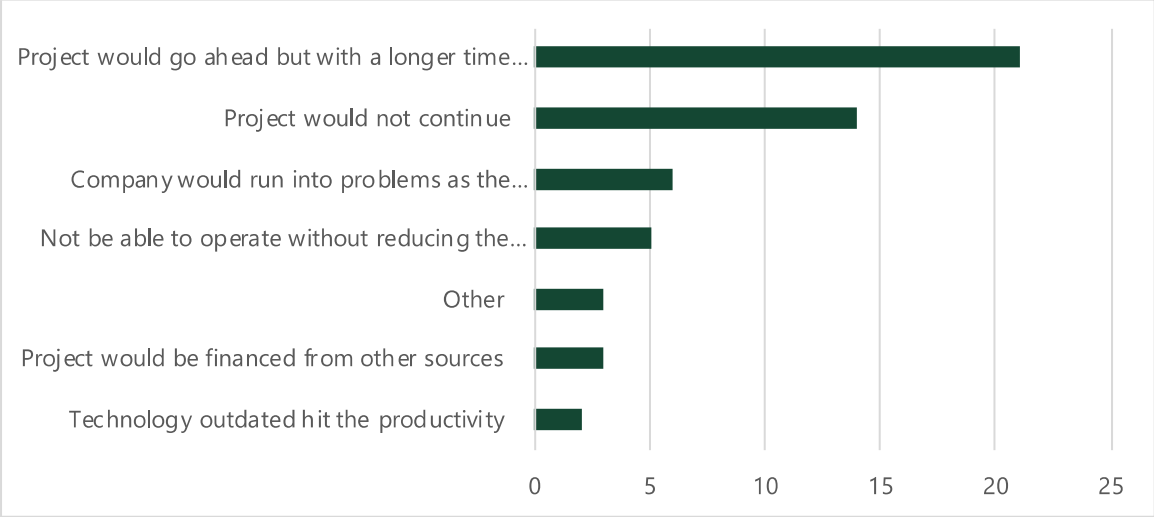
Figure 29 - Motivation for applying



Source: Own research

If the project was not co-funded, over 51% of respondents stated that the project would go ahead but with a longer time frame, 34% stated that the project would not continue, while 15% of them stated that the company would run into problems as the project was one of their key sources of revenue. Some respondents (12%) stated that in the short term they would not be able to operate without reducing the number of employees, while in 5% of the cases the technology would be outdated and the company's productivity would be lower than planned (n=54).

Figure 30 - Results of projects not getting co-funded



Source: Own research

In most of the cases the financing strengthened the applicants' cooperation with other companies (44%), some of them strengthened their innovation processes (42%), others strengthened the exchange of knowledge and ideas with external partners (34%) or developed new knowledge (34%). Strengthening of cooperation with knowledge institutions was the case for 32% of respondents and developing/improving brand awareness for 29% of respondents. 27% of respondents believe that they have strengthened their cooperation with research organizations; 22% of them have strengthened their internal exchange of knowledge and further developed the skills; while 20% of respondents changed their approach to markets and/or their target markets. Others have changed their business model, products or services they offer, improved their revenues, improved the efficiency of their business activities, while a small number of respondents also changed their approach to finance and securing financial resources for development and innovation (n=137, each respondent could provide multiple answers).

37% of respondents did not change the financial basis for their operations with the co-funded project, while 29% of respondents were able to develop ideas and products that attracted additional public funding after the project was co-financed. For 17% of them the success of the project created the basis for private investments, and the same proportion of respondents claims that their internal processes were improved to generate more revenues or profit (n=46).

Based on survey results we may conclude that the ability to develop and sustain partnerships for innovation and development, addressing local and international market and revenue generation strategies and improving business models are the top priorities for the stakeholders in the innovation ecosystem. This is addressed with applications for public funding through which they are trying to obtain financing for further development of their products/services and long-term cooperation with partners. When looking at the results, the above aims are not achieved with the co-financing, except for building different formats of partnerships. Designing new market and revenue generation strategies ranks lower on the list of actual results and developing new business models ranks even lower.

This is re-confirmed with the statement that most of the respondents did not change the financial basis for their operations, indicating that they have not finalised the development of their ideas and products and continue to depend on additional public funding. The projects attracted private investments only in a small number of cases.

The interviewees for this study point out that Slovenian innovation ecosystem did not develop instruments specifically focusing to needs or specific potential of:

- target specific groups (researchers, students, youth and other),
- focus on specific stage of the product/service/process life cycle (research, linking research to market, seed and development, start-up, growth and establishment, expansion, maturity, decline stage), and
- be distinguished by the type of intervention (business problem, regional specifics, transformation needs).

The matrix would make the beneficiaries' performance more efficient after the implementation of instruments, as they would be focused on specific needs and growth potential of the beneficiaries. Interviewees are also noting the absence of a system that would rank beneficiaries according to their ability to grow and perform and be used to identify the instruments that would be the best fit for their individual profile and produce the greatest impacts.

This would improve the evolution of the instruments in terms of support formats, such as grants, loans, venture funding and non-financial support, and volume of support. The mix of support instruments for each beneficiary would lead the beneficiary towards the exit from the support ecosystem, based on performance. The instruments are currently not strong enough to force beneficiaries to change their knowledge and skills management and develop successful consumer-centric business models.

9.1.1 Results of the online survey on support instruments

The survey for in-depth review of instruments showed that most beneficiaries are applying for instrument more than one time (53%) while others only apply rarely with 3% of them being always successful, 17,86% being rarely successful and 25% of those that don't apply many times but are successful when applying (n=56).

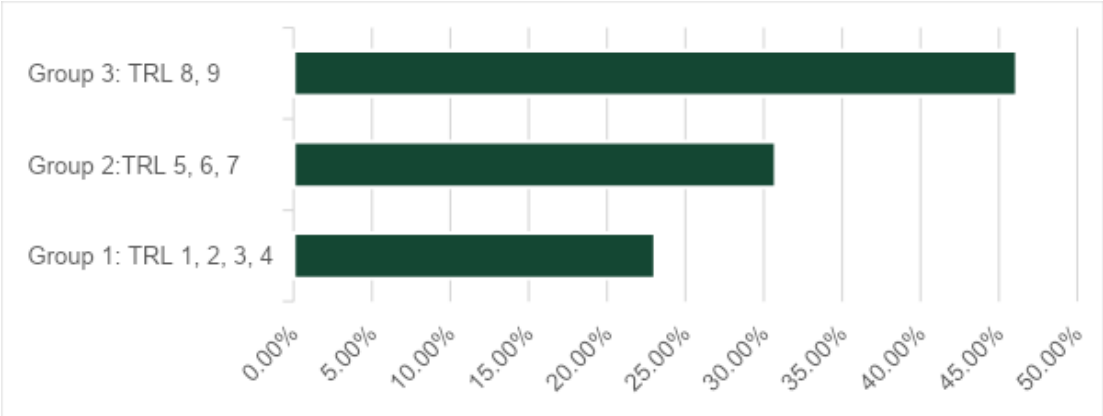
Figure 31 - Success in applications

Source: own research

Respondents believe they would need additional funding to bring their product to the market (48%), 22% of them would need more time and resources to bring the product to the market. While 26% of them brought the product to the market in the duration of the project while 11% of them brought the product to the market long after the project was over (n=34)

Most applicants prepare the applications and manage the project themselves (67%) while in 16% of the cases the application was prepared by external experts but manage the project internally (n=43). In most of the cases the applicants applied for funding when their product was developed above the TRL 4 level (77%) while 23% of the applicants had their product in the initial level of development below TRL 4 (n=39).

Figure 32 - Level of readiness of products when applying

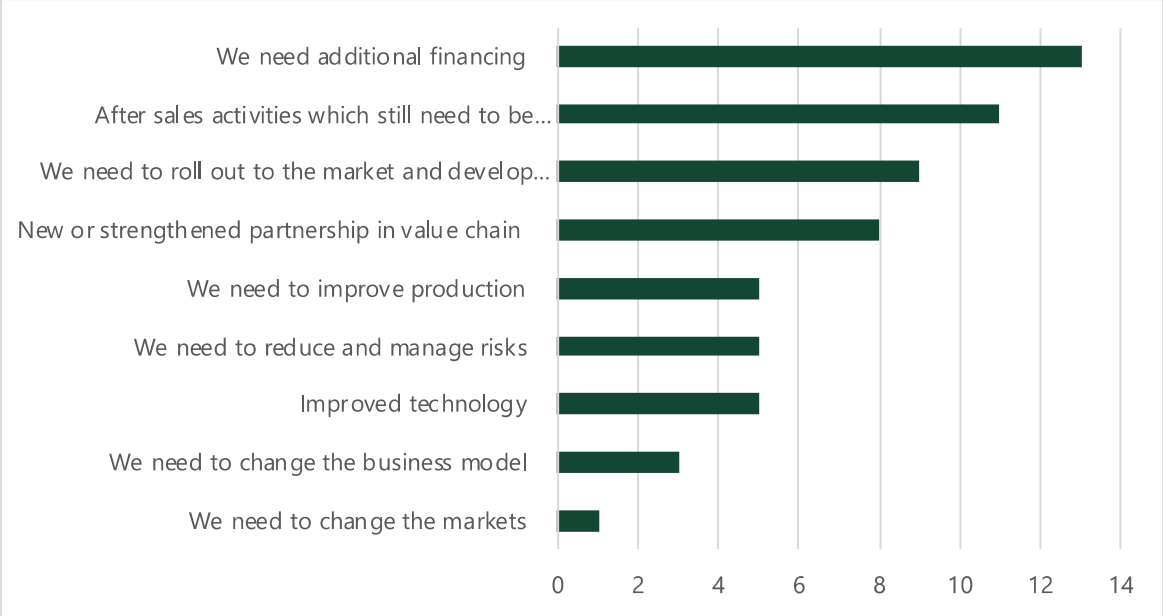


Source: Own research

In most of the cases applicants confirm the costs eligible under the public call were in line with their needs and their plans for the development of the product while 42% believe the eligible costs did not cover the needs (n=31).

When addressing the next steps to successfully bring a product/service/process to market several respondents believe they need additional funding (54%), a large proportion of respondents also need after-sales services to be developed (46%) before entering the market. 37% of them are sure they need to further develop the product/service/process and bring it to the market as soon as possible. To achieve the market roll-out 33,33% of respondents believe new or strengthened partnerships in the value chain are needed. In 20,83% they need improved technology or they need to reduce risks and improve risk management, in same proportion the respondents believe they need to improve the production or operations of the product/service/process. In other cases they also believe they need to change their business model or change markets.

Figure 33 - What is still needed for successful market roll out after public co-financing



Source: own research

When considering the quality of the non-financial instruments and support services the beneficiaries are sure that support helped them to change their business (37,50%), the value of the non-financial instruments and support services is underestimated for 31,25% of respondents. While 25% of them are sure they started to grow because of the help received.

70% of respondents share opinion the sectorial support and specific sectoral measures would be beneficial for their growth while others do not need sector or special support services. But this needs to be further studied as the response rate at this question was very low.

In most cases respondents received an information on public tenders and calls from official information (official sites of the implementing bodies) (55%), from daily news or media (55%). In 43% of the cases, they got the information from innovation ecosystem platforms like technology parks, incubators, SRIPs, TTO and from their partners. Partners were source

of information in 35% of cases, consultants in 30% of cases while social networks (Linkedin, Facebook) were source in 25% of the cases. (n=58, more answers were available for this response).

A very large portion of the respondents are happy with the quality of the information received (85%, n=20) while they see improvements possible with more information events with targeted groups and with direct notification or data base of support instruments to be available.

When discussing potential support services or funding in the field of innovation that would need to be available all the time but not in the form of public calls or tenders, respondents list different types of vouchers to be available to small businesses but without the involvement of intermediaries (such as DIH). They also list international marketing, mentoring, working capital financing and wider network of intermediaries for mega companies in Slovenia. Respondents also mention digital transformation support and market roll out instruments as important instruments that should be constantly available.

9.1.2 Performance of the selected instruments

As discussed in the methodology chapter, in order to study the performance of the instruments we used the propensity score matching method with a subsequent arithmetic calculation of differences before and after in the funding ("treatment") and control groups plus a corresponding panel difference-in-difference model to see whether those findings are statistically significant. A control group analysis is used to estimate impacts in situations where impacts are not directly observable. This is a characteristic problem when an item has been supported from one point of time onwards (by anything like funding, consultancy etc.). In our case, the "treated" group are the innovation ecosystem actors that have received funding – beneficiaries or funded group, while the control group (i.e. "untreated" group) are the innovation ecosystem actors that have not received funding. For the sake of easier understanding, the treated group is hereon called the beneficiaries, and treatment is indicated as financial support.

In this situation, where only data on funding beneficiaries are available, it is only possible to measure a status with financial support (treatment); it is not possible to compare it directly with the untreated status, i.e. status of actors that did not receive support. This would necessitate a parallel existence of one item. The problem is solved by an approximation approach where an artificial benchmark of comparison is established to measure impact. This artificial benchmark is the control group, in our case the fast-growing companies. The use of a control group makes this approach quasi-experimental. The major requirement of a control group is a strong similarity (ideally an infinitesimally small difference) of the character of items with the only distinct exception that the control group items has not received financial support[193].

To achieve sufficient observations in a matching interval and in order to have performance data for two points of time we used data on performance of the studies of beneficiaries and control group for 2014 and 2019. The matching procedure was done by comparing groups of beneficiary companies and non-beneficiary companies with their NACE (SKD)

[193] Bergs R. (2012) Simple Control Group Analysis by Matching: A Brief Introduction. Planung & Forschung (PRAC), Bad Soden, Germany

codes, age, and size classified by the number of employees. It can be assumed that sectoral affiliation, age of a company and the size (micro-enterprise, SME) may characterise a company in a way to estimate the probability of being funded or not. The data was received from the business records agency AJPES. The 678 beneficiary companies were selected from the list of State Aid beneficiary companies supported by instruments as data on State Aid was available for those for 2017 – 2019 period:

- VAV-2, Intellectual property protection voucher
- P4D 2019-2023 Incentives for the digital transformation of companies
- RDI in value chains and networks - Lot 2: Incentives for research and development projects (TRL 6-9)
- SK75 2017 Convertible loan for innovative company start-ups in the amount of EUR 75,000

Out of those 678 firms 96, also appear in the dataset of the fast-growth firms. This is the sample that lends itself for a matching procedure.

In a first step we created a combined database with 96 beneficiaries and 5,866 potential controls. To rule-out a selection bias we first ran several heckit regressions with different combinations of ln(SKD), ln(age) and ln(size) to see whether there are significant inverse Mills ratios. This was not the case. We then performed a propensity score matching procedure to identify siblings for the 96 funded companies. All estimates of the probit regression are significant. With a Pseudo R^2 of 0.10 the determination is weak but not insufficient.

Figure 34 - Probit regression

```
. psmatch2 Treated SKD Age SME

Probit regression                          Number of obs   =       5962
                                      LR chi2(3)      =      95.74
                                      Prob > chi2     =     0.0000
Log likelihood = -443.71924                   Pseudo R2       =     0.0974

------------------------------------------------------------------------------
    Treated |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        SKD |   .0314681   .0110647     2.84   0.004     .0097816    .0531546
        Age |  -.0572983   .0072675    -7.88   0.000    -.0715423   -.0430544
        SME |   .6406251   .1241673     5.16   0.000     .3972616    .8839885
      _cons |  -2.441856   .1819558   -13.42   0.000    -2.798482   -2.085229
------------------------------------------------------------------------------
```

Source: own research

After sorting the observations matched it was possible to calculate the periodical differences in turnover (2014 and 2019) for the beneficiaries and control group. The weight of the controls varies between one and five, hence there are controls that are matched with up to five funded firms.

The arithmetic result

$$Average\ treatment\ effect\ on\ P = (P_t^1 - P_t^0) - (P_c^1 - P_c^0)$$

indicates in a loss of 2.699 million Euro on average. P means performance (=turnover), t funding (treatment) and c control. This does not mean that firms funded incurred a net loss

after funding, but in comparison with the controls their delta of performance is substantially lower.

In other words, without funding the increase of average turnover of the observed companies and in the observed period would have been higher. This result was then verified statistically with a diff-in-diff panel regression.

Figure 35 - Difference-in-differences estimation results

```
. diff Performance, t(Dummy)  p(t)

DIFFERENCE-IN-DIFFERENCES  ESTIMATION  RESULTS
Number of observations in the DIFF-IN-DIFF:   384
          Before        After
  Control: 96            96          192
  Treated: 96            96          192
          192           192
-------------------------------------------------------
 Outcome var.  | Perfo~e | S. Err. |   |t|   |  P>|t|
----------------+---------+---------+---------+---------
Before          |         |         |         |
  Control       | 3.8e+06|         |         |
  Treated       | 4.5e+06|         |         |
  Diff (T-C)    | 7.6e+05|  3.1e+06| 0.25    | 0.805
After           |         |         |         |
  Control       | 8.6e+06|         |         |
  Treated       | 6.7e+06|         |         |
  Diff (T-C)    | -1.9e+06|  3.1e+06| 0.63    | 0.528
                |         |         |         |
Diff-in-Diff    | -2.7e+06|  4.3e+06| 0.62    | 0.535
-------------------------------------------------------
R-square:    0.01
* Means and Standard Errors are estimated by linear regression
**Inference:  *** p<0.01; ** p<0.05; * p<0.1
```

Source: own research

The coefficient of the interaction term confirms the arithmetic result above (-2.7 million Euro), however with a t-statistic of .62 the estimate is insignificant.

Consequently, the results of the evaluation show that there is no significant impact of funding of Beneficiaries on turnover.[194] The most probable explanation for the result could be that firms had not been selected for funding based on criteria which was used for the database for the calculations (e.g. risk investment, patents, SKD sub-sectors of specific importance etc.) but rather based on criteria not observable in the database. Otherwise, given that the matching variables represent siblings of beneficiary companies and non-beneficiary (control group) companies well, it may simply be true that there is no significant impact of funding. This needs to be further inspected and reflected by the Beneficiary of this study.

In conclusion: the study can neither confirm nor reject sluggish innovation progress of the private sector firms which are supported with the instruments in Slovenia. We also must keep in mind that innovation processes may take many years and are not evenly distributed

[194] We also ran the same procedure (PSM matching plus diff-in-diff regression) for the whole database (i.e. all 678 beneficiaries/treated). Here the arithmetic result was a loss of 1.7 million Euro on average, but statistically likewise insignificant.

among firms; some may invent some market booster (like a vaccine), others may simply fail with the investment.

Based on the above and with the data available we may conclude that, on average, companies could not improve their performance in terms of enhanced turnover after they got the funding. This may lead to further exploration of the results and further studying of the data which was in this study restricted due to limitations in the database.

Another conclusion from comparison of beneficiary (treated) and non-beneficiary (control group) companies is that fast-growing companies are not applying for the instruments or they were not selected for funding. Only 97 companies out of all 5906 from the list of fast-growing companies received funding from the selected instruments between 2016 and 2019. The reason for this may be that they were not selected, or they did not apply[195]. This adds to the information on low performance of beneficiary companies before and after they received support, however, these conclusions need to be tested further with larger data and specific data for specific instruments.

This calls for improvement of the evaluation processes in the funding system with more focus on impact and interpretation of the difference between the beneficiary and non-beneficiary companies before and after they are supported.

This also calls for setting up of the monitoring data which will allow use of different evaluation methods and set up the control groups for each instrument. This will highly improve the relevance of the results for the planning process.

As an example: beneficiaries are claiming the full disbursement of the 54.000 EUR under the P2 Incentives to start innovative companies; claiming it in the beginning of the contract would improve the performance of the co-financed companies compared to the current arrangement when this amount is disbursed over the period of 3 years. These are assumptions which are based on expectations and opinion. If the Beneficiary of this study would like to have better arguments for the decision it would be beneficial to set up a test where the instrument would be implemented with different implementing arrangements and evaluation of results would bring the more realistic picture on performance.

9.2 SRIPs as a coordination tool

SRIPs should be perceived as a long-term partnership between business community, research organisations, state and municipalities, and facilitators, users of innovation while their planned role was also to connect the policy making.

The partnership between knowledge institutions and economic entities can successfully identify opportunities for Slovenian actors and prepare them for participation in global value chains, which was the aim of the SRIPs during development of the Smart Specialization Strategy[196]. Therefore, more intensive presence of SRIP representatives in the various government bodies involved in the formulation of strategic documents is

[195] Due to the lack of data the study team was not able to assess this dimension on enough detail.

[196] Bučar M., Črnigoj M., Jaklič A., Lovec M., Stare M., Udovič B., Likar B., Lipnik A., Štrukelj P. (2019) Vmesno spremljanje in vrednotenje delovanja SRIP- ov v obdobju 2017-2019. Ciljni raziskovalni projekt»Strateška Razvojno Inovacijska Partnerstva kot orodje krepitve inovacijske sposobnosti Slovenskega gospodarstva«.

necessary[197] and should be promoted. But also needs to be addressed with the open collaboration of stakeholders in these processes.

SRIPs play an essential role in the formulation of industrial and research policy because they represent qualified hubs for knowledge exchange among science, technological development[198] and economic capacities of the industry. The SRIPs should also strengthen presence of the products/services developed by the partners on a market, selling products, services and capabilities, research and knowledge. With this the SRIPs would be acting as be integrator of policies, state of the art knowledge and product development, closing a loop from researchers to produces, sellers to final consumer.

According to interpretations, the SRIPs were established as a policy governance tool to actively participate in the development of instruments (public calls and tenders) and to provide scientific and expert advice for policy design[199].

A number of representatives of SRIPs who were interviewed for this study expected to be recognised as important stakeholders in policy design and preparation of implementing measures, but in practice they were not involved in the planned format and capacity and were not able to respond to the needs of the policy makers. Besides, their role in the preparation of instruments (public calls and tenders) was neglected and in some cases even seen as an interference of business in the public funding. Due to the size of Slovenia and the need to assure transparency any such mechanism should be designed very carefully to prevent no-competitive behaviour in already small business space.

Currently, SRIPs are involved in the preparation of the new Smart Specialisation Strategy where they strongly cooperate with the Government Office for Development and European Cohesion Policy, while coordination with other ministries is limited to periodical meetings and exchanges.

But as discussed in the network analysis, **online survey respondents in this study did not recognise SRIPs as strong drivers of innovation.** SRIPs are known to a limited number of actors, most likely their members and those who closely cooperate with their members. Interestingly, more actors perceive the Chamber of Commerce and Industry of Slovenia as the most important intermediary institution and broker then is the case for SRIPs. SRIPs were pointed out mainly by actors that are linked to their activities; this indicates that SRIPs are not well known beyond their own partnerships, although the interviews indicated that SRIPs are gaining new members.

9.3 Research and development infrastructure and equipment

The Public Agency for Research of the Republic of Slovenia keeps records of research equipment purchased with national co-financing. The records hold information on research equipment as well as data on access rights for research equipment, its use, utilisation and cost of use. Research organisations report the use of research equipment on a monthly basis[200].

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[197] Ibid.

[198] Ibid.

[199] Ibid.

[200] ARRS, (2021) Raziskovalna infrastruktura. Raziskovalna oprema. Source: http://www.arrs.si/sl/infra/oprema/evidenca/

The current records represent a base for a more open access to publicly funded research infrastructure and equipment, while, as discussed with the Public Agency for Research, there is a need for further promotion and development of mechanisms that would facilitate more frequent and open access.

The same observations were noted in the interviews in this study, where the interviewees see possibilities for open access to publicly funded equipment, but through closer relations with businesses and other researchers which should be developed in the form of structured cooperation and joint research. Businesses are currently not able to find the required equipment by a simple registry search. To be able to find appropriate equipment they would need relevant knowledge and support from the research staff and building connections between industry and science which should develop in the open system. An example of a private-led initiative for joint purchase and use of research equipment is the 3D printing lab jointly set up by several companies and the Faculty of Mechanical Engineering based on joint planning and plans for use of the purchased equipment.

Concerning the question related to open access and accessibility of research and innovation equipment in the online survey, over 64% of respondents stated that the equipment is not openly accessible, while 26% stated that the equipment is available to different social and economic groups (n=62).

As examples of institutions nurturing open access to research and innovation equipment, the respondents mention the National Institute of Chemistry, universities (especially technical faculties), the National Institute of Biology, Institute Jožef Stefan Institute, Ljubljana University Incubator, Kikštarter Kamnik and coworking centers (such as Kovačnica).

When discussing the territorial balance of the research and innovation infrastructure (technology parks, incubators, laboratories, research organizations) in Slovenia, a minority of respondents (18%) believe that the equipment is territorially balanced, while the majority (68%) states that the research and innovation infrastructure in not territorially balanced (N=56). Concerning the perceived need for the research and innovation infrastructure to be evenly distributed across Slovenia, the answers are balanced and 58% or respondents perceive this need, while 42% do not see the need to territorially balance the research and innovation infrastructure (N=55).

When discussing these issues in the interviews, the answers need to be interpreted in the context of regional/local needs and the ability of a certain location or community to utilise that research and innovation equipment and infrastructure and its potential to add value with its use. Equipment location must not act as a driver of fragmentation of the available human and financial resources.

9.4 Monitoring and evaluation

In-depth reviews and impact evaluations of the instruments are currently conducted as part of the evaluation process in ESIF-financed programmes. Setting up internal evaluation procedures for support instruments would certainly improve their performance. Currently the implementing bodies for support instruments do not have established procedures to

collect in-depth data on beneficiary performance and do not have established control groups necessary for in-depth evaluation methods.

The implementing bodies would benefit if the relevant beneficiary data could be collected before the start of implementation of the support instrument and after the end of the supported project. The structure of the existing database could be further improved with data already available in reports and official databases available in the country (AJPES, tax authority). Data interoperability and quality assurance must be ensured.

In addition to regular monitoring, the implementing bodies do not conduct **detailed reviews of implementation of a specific instrument, which may be chosen each year depending on the implementation** (availability of funds) **or changes in the needs of the target groups** (pandemic, economic changes, interest rate changes and similar).

This review should check the compatibility between target groups and the objectives of the RDP 2014-2020. A variety of methods can be used for this purpose, including focus groups and surveys, to provide the Managing Authority with proper feedback that could be used to modify the program and increase its efficiency and effectiveness.

It is necessary to develop the methodology for reviews and select robust indicators (result and outcome) for each instrument that will be independent from any changes in data capture. We suggest that the methodology combine the data on actual use (implementation) and consistent long-term and periodic inventories (e.g. every 2 years) with the census plots used for monitoring indicators. The number of plots should be determined as part of the overall structure of each innovation support instrument. **Each innovation support instrument needs an established control group** covering different areas/regions, sectors and levels of development of products/services or processes, in order to facilitate evaluation of the effects of that instrument by comparing the key parameters (e.g. revenues, number of employees) of the control group with the beneficiary group. When designing the monitoring process, implementing bodies need to cooperate with those responsible for data collection and monitoring. Cooperation with stakeholders in the innovation ecosystem is highly important for establishing the sharing of information and development of the evaluation culture in the innovation ecosystem.

10 Barriers and Drivers

The chapter outlines drivers and barriers, displaying an acute understanding of needs to successfully address challenges in practical terms. The chapter summarises key conclusions framing the future to development of recommendations for the development of the innovation ecosystem in Slovenia.

As stated in the Country Report Slovenia 2020[201], 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. In October 2020 official notification from UNESCO, confirming establishment of the first International Research Center for Artificial Intelligence under the auspices of UNESCO were completed and agreement on the establishment of IRCAI between the Government of the Republic of Slovenia and UNESCO officially entered into force[202]. 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[203]. As observed by the OECD. AI Policy observatory[204] research centre mentioned above is one of the 4 key initiatives in Slovenia. The AI strategy is in progress as the draft of the National Program for the Promotion of the Development and Use of AI in Slovenia until 2025 has been published. Slovenian Artificial Intelligence Society an association of researchers and practitioners in the field of Artificial Intelligence in Slovenia was established back in 1992. 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. Academia-business linkages are particularly important for the successful translation of knowledge into innovation. In the second place, this leads to higher productivity for the industry and improved competitiveness performance of Slovenian economy. Examples of public-private cooperation can be found within the framework of the Strategic Research and Innovation Partnerships[205].

The Country Report Slovenia 2020[206] also indicates the **fourth industrial revolution as a challenge for the Slovenian research community and economic performance** in

[201] 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

[202] IRCAI (2020) The final act in the establishment of IRCAI. Source: https://ircai.org/

[203] 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

[204] https://www.oecd.ai/dashboards/countries/Slovenia

[205] Ibid.

[206] Ibid.

general. In particular, the technological disruption brought about by big data, the internet of things, artificial intelligence and robotics will have a **significant impact** on the Slovenian economy, its productivity and competitiveness as well as on the country's workforce. The development and implementation of digital technologies and new business models calls for increased research activities, improved engineering, mathematics and digital skills, efficient changes in public and private R&D as well as effective integration of all these aspects into the country's economy.

The OECD Reviews of Innovation Policy SLOVENIA[207] set a frame of strengths and weaknesses on which Slovenia needs to work to be able to use the opportunities which innovation system is able to explore. When revising the weaknesses identified back in 2012, several of those seem to be still hindering the Innovation system in Slovenia.

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. As 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%)[208]. Moreover, 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 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[209]. The overall success rate of Slovenian applicants in Horizon 2020 funding was 11% for the period 2014-2016 according to HORIZON 2020. Key facts and figures 2014-2016 compared to Belgium with 18%, Estonia with 14% and Austria with 17%[210]. 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. While on the other hand, the highest contribution to Slovenia's integration into the global value chain comes from motor vehicle production and metal products with lower value added[211].

Looking into more detail at Estonia, which forms one of the best practice comparison countries in this study, the country has a competitive start-up scene, excellent broadband capacity and other infrastructure as well as business-friendly regulation. This has generated numerous successful companies, principally in software- and in Internet-based businesses that have low entry and exit barriers. Estonia also offers favourable macroeconomic conditions for business, foreign investment and foreign entrepreneurs who settle in Estonia. Particular strong points of its innovation system, which could act as inspiration for Slovenia

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

[208] 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

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

[210] European Commission, (2018) HORIZON 2020 IN FULL SWING — Three Years On - Key facts and figures 2014-2016. Directorate-General for Research and Innovation. Source: https://ec.europa.eu/programmes/horizon2020/en/news/horizon-2020-full-swing-three-years

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

are formed by its reliance on competitive project-based policy measures, both in funding public universities and private companies. This is particularly evident in research where ca 70% of all funding is competitive. Moreover, 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. Lastly, the government introduced a single strategy – Estonia 2035 (approved 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 'societal challenges' such as climate change and ageing of the population. Moreover, 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 RI, helping to avoid duplication. Concretely, new RI is proposed by the universities and other public research organisations through a competitive process. The proposals are peer reviewed using criteria such as:

- Potential for world-class research, scientific breakthroughs and potential to introduce new cutting-edge technologies;
- Accessibility to a wide community of public and private researchers;
- Sustainability in the form of a long-term plan for scientific goals, maintenance, finance and utilisation of the RIs; and
- Feasibility of access to and preservation of data and/or materials collected.

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 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[212]. This study finds the missing elements of performance-based **financing among actors in the business support** ecosystem like SIO and SRIPs which is discussed in other parts of this report.

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[213]**. Interviewees for this study mention clusters, centers of excellence and centers of competence as a thread of development even if not all of them were successful, they were diluted with the introduction of structures necessary for the implementation of the smart specialisation strategy (SRIPs).

Crucially, the divide between the **government, public funded sector and other actors in the Quadruple helix is observed as a key barrier for development**. This causes weak policy responses being developed consisting of control mechanisms rather than enabling principles. The key weakness of the quadruple helix in Slovenia is formed by a lack of consultation and collaboration among all partners where the government should lead as

[212] 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.

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

an example. Only a small part of stakeholders which participated in the on-line survey for this study stated that the government forms partnership approaches when building polices and strategies. Others see cooperation on the level of consultation[214] and informing.[215] A quarter of the stakeholders also stated that there is some form of manipulation in the public participation in the processes, while none of them believe that policy making is done through delegation of power or control to citizens, where strength in decision making would equally distribute among partners.

Collaboration with the **people, the society factor in quadruple helix, is the weakest point** in the system with limited collaboration noted. As discussed before study shows most respondents believe the cooperation among the Quadruple Helix partners in Slovenia is established periodically based on ad hoc proposals and due to financial incentives. Only smaller part of the stakeholders believes the cooperation is well established and well thought and is long-term. **They also believe that collaboration in the Quadruple Helix Model is based on occasional informing where decision-makers inform stakeholders about the process of the decision making but decisions are only partly conditioned by the opinion of stakeholders.**

Overall spending on research and innovation relative to GDP in Slovenia grew from 1,63% in 2008 to 1,95% in 2018. In 2018 funding of research and innovation was provided mainly by business enterprise sector (62,6% of total) and government sector (23,7%). Funding from abroad amounted to 13,1% and funding from private non-profit sector to 0,2%[216]. **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 effort 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[217]. Slovene companies (particularly, the large ones) have a lower value added in the global value chains compared to other countries. This is causing a lack of capacity with businesses to invest in research and innovation. After several years of decline in investments in R&D, the investments slipped below the EU average and it is much lower than in the leading innovator countries[218]. Investments decreased both in the public sector in 2016 and in the private sector during the period 2015-2017[219]. The private sector was the major contributor in terms of investments in research and development until 2015. The subsequent decline in research and development investments is linked to several factors: firstly, a lower volume of European funds between 2013-2014 and the late and slow absorption of European funds in the begging of the implementation of the 2014-2020 perspective and secondly, in 2015,

[214] Consultation is the participation in the decision-making process where decisions are at least partly conditioned by the opinion of citizens (Arnstein, 1969).

[215] Decision - makers inform citizens on the decision-making process and assure flow of information with different information channels (Arnstein, 1969).

[216] Eurostat, (rd_e_fundgerd), (2018) R & D expenditure. Source: https://ec.europa.eu/eurostat/statistics-explained/index.php/R_%26_D_expenditure#R_.26_D_expenditure_by_source_of_funds

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

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

[219] Ibid.

the volume of tax relief for research and development began to decline. Consequently, the level of R&D self-financing of the business sector has increased between the years 2008 and 2017 from 93% to 97%.[220].

A lack of internal purchase power for innovation is caused by the practical absence of a venture capital (VC) market in Slovenia. This gap was slightly closed with instruments of the Slovene Enterprise Fund's (which is not a business venture but another government-backed scheme) in the form of start-up incentives, seed capital, venture capital, microcredits, guaranties and special incentives and some selected instruments of other institutions. However, the gap in capital is larger than the country is being able to secure. **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. Funding from private instruments is scarce. Innovation is transferred from Slovenia to other countries with the requirement of the VC funds to locate the business in the country of origin of the VC fund. As at mid-2018, none of the centrally managed EU-backed venture capital funds had invested in Slovenia[221]. According to the OECD, venture capital investments in Slovenia in 2018 amounted to 0.354 million US dollars and all of them were in later-stage ventures. In the same year, total VC investments in Austria were 102.018 million US dollars, in Estonia total investments were 17.904 million US dollars (seed 4.965 mil. USD, start-up and other early stage 1.129 mil. USD and 11.810 mil. USD in later-stage ventures)[222], no detailed data is available for Slovenia.

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. The knowledge and skills required for development and implementation of business models are scarce and need to be promoted. When discussing an issue with interviewees for this study they mention also lack of systematic approach to individual market as an obstacle. Slovenia plays with individual companies or clusters trying to get to individual market while systematic and wider strategic approach is missing.

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. There are examples of joint problem-solving platforms and blended public-private problem-solving platforms (presented in the case studies) but there is a lack of systematic approach to new methodologies and opening of innovation and development.

Tax incentive regulations are currently limiting the research and development support and these need to be updated to enable wider support of research and development, while not being narrowly linked to the success of businesses in projects related to public calls. In 2015, the volume of tax relief for research and development began

[220] Ibid.

[221] ECA (2019) Centrally managed EU interventions for venture capital: in need of more direction. Source: https://www.eca.europa.eu/Lists/ECADocuments/SR19_17/SR_Venture_capital_EN.pdf

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

to decline. In 2017, guidelines to ensure tax certainty in tax enforcement on research and development incentives were prepared to assure better control[223].

Stakeholders in the online survey mention barriers, which may be grouped as:

- **Policy, institutional, financial issues:** resulting in instability and long-term inconsistency in the development of the support ecosystem, with constant changes and insufficient public funding for innovation in the long term. Stakeholders also mention limiting, or better put, late legislative response. They also mention a broad national policies and strategic priorities to fit all and see the lack of risk funding as a limiting factor for innovation in Slovenia.
- **Lack of cooperation on the innovation system** which is seen in terms of lack of knowledge sharing and weak cooperation among institutions being based predominantly on funding not on the product development. This also causes superficial, narrow and weak understanding of innovation and the related processes, but which also causes innovation capacities and infrastructure to be underutilised; and
- **Small market and lack of introduction of innovation in markets**. This also causes both public institutes and businesses not to be able to achieve a critical mass of resources nor to develop practices for sharing resources.

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[224]. However, Slovenia finds itself in front of new transition requirements coming from the Covid-19 pandemic as well as the resilience needs of the country. While, **Slovenia's economic growth decelerated considerably in 2019, it remained robust until the hit of the COVID-19 pandemic (EC, 2020b)**. After growing by more than 4% during the period 2017-2018, the Slovenian economy was expected to grow at a slower rate of 2.5% in 2019, and 2.7% in the years 2020 and 2021 while the hit of the pandemic hit the growth rates. In the first quarter of 2020, the economy contracted by 4.5% quarter by quarter[225]. As the second quarter was more affected by confinement measures, the decline in GDP was expected to be even steeper. According to the forecasts of economic trends the beginning of the recovery of economic activity is expected in the second quarter of 2021 in Slovenia and acceleration in the second half of the 2021. The country expects GDP growth of 4.6% in 2021 after last year's deep decline in economic activity.[226].

Slovenia was a leading innovator among central and eastern European countries back in 2012 while the according to the European Innovation Scoreboard 2020[227] since 2012, innovation performance increased in 24 EU Member States and decreased in only three. Performance has increased the most in Lithuania, Latvia, Portugal and Greece, and

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

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

[225] European Commission, (2020) ECFIN Forecasts. Electronic source: https://ec.europa.eu/economy_finance/forecasts/2020/summer/ecfin_forecast_summer_2020_si_en.pdf

[226] UMAR (2020) Pomladanska napoved gospodarskih gibanj 2021 Source: https://www.umar.gov.si/

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

decreased the most in Slovenia and Romania. The performance of Croatia, Cyprus, Czechia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, and Spain is below the EU average[228].

Slovenia is still 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[229] 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[230] performs lower than EU average.

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. Currently the support institutions in the innovation system offer similar or same services without specialisation to target groups. Only small number of support institutions are able to offer specific support to specific target groups e.g. students with university incubator or similar. Besides support institutions in SIO, SRIPs and similar are not financed on the merits of success or performance but based on eligible costs.

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 2020[231].

Successful participation in European innovation and research programmes and researchers ability to participate in international research networks is a potential driver **which needs to materialise in improved sales impacts where Slovenia has the weakest innovation dimension** in the European Innovation Scoreboard 2020[232].

Stakeholders in the online survey mention drivers which may be grouped as:

- Flexibility and speed of change due to the small size of the country and smaller number of stakeholders in the innovation system. This also enables connectivity mostly in informal networks;
- Established and good business support and R&D infrastructure which connects companies, PRO and supports the commitment of innovators; and
- Well-developed knowledge and high expertise which enables complex technological solutions. This also enables internationalisation of the knowledge and sales of specific technologies based on high competences and niche skills. Also enabling cooperation in international projects, networks, platforms.

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[228] Ibid.

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

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

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

[232] Ibid.

A vital while widely overlooked element of innovation systems is set of social norms shaping the behaviour of actors in the innovation system. Social norms include behaviour, habits, routines, values, and aspirations, all of which are rooted in society, culture affecting the performance[233]. Example of social norms largely affecting the innovation is attitude towards failure and the perception of the appropriate level of engagement of universities with the private sector. Social norms may limit women's access to infrastructure, decision making and similar. When looking to Slovenia and its social related drivers of innovation much more must be done in promotion of innovation among all social groups and among decision makers.

Table 24 - Innovation system drivers based in social norms in Slovenia

Driver	Level	Slovenia
Make Everyone Responsible for Innovation / Citizen science	Individual	Innovation is not agenda of every single person in the country. A lot was done in last decade promote the innovation and make it recognised by larger groups of citizens while attitude of common people towards the innovation is that is belong to institutes and companies.
Develop Innovation Processes that Everyone Can Use	Organisations	As discussed before there are marginal examples of open innovation processes operating in the country and these are mostly designed and used by companies (Parent cloud) and sometimes in blended public-private platforms (Partnership for Growth). There were some examples of promotion of the innovation among teachers and other groups but they remain scares and limited.
Go beyond developing products and services	Organizations	As described by participants in the interviews and according to the European Innovation Scoreboard 2020, the weakest innovation dimension for Slovenia is sales impact or the innovation system is not user centric/business driven. The interviews for this study show a lack of knowledge and skills among business and public institutions to design and develop innovation processes. Even if are examples of good practices the country still lacks knowledge and momentum. As discussed, innovation processes need to develop focus on consumer and strongly focus on go to market strategies.
Create durable networks and teams that	Society/ Enterprises Organizations, Teams	Slovenia is still developing the SRIP and SIO network which need to bring together the innovation teams from research and business. To achieve this more coherent and stronger coordination of government and the innovation networks is necessary to bring the strategies and action

[233] Botta E., McCormick C., Eis J. (2015) A Guide to Innovation System Analysis for Green Growth. Global Green Growth Institute, Seoul, Korea

support innovation		plans of business and research institutions in line with policies. This needs to be done on policy and on the operational levels where all tools need to be used.
Welcome new ideas	Society	As described by Hofstede Insights[234], uncertainty avoidance tells how society deals with the fact that the future can never be known. We can relate the welcoming of new ideas with uncertainty avoidance. Slovenia scores 88 on this dimension and thus has a very high preference for avoiding uncertainty. Cultures with high uncertainty avoidance maintain rigid codes of belief and behaviour and are intolerant of unorthodox behaviour and ideas.
Build a culture of innovation	Enterprises	Some sense of cultural response to innovation can be seen from the fact that 81% of Slovenians positively evaluate the impact of digital technologies on the *economy*, while the EU average is 75%. But they do not see positive impact of digital technologies on the quality of life of individuals and society in question, only Croatia and France were ranked lower than Slovenia[235]. Slovenians do not see a connection between successful economy and quality of life and society. Building the culture of innovation takes time and needs to be a long-term policy of the country. As discussed by one of the interviewees the technical education in Slovenia was abolished or made optional in primary schools which does not help in building of culture of innovation.
Show that innovation is important	Society/ Enterprises	Stronger promotion of innovation and the benefits of innovation should be handled by several associations, ranging from business (Managers' Association of Slovenia, all three chambers) to social, and not by trade unions. Promotion of innovation in all segments of life should be broadly managed by the government, line ministries and all governmental institutions. The importance of innovation must not be diminished in economic, health, political or social crises, when innovation may provide possible solutions. Education on innovation in schools needs to be further developed to cover technological history, great Slovene and other innovators.
Design spaces for people to be creative	Society/ Enterprises	Slovenia has developed several technology parks and incubators that are by their nature more open to the public, especially those that target groups with entrepreneurial ideas and spirit. Other innovation infrastructure remains closed to different outsiders (social and economic groups) even through the Research Agency

[234] Hofstede Insights (2021) Culture Compass™ - Slovenia. Source: https://www.hofstede-insights.com/country-comparison/slovenia/

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

		requires open listing of available infrastructure and equipment in PROs, but access to and use of this infrastructure is not agreed or promoted. Majority of stakeholders surveyed for this study state that the public innovation infrastructure and equipment are not open to different social groups. There were attempts of industry and knowledge institutions to promote better access to infrastructure (such as joint purchase of 3D printers by the Faculty of Mechanical Engineering and some companies), however such cases are scarce.
Fund innovation even during tough times	Society	Information from the Beneficiary and from the users of the innovation instruments shows some instruments are not constantly available. Short term (2 years) planning of the instruments is also not helping the innovation support ecosystem to be stable and able to focus on objectives and outcomes. Especially in the crisis, investments in the innovation and research may play an important role in the recovery of the country.

Based on: Morgan[236], 2018, own research

[236] Morgan D., (2018) Top 10 Drivers of Innovation. Innovation Culture. Source: https://newandimproved.com/2018/10/05/top-10-drivers-innovation/

11 Summary Synthesis

The **structure of the innovation ecosystem in Slovenia** was built on the experience gained in twinning programmes with partners from Austria, Ireland and Germany and elsewhere. Slovenia does not have a central innovation, research, and development coordination, but has **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 and the other for the growth, smart specialization and start-up under the domain of the Ministry of Economic Development and Technology and its implementing institutions and networks. A **third vertical** may be noticed within the scope of the Government Office for Development and European Cohesion Policy with the Smart Specialization Strategy.

Several **strategies and programmes** were adopted and implemented in the last decades to support research, development and innovation. Their priorities and measures changed through the years, thus affecting the strategic set up and financing, for example from support for clusters, competence centres and centres of excellence earlier on to SRIPs lately. The key current programming documents are well developed in terms of context[237], however the **implementation of some of these programmes**, for example Research and Innovation Strategy, **is lagging behind**.

This analysis confirmed the general consensus that the Slovenian innovation system **recognises the importance of the priorities set in the strategies and programmes**. Consequently, a more open and **collaborative approach** to hard principles (legislation, regulations) and **soft principles** (ethics, social norms) in the innovation system would be beneficial for all in the ecosystem. The **vertical coordination** is functioning well and is recognised as one of the key factors of success, moreover, R&I policy is increasingly embedded into other policy areas. However, there is **lack of coordination** among several strategies and policies that are being developed, thus **the effectiveness of cross-sector coordination in the strategic planning process may be questionable**. This is particularly important because of Slovenia's high dependency on EU funding streams and governance arrangements depending on the requirements from the European Commission, thus coordination with Government Office for Development and European Cohesion Policy which is in charge of ESI funds is very important.

In addition, there is **lack of systematic consultation with a broader array of stakeholders** which indicates that planning and implementation of the funding mechanisms do not really consider the innovation ecosystem members as customers. This results in **calls for proposals that are not tailored to needs and capacities** of smaller actors, and **lack of appropriate pace and motivation** of the preparation and implementation of programmes and strategies. The interview process also revealed a **lack**

[237] For example the Research and Innovation Strategy of Slovenia 2011–2020 (adopted in 2011), Industrial Policy of Slovenia (adopted in 2013), Smart Specialisation Strategy (adopted in December 2017, new one in preparation), National Strategy of Open Access to Scientific Publications and Research Data in Slovenia 2015–2020 (adopted in September 2015) and Programme for the Development of the Innovation System (adopted in January 2021).

of trust in the implementing agencies because of relatively frequent change of implementing arrangements and instruments. Long-term availability and stability of innovation instruments play an important role in the development as they provide resilience in financial crisis or budget shortages. Moreover, **public administration communicates inconsistently with the public**, thus its activities and achievements are largely unknown to the broader public.

Lack of support for international scale-up and commercialisation is especially important due to limited size of the domestic market, limited natural resources and limited knowledge. **Slovene innovation managers still lack knowledge and experience in commercialisation and scale-up**, resulting in weak perspective of the user/consumer and poor focus on markets and revenues, consequently weakening the push for innovation process. **Open innovation and other modern innovation principles** (Six Sigma, Agile, Design Thinking, Global Innovation Management Methodology etc.) **are not widely used in the country** though they are seen in some organisations.

Formats of collaboration between the members of innovation ecosystem, particularly R&D and business have **evolved and changed with time**. The **Smart Specialisation Strategy of Slovenia** has the possibility to strengthen the collaborative approach to innovation and may be seen as a **governance framework to organize interactions among the elements of the Quadruple Helix Model** as their strong involvement ensures diverse knowledge, innovation and mutual cross-learning, while the their coordination is crucial for efficiency. Clusters, centres of excellence and competence centres are seen as a **thread of development that was diluted with yet another change**, the introduction of structures necessary for the implementation of the smart specialisation strategy, such as Strategic Research and Innovation Partnerships (SRIPs) which bring together representatives of the businesses, knowledge institutions and the state in the target areas of the Smart Specialization Strategy. **SRIPs are not yet perceived as strong drivers of innovation** as they are known to a limited number of actors (their members and those who closely cooperate with them), while the **Chamber of Commerce and Industry of Slovenia is perceived as a strong intermediary institution.** The interviews indicated that SRIPs are gaining new members, thus their position might change. The tools developed for the **implementation of smart specialisation may thus facilitate better coordination between R&D and businesses, as well as integration of their needs into policies**, however the results of this are yet to be seen.

In Slovenia both the funding institutions and the current beneficiaries of the innovation funding are rather detached. Results of the survey conducted in this study revealed that **well-established long-term institutional cooperation is rare**. Therefore, it can be concluded that quadruple helix partners in Slovenia establish **periodical cooperation based on ad hoc proposals, or due to financial incentives. Some collaborative formats remained stable** even after the change of the funding mechanisms (e.g. changes in types of support and calls for proposals) or the policy changes (e.g. amendments of strategies and programmes) which seems to be due to the **stronger links and better developed services they are providing to their members**. **More innovative companies openly and actively cooperate with various stakeholders** in the innovation

ecosystem; the companies that are highly recognised as important drivers of innovation in the country are mainly in hi-tech, pharmaceutical and automotive sectors. **Universities and institutes are strongly involved in innovation, but the cooperation with other actors varies** across faculties and/or departments and the degree of closedness for initiatives by other actors. **Link between R&D and businesses is weak** due to the focus of most important public research organisations (primarily funded by the national government) on a scientific rationale, keeping collaboration with industry as one of the secondary activities. The situation was worsened by closure of the Technology Agency (TIA).

On ongoing challenge is that stakeholders have widely differing views on scientific excellence, relevance of research for technological applications, and research priorities. The industry perceives a **lack of long term and premeditated cooperation among knowledge institutions and industry** as the key barrier to innovation. There is a **need to facilitate long-term collaborations (including both projects and platforms) between businesses, researchers and research institutions** that would give them enough time and space to identify the knowledge potential, scope potential areas and options for close collaboration, to structure that collaboration and then carry it through to completion. The **public funding of the institutions** in the innovation system is **based on their eligible costs and not on their performance**, resulting in uneven innovation performance, as identified by OECD. The divide between the **government, publicly funded sector and other actors in the quadruple helix is perceived as a key barrier for development**.

Mapping of the support instruments in Slovenia listed **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 as well as several private institutions. Case studies of selected instruments show that funding from private instruments is scarce. **The venture capital market is practically non-existent in Slovenia, which contributes to the lack of internal purchasing power for innovation.** Instruments of the Slovene Enterprise Fund in the form of start-up incentives, seed capital, venture capital, microcredits, guarantees and special incentives as well as some selected instruments of other institutions helped to bridge this gap. Nevertheless, this gap in capital remains larger than the country is able to fill. **According to experts in the venture capital market interviewed for this study, the annual need for funding in Slovenia from VC is around EUR 70 million** while the country has a fragment of the funds ready to invest.

In instruments funded by ESI funds there are delays and administrative burden due to a **complex and detailed financial and content control system** for payment claims for projects. The main characteristic of publicly funded instruments analysed in case studies are **lack of instrument evaluation** (that would be beyond regular project monitoring) and **lack of consistent feedback and follow-up** on performance from all the beneficiaries. Evaluation of an instrument per year, chosen on the basis of level of implementation or the needs of the target groups would provide the basis for instrument adjustments. The **evaluation and planning potential would be increased by collecting more data on beneficiaries and forming a control group**, with data collected before the start of implementation of the support instrument and again after the end of the supported project.

The structure of the existing database could be further improved with data from reports and official databases available in the country (AJPES, tax authority), **improved interoperability and quality assurance**.

In the **product development and life cycle the weakest point** of the Slovenian research and development process in its **inability to develop and sustain partnerships** for innovation and development, followed by weak market and revenue generation strategies and weak business models. **Slovenian innovation ecosystem lacks development of a sufficient number of instruments for either specific groups** (researchers, students, youth and other), **specific stage of the life cycle** of product/service/process (research, linking research to market, seed and development, start-up, growth and establishment, expansion, maturity, decline stage), or type of intervention (business problem, regional specifics, transformation needs). Thus, more effort is required to **address the lack of knowledge sharing** on project preparation and knowledge gained in the projects co-financed from ESI funds. Beneficiaries of the instruments suggest **contracting with larger flexibility** in terms of project implementation, but **strict commitment to results or indicators**.

In terms of innovation areas, development of **blockchain technologies** and research in **artificial intelligence, dynamic start-up ecosystem in ICT, backed by solid business support services** are an important driver for the country's industrial transition. The development and implementation of digital technologies and new business models calls for increased research activities, improved engineering, mathematics and digital skills, efficient changes in public and private R&D as well as effective integration of all these aspects into the country's economy.

12 References and Literature

- ABC Accelerator, (2018) SOUTH-EAST EUROPE STARTUP REPORT 2018. Source: https://www.startup.si/en-us/strategy-and-goals/documents/southeast-europe-startup-report-2018 [access 10 March 2021].
- AmCham, (2021) Partnerstvo za spremembe - Nacionalna platforma sodelovanja. AmCham, Ljubljana, 2021
- Applica-Ismeri-wiiw (2006) Ex Post Evaluation of Cohesion Policy Programmes 2000-2006 financed by the European Regional Development Fund in Objective 1 and 2 regions Work package 1: Coordination, analysis and synthesis Source: https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2006/wp1_tsk4_slovenia.pdf [access 3 April 2021].
- Applica, Ismeri Europa and Cambridge Economic Associates (2016) Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF), Country Report Slovenia, September 2016, Source: https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2013/wp1_sl_report_en.pdf [access 4 April 2021]
- Arnstein, S. R. (1969) A ladder of citizen participation. Journal of the American Institute of Planners. Source: https://www.researchgate.net/publication/334078940_Building_A_Ladder_of_Citizen_Participation_Sherry_Arnstein_Citizen_Participation_and_Model_Cities [access 5 March 2021].
- ARRS (2017) Gross Domestic Expenditure on R&D by Sources of Funds in Percentage of GDP in 2017. Source: https://www.arrs.si/en/analize/odlicnost/izdatki.asp [access 15. March 2021].
- ARRS (2020) ARRS / Poročilo o financiranju 2019. Source: http://www.arrs.si/Report/fin-por-2019.aspx#P3566b4e228ce432a89188bb2e06f1dc7_3_101iT0R0R0x0 [access 14. March 2021].
- ARRS (2020) Letno poročilo 2019 (Revidirano). Source: https://www.arrs.si/sl/finan/letpor/19/inc/Revidirano-Letno-porocilo-ARRS-2019.pdf [access 1 April 2021].
- ARRS, (2021) Raziskovalna infrastruktura. Raziskovalna oprema. Source: http://www.arrs.si/sl/infra/oprema/evidenca/ [access 18. March 2021].
- Banka Slovenije (2020) Analiza učinkov COVID-19 na slovensko gospodarstvo. Banka Sovenije, marec 2020.
- Bergs R. (2012) Simple Control Group Analysis by Matching: A Brief Introduction. Planung & Forschung (PRAC), Bad Soden, Germany
- Botta E., McCormick C., Eis J. (2015) A Guide to Innovation System Analysis for Green Growth. Global Green Growth Institute, Seoul, Korea

- Bučar M., Črnigoj M., Jaklič A., Lovec M., Stare M., Udovič B., Likar B., Lipnik A., Štrukelj P. (2019) Vmesno spremljanje in vrednotenje delovanja SRIP- ov v obdobju 2017-2019. Ciljni raziskovalni projekt»Strateška Razvojno Inovacijska Partnerstva kot orodje krepitve inovacijske sposobnosti Slovenskega gospodarstva«.
- Center RS za mobilnost in evropske programe izobraževanja (2016) Strategija internacionalizacije slovenskega visokega šolstva 2016–2020, Ljubljana, November 2016
- Chamber of Commerce and Industry of Slovenia (2020) Takšno je dejansko stanje inovativnosti v slovenskem gospodarstvu. Glas gospodrastva, december 2020. Source: https://www.gzs.si/Portals/SN-informacije-Pomoc/Vsebine/GG/2020/December/gg_12_lores.pdf [access 25. March 2021].
- ECA (2019) Centrally managed EU interventions for venture capital: in need of more direction. Source: https://www.eca.europa.eu/Lists/ECADocuments/SR19_17/SR_Venture_capital_EN.pdf [access 12. March 2021].
- European Commission (2021) Pilot action: Regions in industrial transition. Source: https://ec.europa.eu/regional_policy/en/information/publications/factsheets/2018/pilot-action-regions-in-industrial-transition [access 25 March 2021].
- European Commission, (2018) HORIZON 2020 IN FULL SWING — Three Years On - Key facts and figures 2014-2016. Directorate-General for Research and Innovation. Source: https://ec.europa.eu/programmes/horizon2020/en/news/horizon-2020-full-swing-three-years [access 25. March 2021].
- European Commission, (2020a) European innovation scoreboard 2020, Electronic source: https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en [access 6. January 2021].
- European Commission, (2020b) Country Report Slovenia 2020, Communication from the Commission to the European Parliament, the European Council, the Council, the European Central Bank and the Eurogroup. 2020 European Semester: Assessment of progress on structural reforms, prevention and correction of macroeconomic imbalances, and results of in-depth reviews under Regulation (EU) No 1176/2011. Electronic source: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020SC0523&from=EN [access 6. January 2021].
- European Commission, (2020c) ECFIN Forecasts. Electronic source: https://ec.europa.eu/economy_finance/forecasts/2020/summer/ecfin_forecast_summer_2020_si_en.pdf [access 6. January 2021].
- European Commission, (2020d) Digital Economy and Society Index (DESI) 2020 Slovenia. Electronic source: https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=66929 [access 6. January 2021].
- European Commission, (2020e) COMMISSION STAFF WORKING DOCUMENT Country Report Slovenia 2020, Communication from the Commission to the European Parliament, the European Council, the Council, the European Central Bank and the Eurogroup, 2020 European Semester: 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.

- European court of Auditors (2019) Special Report: Centrally managed EU interventions for venture capital: in need of more direction. European union, 2019.
- European Union (2017) RIO Country Report 2017.
- EUROSTAT, (2019) Newsrelease. January 2019. Source: https://ec.europa.eu/eurostat/documents/2995521/9483597/9-10012019-AP-EN.pdf/856ce1d3-b8a8-4fa6-bf00-a8ded6dd1cc1 [access 15. March 2021].
- EUROSTAT, (2021) BERD by NACE Rev. 2 activity [rd_e_berdindr2]. Source: http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do [access 15. March 2021].
- 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 [access 5. March 2021].
- Eurostat, (rd_e_fundgerd), (2018) R & D expenditure. Source: https://ec.europa.eu/eurostat/statistics-explained/index.php/R_%26_D_expenditure#R_.26_D_expenditure_by_source_of_funds [access 5. March 2021].
- EURYDICE (2019) Vrste višješolskih in visokošolskih izobraževalnih zavodov. Source: https://eacea.ec.europa.eu/national-policies/eurydice/content/types-higher-education-institutions-77_sl [access 14. March 2021].
- Freeman, C. (2002) Continental, national and sub-national innovation systems – complementarity and economic growth, Research Policy. Source: https://www.sciencedirect.com/science/article/abs/pii/S0048733301001366 [access 20. March 2021].
- Gebhardt C. and Stanovnik P. (2016) European innovation policy concepts and the governance of innovation Slovenia and the struggle for organizational readiness at the national level. INDUSTRY & HIGHER EDUCATION Vol 30, No 1, February 2016, pp 53–66, doi: 10.5367/ihe.2016.0290.
- Global economy (2021): High tech exports - Country rankings. Source: https://www.theglobaleconomy.com/rankings/High_tech_exports/ [access 3 April 2021]
- Government of the Republic of Slovenia (2019) Poročilo o uresničevanju Resolucije o raziskovalni in inovacijski strategiji Slovenije za obdobje 2015–2017. Source: https://www.gov.si/assets/ministrstva/MIZS/Dokumenti/ZNANOST/Strategije/Porocilo-o-uresnicevanju-Resolucije-o-raziskovalni-in-inovacijski-RS-20152017.pdf [access 24 March 2021].
- Hofstede Insights (2021) Culture Compass™ - Slovenia. Source: https://www.hofstede-insights.com/country-comparison/slovenia/ [access 5. March 2021].

- Horizon (2020) Horizon 2020 Key Figures. Source: https://webgate.ec.europa.eu/dashboard/extensions/CountryProfile/CountryProfile.html?Country=Slovenia [access 15. March 2021].
- Howells J. (2006) Intermediation and the role of intermediaries in innovation. ESRC Centre for Research in Innovation and Competition (CRIC), Institute of Innovation Research, University of Manchester. 2006 Elsevier
- Institut Jožef Stefan (2020) Poročilo o delu v letu 2019, Ljubljana, julij 2020
- IPP (2021) Targeting priority areas/sectors. Source: http://www.innovationpolicyplatform.org/www.innovationpolicyplatform.org/content/slovenia/index.html [access 17. March 2021].
- IRCAI (2020) The final act in the establishment of IRCAI. Source: https://ircai.org/ [access 19 March 2021].
- IRENA (2021) How patents encourage innovation in technological development and deployment. Source: https://www.irena.org/inspire/Intellectual-Property-Rights/Innovation. [access 4. April 2021].
- JRC (2017) Analysis of national public research funding (PREF). Handbook for Data Collection and indicators production. European Union, 2017
- KETs Observatory (2021) Enterprises with innovations 2016. Source: https://ati.ec.europa.eu/data-dashboard/country?filter[technology]=non_technology_specific&filter[geo]=EU27,SV&filter[year]=2016&filter[dimension]=innovation&filter[indicator]=Enterprises_innovation [access 25 March 2021].
- KETs Observatory (2021) Enterprises with innovations 2016. Source: https://ati.ec.europa.eu/data-dashboard/country?filter[technology]=non_technology_specific&filter[geo]=EU27,SV&filter[year]=2018,2017,2016,2015&filter[dimension]=entrepreneurship&filter[indicator]=Survival_rate [access 25 March 2021].
- KETs Observatory (2021) Enterprises with innovations 2016. Source: https://ati.ec.europa.eu/data-dashboard/country?filter[technology]=non_technology_specific&filter[geo]=EU27,SV&filter[year]=2018,2017,2016,2015&filter[dimension]=skills&filter[indicator]=Firms_ICT_training [access 25 March 2021].
- Lafley A. G., Charan R. (2008) The Game-Changer: How You Can Drive Revenue and Profit Growth with Innovation.
- Lesjak D., Breznik K., Dermol V., Laporšek S., Likar B., Lipnik A., Skrbinjek V., Vodopivec M., Novak M., Mohorko J., Tadina T., Žitko T. (2021) Analiza učinkovitosti vlaganj v raziskovalno-razvojno dejavnost v Sloveniji (AUV-RRD-SLO) - zaključno poročilo. Univerza na Primorskem, Fakulteta za management (UP FM), Mednarodna fakulteta za družbene in poslovne študije (MFDPŠ). ARRS in MIZŠ, 2021
- MF, (2017) DAVČNE OLAJŠAVE ZA VLAGANJA V RAZISKAVE IN RAZVOJ, Smernice za zagotavljanje večje davčne gotovosti pri uveljavljanju davčnih olajšav za vlaganja v

raziskave in razvoj, pripravljene v sodelovanju MGRT in FURS in Vprašanja in odgovori glede davčnih olajšav za vlaganje v raziskave in razvoj pripravljeni na FURS, Podrobnejši opis. Republika Slovenija, Ministrstvo za finance, Finančna Uprava Republike Slovenije, julij 2017

- Morgan D., (2018) Top 10 Drivers of Innovation. Innovation Culture. Source: https://newandimproved.com/2018/10/05/top-10-drivers-innovation/ [access 5. March 2021].
- NAKVIS (2021) Podatki o visokošolskih zavodih. Source: https://www.nakvis.si/analize-in-publikacije/porocila-strokovnjakov-in-odlocbe/ [access 14. March 2021].
- OECD (2012) OECD Reviews of Innovation Policy SLOVENIA. OECD Publishing. http://dx.doi.org/10.1787/9789264167407-en
- OECD (2013) International funding of R and D, in OECD Science, Technology and Industry Scoreboard 2013: Innovation for Growth, OECD Publishing, Paris.
- OECD (2017) OECD Skills Strategy Diagnostic Report - Slovenia 2017, OECD, OECD Directorate for Education and Skills and Special Advisor to the Secretary-General on Education Policy.
- OECD (2020) Better Life Index. Electronic source: http://www.oecdbetterlifeindex.org/countries/slovenia/ [access 8. January 2021].
- OECD Data (2021) Gross domestic spending on R&D Source: https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm [access 3 April 2021].
- OECD. Stat Graduates by field Soure: https://stats.oecd.org/Index.aspx?DataSetCode=EDU_GRAD_FIELD. [access 4. April 2021].
- OECD.Stat (2021) Venture capital investments. Source: https://stats.oecd.org/Index.aspx?DataSetCode=VC_INVEST [access 5. March 2021].
- Pietersen W. G. (2010) Strategic learning: how to be smarter than your competition and turn key insights into competitive advantage. John Wiley & Sons, Inc., Hoboken, New Jersey.
- Property Rights Alliance (2020) International Property Rights Index, 2020. Source: https://internationalpropertyrightsindex.org/compare/country?id=1,7,112,24 [access 14. March 2021].
- SID (2021) About SID Bank and Financing. Source: https://www.sid.si/en/about/about-sid-bank [access 24 March 2021].
- SPIRIT (2020) Predstavitev Subjektov inovativnega okolja (SIO) in uspešnih podjetniških zgodb, ki so prejeli podporo od slednjih. SPIRIT, Ljubljana.
- SPIRIT (2020) Program razvoja inovacijske dejavnosti, verzija 1/2020. Javna agencija Republike Slovenije za spodbujanje podjetništva, internacionalizacije, tujih investicij in tehnologije, Ljubljana, 2020.
- SPIRIT (2020) Programme for Development of the Innovation Ecosystem, Version 1/2020. Public Agency for Entrepreneurship, Internationalization, Foreign Investments and Technology, Ljubljana, 21 August 2020

- SPIRIT (2020) Revidirano letno poročilo za leto 2019. Source: https://www.spiritslovenia.si/resources-new/vsebine/SPIRIT/StaticneStrani/7/2020%2007%20SPIRIT%20letno%20porocilo%202019_nov%20design_01%20web_OBLIKOVANO.pdf [access 1 April 2021].
- SPIRIT (2021) STRATEŠKO RAZVOJNO-INOVACIJSKA PARTNERSTVA – SRIP pregled področja
- SPS (2020) LETNO POROČILO 2019, June 2020. Source: https://podjetniskisklad.si/images/letnaporocila/LETNO-POROILO-2019-sprejeto-na-vladi-11.8.2020.pdf [access 1 April 2021].
- SRRS (2021) Programi spodbud. Source: https://www.srrs.si/#front-programs [access 24 March 2021].
- Start:up Slovenia (2021) Start:up Slovenia Project. Source: https://www.startup.si/en-us/startup-slovenia-project [access 14. March 2021].
- SURS (2019) In 2018 gross domestic expenditure on research and development in Slovenia amounted to 2.0% of GDP. Source: https://www.stat.si/StatWeb/en/news/Index/8441 [access 14. March 2021].
- SURS (2019) Slovenia allocated nearly EUR 990 million for research and development (R&D) in 2019. Source: https://www.stat.si/StatWeb/en/News/Index/9192 [access 15. March 2021].
- SURS (2020): Na voljo končni podatki o raziskovalno-razvojni dejavnosti (RRD) v 2018. Source: https://www.stat.si/StatWeb/News/Index/8692 [access 14. March 2021].
- SVRK (2020): Tabela prioritet Slovenske strategije pametne specializacije (S4) in pripadajočih fokusnih področij in tehnologij, Source: https://www.gov.si/assets/vladne-sluzbe/SVRK/S4-Slovenska-strategija-pametne-specializacije/Tabela-fokusnih-podrocij_ANza3fazo_november-2020.pdf [access 24. September 2021].
- The World Bank (2002), Building Knowledge Economies: Opportunities and Challenges for EU Accession Countries; Final report of the Knowledge Economy Forum, Paris, Feb. 19-22, 2003; The WB and the World Bank Institute.
- The World bank (2021) UNESCO Institute for Statistics. Source: World Development Indicators (WDI) Source: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?contextual=default&locations=SI-AT-EE-IL&name_desc=true [access 15. March 2021].
- UMAR (2020) Poročilo o produktivnosti 2020. UMAR, Ljubljana, november 2020.
- UMAR (2020) Zimska napoved gospodarskih gibanj 2020. Electronic source: https://www.umar.gov.si/fileadmin/user_upload/napovedi/vmesna/zimska_2020/ZimskaNGG_2020_01.pdf [access 6. January 2021].
- UMAR (2021) Pomladanska napoved gospodarskih gibanj 2021. Source: 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 [access 1 April 2021].

- UNDP (2018) Human Development Indices and Indicators: 2018 Statistical Update, Briefing note for countries on the 2018 Statistical Update, Slovenia. Source: http://hdr.undp.org/sites/default/files/Country-Profiles/SVN.pdf [access 6. January 2021].
- WIPO (2020) Global innovation index – Slovenia. Source: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2018-profile43.pdf [access 25. March 2021].
- WIPO (2021) About the Global Innovation Index. Source: https://www.globalinnovationindex.org/about-gii#framework [access 7 June 2021].
- WIPO (2021) Statistical Country Profiles. Source: https://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=SI [access 25 March 2021].
- World bank (2021) High-technology exports as % manufactured exports. Source: https://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS?locations=AT-EE-IL-SI [access 3 April 2021]
- World bank (2021): Medium and high-tech exports as % manufactured exports. Source: https://data.worldbank.org/indicator/TX.MNF.TECH.ZS.UN?end=2018&locations=SI-EE-AT-IL&start=1990&view=chart [access 3 April 2021].

Annex 1 List of consulted stakeholders

	Type	Organisation	Contact person
Policy/system level	Industry	SRIP Mobility	Tanja Mohorič
	Industry	Managers association of Slovenia	Medeja Lončar
	Policy	IMAD	dr. Peter Wostner
	Education	University of Ljubljana	Prof. Dr. Igor Papič
	Infrastructure/brokers	University of Ljubljana, Office for knowledge transfer	Simona Rataj
	Infrastructure/brokers	University of Ljubljana, Office for knowledge transfer	Urška Jerše
	Financial institutions	University of Ljubljana, Faculty of Economy and VC funding	dr. Aleš Pustovrh
	Infrastructure	Technology park Ljubljana	dr. Jernej Pintar
	Policy	Technological Development and Innovation at The Chamber of Commerce and Industry of Slovenia	dr. Aleš Ugovšek
Instruments level	Business	Lemur legal	dr. Peter Merc
	Platforms	AmCham	Brina Tomovič Kandare
	Platforms	AmCham	Ajša Vodnik
	Platforms	AmCham	Tonja Avsenik
	Infrastructure	former CEO of Technology park Ljubljana	Iztok Lesjak
	Public body	Slovene research agency	Ljiljana Lučić
	Platforms	Silicon Alps	David Johannes Tatschl
	Platforms	American Slovenian Education Foundation	Jure Leskovec
	Platforms	American Slovenian Education Foundation	Matej Drev
	Infrastructure	Primorski tehnološki park	Tanja Kožuh
	Financial infrastructure	Slovene research agency	Polona Novak
	Platforms	American Slovenian Education Foundation	Barbara Zagorc
	Financial infrastructure	Business Angels of Slovenia	Nina Dremelj
	Financial infrastructure	Business Angels of Slovenia	Maja Križan
	Financial infrastructure	South Central Ventures	Domagoj Oreb
	Platforms	SRIP circular economy	Dragica Marinič
	Public body	SPIRIT	Irena Meterc
	Public body	SPIRIT	Karin Žvokelj
	Ministry	Ministry of Economic Development and Technology	dr. Matej Novak
	Infrastructure	Katapult incubator	Marko Novak
	Business	Inštitut za raziskovanje podjetništva Tovarna podjemov Maribor	Matej Rus
	Public body	Slovene enterprise fund	Nina Urbanič
	Public body	Slovene enterprise fund	Rok Huber
	Ministry	Ministry of Economic Development and Technology	Sebastijan Milovanovic Jarh
	Platforms	SRIP Zdravje medicina	dr. Alenka Rožaj Brvar, MBA
	Infrastructure	RIC Bela krajina	Kristian Asani
	Public body	Slovene research agency	Simon Ošo

	Type	Organisation	Contact person
	Ministry	Ministry of Economic Development and Technology	Maša Ravnik
	Ministry	Ministry of Economic Development and Technology	Marta Slokar
	Ministry	Ministry of Economic Development and Technology	Simona Cetin
	Public body	SAŠA incubator	Ana Anžej
	Ministry	Ministry of Economic Development and Technology	Miša Osterc
	Public body	Slovene enterprise fund	Tina Zager
	Ministry	Ministry of Economic Development and Technology	Marlen Skarlovnik

Annex 2 Survey results on cooperation with different type of actors

Cooperation with actors (no. of respondents)	Purpose of cooperation	Results								
		No results	Improved products/service	New products/service	New market/new clients, internationalisation	New financial resources	Increased revenues	New knowledge for future products	New business models	Other
With businesses (46)	Innovation and development	0,00%	4,35%	54,35%	2,17%	6,52%	0,00%	26,09%	4,35%	2,17%
	Employment, human resources sharing, coworking and similar	13,04%	6,52%	13,04%	0,00%	4,35%	8,70%	34,78%	10,87%	8,70%
	Business models development	17,39%	4,35%	6,52%	8,70%	8,70%	6,52%	6,52%	36,96%	4,35%
	Funding	10,87%	0,00%	21,74%	4,35%	39,13%	15,22%	2,17%	4,35%	2,17%
	Access to markets, rollout strategies, revenues generation	8,70%	2,17%	6,52%	32,61%	8,70%	32,61%	2,17%	2,17%	4,35%
	Risk management	23,91%	2,17%	10,87%	4,35%	6,52%	13,04%	17,39%	2,17%	19,57%
	Execution, production, assembling, support services, after sales	15,22%	6,52%	23,91%	8,70%	2,17%	13,04%	10,87%	13,04%	6,52%
With financial institutions and intermediaries (for example, venture capital funds and the like,	Innovation and development	5,88%	5,88%	5,88%	11,76%	52,94%	5,88%	11,76%	0,00%	0,00%
	Employment, human resources sharing, coworking and similar	23,53%	11,76%	0,00%	5,88%	11,76%	17,65%	23,53%	0,00%	5,88%
	Business models development	17,65%	0,00%	0,00%	5,88%	17,65%	17,65%	11,76%	29,41%	0,00%
	Funding	0,00%	0,00%	5,88%	5,88%	64,71%	17,65%	0,00%	5,88%	0,00%

banks, business angels, etc.) (17)	Access to markets, rollout strategies, revenues generation	5,88%	5,88%	5,88%	35,29%	23,53%	23,53%	0,00%	0,00%	0,00%
	Risk management	17,65 %	5,88%	5,88%	0,00%	17,65%	11,76%	0,00%	29,41%	11,76 %
	Execution, production, assembling, support services, after sales	23,53 %	0,00%	11,76%	5,88%	11,76%	11,76%	5,88%	23,53%	5,88%
With intermediary institutions and networks (eg technology centres, technology platforms, centres of excellence, clusters) (25)	Innovation and development	0,00%	4,00%	40,00%	4,00%	4,00%	4,00%	28,00%	12,00%	4,00%
	Employment, human resources sharing, coworking and similar	20,00 %	0,00%	12,00%	0,00%	4,00%	0,00%	32,00%	16,00%	16,00 %
	Business models development	12,00 %	4,00%	4,00%	4,00%	0,00%	4,00%	12,00%	52,00%	8,00%
	Funding	16,00 %	0,00%	4,00%	4,00%	52,00%	8,00%	12,00%	4,00%	0,00%
	Access to markets, rollout strategies, revenues generation	12,00 %	4,00%	4,00%	40,00%	8,00%	16,00%	4,00%	0,00%	12,00 %
	Risk management	24,00 %	4,00%	0,00%	0,00%	4,00%	4,00%	20,00%	12,00%	32,00 %
	Execution, production, assembling, support services, after sales	20,00 %	4,00%	8,00%	0,00%	4,00%	12,00%	20,00%	20,00%	12,00 %
With infrastructure organisations (eg technology parks, business and	Innovation and development	10,34 %	3,45%	37,93%	0,00%	6,90%	0,00%	20,69%	10,34%	10,34 %
	Employment, human resources sharing, coworking and similar	17,24 %	3,45%	6,90%	0,00%	0,00%	0,00%	37,93%	17,24%	17,24 %
	Business models development	13,79 %	0,00%	3,45%	3,45%	0,00%	0,00%	10,34%	55,17%	13,79 %

university incubators) (29)	Funding	13,79 %	0,00%	6,90%	0,00%	65,52%	6,90%	0,00%	0,00%	6,90%
	Access to markets, rollout strategies, revenues generation	13,79 %	3,45%	3,45%	48,28%	10,34%	6,90%	3,45%	0,00%	10,34 %
	Risk management	31,03 %	6,90%	6,90%	6,90%	6,90%	6,90%	10,34%	3,45%	20,69 %
	Execution, production, assembling, support services, after sales	13,79 %	10,34%	20,69%	3,45%	0,00%	6,90%	17,24%	13,79%	13,79 %
With regional development agencies (19)	Innovation and development	21,05 %	10,53%	21,05%	15,79%	15,79%	0,00%	0,00%	5,26%	10,53 %
	Employment, human resources sharing, coworking and similar	26,32 %	0,00%	5,26%	5,26%	15,79%	5,26%	36,84%	0,00%	5,26%
	Business models development	36,84 %	0,00%	15,79%	5,26%	5,26%	0,00%	5,26%	21,05%	10,53 %
	Funding	21,05 %	0,00%	5,26%	5,26%	36,84%	15,79%	5,26%	5,26%	5,26%
	Access to markets, rollout strategies, revenues generation	31,58 %	0,00%	5,26%	36,84%	5,26%	5,26%	0,00%	5,26%	10,53 %
	Risk management	47,37 %	0,00%	5,26%	5,26%	5,26%	5,26%	0,00%	21,05%	10,53 %
	Execution, production, assembling, support services, after sales	31,58 %	15,79%	15,79%	10,53%	0,00%	0,00%	5,26%	5,26%	15,79 %
With universities and other institutions of higher	Innovation and development	2,27%	11,36%	34,09%	0,00%	0,00%	0,00%	45,45%	2,27%	4,55%
	Employment, human resources sharing, coworking and similar	13,64 %	6,82%	15,91%	2,27%	0,00%	4,55%	40,91%	4,55%	11,36 %

education (44)	Business models development	25,00 %	6,82%	4,55%	0,00%	0,00%	6,82%	15,91%	31,82%	9,09%
	Funding	22,73 %	2,27%	0,00%	0,00%	40,91%	6,82%	11,36%	4,55%	11,36 %
	Access to markets, rollout strategies, revenues generation	31,82 %	2,27%	6,82%	22,73%	2,27%	9,09%	11,36%	0,00%	13,64 %
	Risk management	36,36 %	2,27%	4,55%	0,00%	2,27%	4,55%	20,45%	6,82%	22,73 %
	Execution, production, assembling, support services, after sales	22,73 %	13,64%	9,09%	4,55%	0,00%	2,27%	22,73%	11,36%	13,64 %
With vocational training institutions and secondary schools (21)	Innovation and development	19,05 %	19,05%	19,05%	0,00%	0,00%	4,76%	33,33%	0,00%	4,76%
	Employment, human resources sharing, coworking and similar	19,05 %	4,76%	9,52%	0,00%	0,00%	0,00%	42,86%	4,76%	19,05 %
	Business models development	38,10 %	4,76%	4,76%	0,00%	0,00%	0,00%	14,29%	23,81%	14,29 %
	Funding	38,10 %	4,76%	0,00%	0,00%	38,10%	0,00%	4,76%	0,00%	14,29 %
	Access to markets, rollout strategies, revenues generation	47,62 %	9,52%	9,52%	9,52%	0,00%	0,00%	4,76%	0,00%	19,05 %
	Risk management	52,38 %	9,52%	4,76%	0,00%	0,00%	4,76%	9,52%	0,00%	19,05 %
	Execution, production, assembling, support services, after sales	42,86 %	9,52%	9,52%	0,00%	0,00%	4,76%	4,76%	0,00%	28,57 %
	Innovation and development	2,38%	7,14%	33,33%	0,00%	9,52%	2,38%	38,10%	2,38%	4,76%

With public research institutions (42)	Employment, human resources sharing, coworking and similar	14,29 %	2,38%	7,14%	2,38%	7,14%	2,38%	38,10%	9,52%	16,67 %
	Business models development	23,81 %	4,76%	2,38%	4,76%	4,76%	7,14%	11,90%	33,33%	7,14%
	Funding	21,43 %	4,76%	0,00%	0,00%	40,48%	7,14%	11,90%	2,38%	11,90 %
	Access to markets, rollout strategies, revenues generation	28,57 %	4,76%	2,38%	19,05%	16,67%	2,38%	9,52%	4,76%	11,90 %
	Risk management	35,71 %	2,38%	0,00%	4,76%	2,38%	4,76%	16,67%	7,14%	26,19 %
	Execution, production, assembling, support services, after sales	21,43 %	11,90%	2,38%	7,14%	7,14%	7,14%	19,05%	11,90%	11,90 %
With private research institutions (30)	Innovation and development	3,33%	13,33%	30,00%	0,00%	0,00%	13,33%	36,67%	0,00%	3,33%
	Employment, human resources sharing, coworking and similar	20,00 %	3,33%	3,33%	3,33%	0,00%	6,67%	43,33%	3,33%	16,67 %
	Business models development	23,33 %	3,33%	13,33%	6,67%	0,00%	6,67%	13,33%	23,33%	10,00 %
	Funding	30,00 %	3,33%	3,33%	0,00%	30,00%	6,67%	13,33%	0,00%	13,33 %
	Access to markets, rollout strategies, revenues generation	23,33 %	3,33%	3,33%	20,00%	6,67%	10,00%	20,00%	0,00%	13,33 %
	Risk management	33,33 %	3,33%	6,67%	3,33%	3,33%	6,67%	23,33%	3,33%	16,67 %
	Execution, production, assembling, support services, after sales	26,67 %	3,33%	3,33%	3,33%	3,33%	16,67%	23,33%	6,67%	13,33 %

With public administration institutions that are implementing innovation policies and programmes (34)	Innovation and development	8,82%	8,82%	29,41%	8,82%	20,59%	0,00%	8,82%	0,00%	14,71 %
	Employment, human resources sharing, coworking and similar	20,59 %	0,00%	8,82%	2,94%	8,82%	2,94%	23,53%	11,76%	20,59 %
	Business models development	23,53 %	2,94%	2,94%	8,82%	2,94%	2,94%	8,82%	32,35%	14,71 %
	Funding	5,88%	0,00%	5,88%	5,88%	47,06%	17,65%	5,88%	2,94%	8,82%
	Access to markets, rollout strategies, revenues generation	11,76 %	2,94%	8,82%	32,35%	8,82%	11,76%	5,88%	0,00%	17,65 %
	Risk management	35,29 %	2,94%	2,94%	0,00%	8,82%	5,88%	2,94%	2,94%	38,24 %
	Execution, production, assembling, support services, after sales	20,59 %	11,76%	5,88%	0,00%	8,82%	5,88%	11,76%	8,82%	26,47 %

Annex 3 Mapping of actors in the ecosystem

This annex provides a more detailed map of the innovation ecosystem actors. While crucial as background information, it was deemed to be of best use when used to support the analysis contained in the body of the report.

When looking at essential and interrelated elements of building a knowledge economy, four elements of society must be built for the economy to function based on innovation and entrepreneurship[238]:

- The society must create **an appropriate economic incentive and institutional regime** that encourages widespread and efficient use of local and global knowledge in all sectors of the economy, that fosters entrepreneurship and permits and supports the economic and social transformations engendered by the knowledge revolution.
- The society must generate **skilled, flexible and creative people**, with opportunities for quality education and life-long learning available to all, and a flexible and appropriate mix of public and private funding.
- The society must build **a dynamic information infrastructure and a competitive and innovative information sector** of the economy that fosters a variety of efficient and competitive information and communications services and tools available to all sectors of society (not only "high-end" ICTs like Internet and mobile telephony, but also other elements of an information-rich society, such as radio, television and other media, computers, as well as other devices for storing, processing and using information, and a range of communications services).
- The society must create **an efficient innovation system comprising of firms, science/research centres, universities, think tanks and other organisations** that can tap into and contribute to the growing stock of global knowledge, adapt it to the local needs and use it to create new products, services and ways of doing business.

The country in question needs to develop a broad approach to its national innovation system, where the "narrow", directly innovation-related institutions (institutions, which promote acquisition and dissemination of knowledge and are the main sources of (technological) innovation) are embedded in a much wider socio-economic system, in which political and cultural influences and economic policies help to determine the scale, direction and relative success of all innovative activities[239].

To put the governance of RTDI into a wider context, there has been a general trend over the past decade for OECD countries to highlight the importance of RTDI policy. In Europe, RTDI policy is, at least in part, coordinated by the offices of prime ministers or similar central cabinets.

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[238] The World Bank (2002), Building Knowledge Economies: Opportunities and Challenges for EU Accession Countries; Final report of the Knowledge Economy Forum, Paris, Feb. 19-22, 2003; The WB and the World Bank Institute.

[239] • Freeman, C. (2002) Continental, national and sub-national innovation systems – complementarity and economic growth, Research Policy. Source: https://www.sciencedirect.com/science/article/abs/pii/S0048733301001366

Individual country histories and institutional preferences play a distinct role in how RTDI systems are organised. In countries that are currently less competitive in RTDI, it can be challenging to find the political will and consensus for prioritisation of funding and investments. This creates a precarious situation where innovation and development investments are short-term, prone to drastic shifts when there is a change in political administrations and taking a low profile during the election campaigns. There are many factors that play a role in addressing problems of low innovation and research competitiveness.

Political system actors and their roles

Actors in the political system are seen on two levels, i.e., the Government with its ministries and the other bodies implementing the national policies, such as the Slovenian Research Agency, SPIRIT Slovenia and SEF.

Slovenia's public administration is characterised as a centralised state, as the country does not have regions in the administrative sense. The central government holds the competences for the innovation and research policy, as well as for science, technology policy, industrial policy and higher education policy.

The **Slovenian Research Agency**[240] ARRS is an independent public funding organisation performing tasks relating to the National Research and Development Programme and creation of European Research Area. It provides framework for scientific research within the national budget and other sources, it promotes high quality scientific research and supports the development of the internationally comparable evaluation standards. The agency is responsible for the implementation of the:

- research programmes (funding research in public (mostly) and private research organizations, financing of concessional research programs)
- fundamental and applied competitive research projects and
- target research programmes (e.g. Slovenian Competitiveness 2006-2013, Science for Peace and Security 2004-2010, Resolution on the Strategic Orientations of Development of Slovenian Agriculture and Food Industry in 2020 and projects based on declared institutional interest).

The Slovenian Research Agency ARRS is focusing on early-stage research and development which can be described as projects where basic principles are observed and technology is still being formulated - basic/fundamental and applied research. The support for these institutions would also be focused on experimental proof of concept and technology that is validated in lab or in the relevant industrial environment.

The **Public Agency for Entrepreneurship, Internationalization, Foreign Investments and Technology** (**SPIRIT Slovenia**, hereafter referred to as SPIRIT) was set up in 2013 after the merger of the Slovenian Technology Agency (TIA) and the Public Agency for Entrepreneurship and Foreign Investments (JAPTI). SPIRIT is an implementing agency and it operates under the jurisdiction of the Ministry of Economic Development and Technology (MEDT). The Agency acts as a support agency for Entrepreneurship and Technology Promotion, as a Financial Incentives body and Internationalisation Promotion agency. The **Slovenian Enterprise Fund**

[240] ARRS (2021) http://www.arrs.si/en/index.asp

(SEF) is acting towards improved access to finance for micro, small and medium-sized enterprises in Slovenia, while the Slovene Research Agency acts as a financing body for public research and as a public research infrastructure body.

Both agencies, SPIRIT and SEF, together with MEDT address the later development phases in which technological readiness is above 4. This implies their instruments are focused on technology that is validated or demonstrated in lab or in relevant industry environment. The instruments also support prototype demonstration for the completion and actual proven products for manufacturing.

The **Government Office for Development and European Cohesion Policy** acts as a Managing authority for the implementation of the Slovenian Cohesion policy. Additionally, it is responsible for the implementation of the Slovenian Smart Specialisation Strategy (S3). A coordination vertical may be noticed within the scope of the Government Office for Development and European Cohesion Policy with the Smart Specialization Strategy. The network of SRIPs is closely linked to the Ministry of Economic Development and Technology due to financing and to both the Ministry and SPIRIT due to the implementation arrangements.

As a result, the effectiveness of cross-sector coordination in the strategic planning process may be questionable. SRIPS are financed by the Ministry of Economic development and Technology while coordination is reached with Government Office for Development and European Cohesion Policy for the planning the EU funding for innovation, research and development in Slovenia. EU funds are hugely important element of coordination among the ministries especially with Slovenia's high dependency on EU funding streams and governance arrangements depending on the requirements from the European Commission.

An overall observation from the interviews is that tools developed for the implementation of smart specialisation may facilitate better coordination between R&D and business, as well as integration of needs into policies, but the results of this will need to be proven.

The interview process identified the international scale-up as a major capacity weakness of the agencies in the country, especially SPIRIT, an issue which will need to be addressed in the future. The critical points pointed out in the interviews were long delays in the publication of calls for tenders and in practically fully closed and non-transparent planning of the calls for tenders; addressing this issue would improve the planning of projects and their impact. Transparency is seen as better in the scope of the ARRS field of focus which may also be seen in transparent and analytical overview of financing (see the web site of the Agency).

Less known and recognised among the participants in the survey and interviews are the Slovenian Regional Development Fund and the **Slovene Export and Development Bank**. The **Slovenian Regional Development Fund** promotes projects in entrepreneurship with incentives for priority areas of regional policy in order to reduce growth disparities, increase competitiveness and increase or maintain number of employees. Instruments are formulated in line with the regional development policy of Slovenia. As a result, the focus of the fund are the regional development priority areas and border problem areas while aiming at entrepreneurship, competitiveness, market orientation and technological development of

companies. The fund also promotes projects in wood processing and provides liquidity funds[241].

Knowledge institutions

Knowledge institutions and intermediary institutions include higher education institutions, research institutions and professional, training and skills institutions. Higher education institutions and public research institutions are the key research performers in Slovenia. Higher education is provided by universities and colleges established by the state or private ones. In 2016/2017, there were 28 public and 20 private vocational colleges with 31 different study programmes[242]. Slovenia currently has 7 accredited universities and 40 accredited independent higher education institutions[243].

According to Lesjak et al in 2018, 23,633 persons were involved in the implementation of research and development activities in Slovenia. Among them, 15,388 or 65.1% were researchers[244]. The workload of research and development staff in 2018 was equivalent to the work of 15,686 full-time employees, which is 6.6% more than in 2017. Almost two thirds (64.2%) of this workload refers to researchers in 2018. Compared to 2017, the workload of research and development staff in 2018 increased in all occupational groups, most notably for researchers, by 8.2%; for other support staff it increased by 6.3% and for technical staff by 2.7%[245]. According to ARRS data, there were 16 public research institutions in Slovenia in 2019 and in total they received over 182 million EUR in funding, of which over 106 million EUR was dedicated to research programmes and projects, 25 million EUR to development of human resources and over 3 million EUR to procurement of research equipment[246].

A 2021 study[247] "Investment efficiency analysis research and development activity in Slovenia" concludes that research organisations from the academic environment are most interested in cooperating with another group of research organisations. Higher ranking organisations in terms of cooperation are the University Clinical Centre Ljubljana, followed by Institute Jožef Stefan and the Faculty of Medicine and Biotechnical Faculty, both at University of Ljubljana. This is reflected in the responses to question about collaboration in the survey. While survey respondents were from a variety of institutions, their answers show that after joint projects are finished, collaboration is most often focused on joint preparation of scientific publishing (scientific articles, scientific monographs, etc.), while very rarely it continues to jointly develop and commercialise new products or services.

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[241] SRRS (2021) Programi spodbud. Source: https://www.srrs.si/#front-programs

[242] EURYDICE (2019) Vrste višješolskih in visokošolskih izobraževalnih zavodov. Source: https://eacea.ec.europa.eu/national-policies/eurydice/content/types-higher-education-institutions-77_sl

[243] NAKVIS (2021) Podatki o visokošolskih zavodih. Source: https://www.nakvis.si/analize-in-publikacije/porocila-strokovnjakov-in-odlocbe/

[244] Lesjak D., Breznik K., Dermol V., Laporšek S., Likar B., Lipnik A., Skrbinjek V., Vodopivec M., Novak M., Mohorko J., Tadina T., Žitko T. (2021) Analiza učinkovitosti vlaganj v raziskovalno-razvojno dejavnost v Sloveniji (AUV-RRD-SLO) - zaključno poročilo. Univerza na Primorskem, Fakulteta za management (UP FM), Mednarodna fakulteta za družbene in poslovne študije (MFDPŠ). ARRS in MIZŠ, 2021

[245] SURS (2020): Na voljo končni podatki o raziskovalno-razvojni dejavnosti (RRD) v 2018. Source: https://www.stat.si/StatWeb/News/Index/8692

[246] ARRS (2020) ARRS / Poročilo o financiranju 2019. Source: http://www.arrs.si/Report/fin-por-2019.aspx#P3566b4e228ce432a89188bb2e06f1dc7_3_101iT0R0R0x0

[247] Lesjak D., Breznik K., Dermol V., Laporšek S., Likar B., Lipnik A., Skrbinjek V., Vodopivec M., Novak M., Mohorko J., Tadina T., Žitko T. (2021) Analiza učinkovitosti vlaganj v raziskovalno-razvojno dejavnost v Sloveniji (AUV-RRD-SLO) - zaključno poročilo. Univerza na Primorskem, Fakulteta za management (UP FM), Mednarodna fakulteta za družbene in poslovne študije (MFDPŠ). ARRS in MIZŠ, 2021

Intermediary institutions, support services

SRIPs, Technology transfer offices, clusters and financial intermediaries like venture funds, business angels' associations and similar can be classified as intermediary institutions. Preliminary case study on best practices has revealed that countries with higher RDI index have reorganised the knowledge institutions in a way to raise the focus and funding on application-based research (business-oriented research). This in turn positively influenced the increase in patent activities. For example, after year 2000 Austria has seen above-average growth in patents and is, in proportion to its number of inhabitants, clearly above EU average.

In order to facilitate exchange and cooperation among research and industry Slovenia engaged in 9 SRIPs, established to cover the priority areas of the Smart Specialization Strategy. According to SPIRIT data, SRIPs connect large numbers of industry representatives with the research arena[248].

Table 25 – Focus areas of SRIPs

SRIP	Networks
Smart Cities and Communities	Vertical: ● Health ● Energy and other supply ● Mobility, transport and logistics ● Security ● Quality of urban living ● Smart city ecosystem
	Horizontal: ● Digital transformation ● IoT (Internet of Things, embedded systems and sensors) ● IoS (Internet services, platforms) ● Cyber security ● HPC & Big Data ● GIS-T
Smart buildings and home with wood chain	● Supply and management of buildings and connectivity with the neighbourhood ● Construction ● Interior elements ● Smart almost zero energy building
Network for the transition to a circular economy	● Sustainable energy ● Biomass and alternative raw materials ● Secondary raw materials ● Functional materials ● Processes and technologies ● Circular business models
Sustainable food	● Sectoral value chains ● New technologies and materials ● Sensory research ● Digitization
Sustainable tourism	● Sustainable systems and solutions ● Digital transformation
Factories of the Future	Vertical: ● Robotic systems and components

[248] SPIRIT (2021) STRATEŠKO RAZVOJNO-INOVACIJSKA PARTNERSTVA – SRIP pregled področja

	• Advanced photon technologies and intelligent laser systems for the factories and clinics of the future • (High-tech automated) smart plasma systems (for continuous production) • Advanced sensors • Advanced materials • Intelligent control systems • Smart mechatronic tools • Smart factories
	Horizontal: • Photonics • Nanotechnologies • Modern production technology for materials • Plasma technologies • Robotics • Control technology
Health- Medicine	• Translational medicine • Active and healthy aging • Resistant bacteria • Biopharmaceuticals • Natural medicines and cosmetics • Cancer treatment
Mobility	• Components and systems for green, safe and comfortable vehicles • Advanced transport and logistics with business models • Advanced infrastructure • Digitization and new technologies for higher competitiveness • Green models and approaches
Materials as products	• Steel and special alloys sector • Aluminium • Technology • Multicomponent smart materials • Functional coatings and advanced metal binders

Source: SVRK (2020): Tabela prioritet Slovenske strategije pametne specializacije (S4) in pripadajočih fokusnih področij in tehnologij, Source: https://www.gov.si/assets/vladne-sluzbe/SVRK/S4-Slovenska-strategija-pametne-specializacije/Tabela-fokusnih-podrocij_ANza3fazo_november-2020.pdf

A significant part of the innovation ecosystem in Slovenia evolved on the basis of value chains, with support for development of various forms of cooperation, ranging from clusters to centres of excellence and competence and currently to SRIPs. Since pre-accession times it was mostly driven by the EU funding which was also evolving with its best practices and downsides. The interviewees pointed out that the SRIPs platform needs to remain in place for some time in order to evaluate its real efficiency and effectiveness as in the past the tools for the innovation and research were changing too fast.

Technology transfer offices are the bridge that links research with business by means of connecting researchers and in some cases students with potential innovations to businesses looking for technology and knowledge. They encourage a variety of collaboration opportunities, usually in the field of the institution located in. In Slovenia, technology transfer offices are organised as part of various research institutions, e.g., University of Ljubljana with the Knowledge Transfer Office, University of Maribor with the Knowledge and Technology

Transfer Office, TTO at Faculty of Information Studies in Novo mesto, Center for Technology Transfer and Innovation at the Jožef Stefan Institute, Technology Transfer Office at the National Institute for Biology and similar offices at the Chemical Institute and so on. There is also an Association of Technology Transfer Professionals of Slovenia, which was established to support these activities. Interviewees see technology transfer offices (TTO) as a unique support tool for collaboration between researchers and businesses, but the system will need to evolve and increase its capacity to help researchers and students with potential innovations to structure these ideas in more advanced ways. The TTOs currently do not have the necessary funding, networks and, in some cases, knowledge to develop ideas to the level necessary to understand their commercialisation potential and present them to businesses. Although some TTOs have achieved significant results, their role and mechanisms need to be further developed. The current legislation prevents public universities from establishing spin-offs, which is, according to the interviewees, an obstacle for closer cooperation between TTO and SIO network. With this legal obstacle the public financed research for businesses is blocked. This problem is currently mitigated by means of licencing agreements, which allow at least some of the knowledge and research potential of the universities to be commercialised. Besides, teaching staff and other PRO employees face several obstacles when attempting to develop business entities while employed in the public institution, which further prevents the spillover of knowledge and research potential.

The **Start:up Slovenia** project was launched in 2004 when the Venture Factory Institute registered the Start:up Slovenia brand and in 2011, in collaboration with the Ministry of Economic Development and Technology and Technology park Ljubljana. Start:up Slovenia became an integral part of the P2 start-up incentive of the Slovene Enterprise Fund. This enables companies to take part in the Start:up Slovenia pre-selection procedure and acquire additional points for the P2 tender[249]. The start-up ecosystem in the country is still evolving, with private corporations engaging in the system by sponsoring events and by establishing private accelerators and VC funds. Private accelerators with small seed investments are present in Slovenia, but they operate with relatively infrequent and minor investments[250]. Nevertheless, this helps the development of the private-led start-up system in the country. To become more dynamically engaged in start-ups, several public universities in more developed ecosystems started their own start-up incubators[251], such as incubator of the University of Ljubljana (LUI), which they operate with various degrees of success.

Slovene Export and Development Bank (SID Bank) promotes the development and export and is owned by the Republic of Slovenia. While the SID Bank doesn`t focus on the problems of use of the available funding and the absorbance capacity of companies to absorb the funding their key activities of the SID Bank are to recognise and finance projects identified as a funding market gaps. These may be found in SME funding, research, development and innovation, environmental protection, energy efficiency and climate change, international business transactions and international economic cooperation, regional development, and in failures of the market when financing the public infrastructure. Since 2017 the Bank acts as the

[249] Start:up Slovenia (2021) Start:up Slovenia Project. Source: https://www.startup.si/en-us/startup-slovenia-project

[250] ABC Accelerator, (2018) SOUTH-EAST EUROPE STARTUP REPORT 2018. Source: https://www.startup.si/en-us/strategy-and-goals/documents/southeast-europe-startup-report-2018

[251] Start:up Slovenia (2021) Start:up Slovenia Project. Source: https://www.startup.si/en-us/startup-slovenia-project

Fund of Funds for the use of European Cohesion Funds. The SID Bank was appointed as a manager of the Fund of Fund with €253 million invested from the European Cohesion Funds to finance projects until 2023. Debt and equity financing is focused on four areas: research, development and innovation, SMEs, energy efficiency and urban development. With the financial intermediaries providing additional funds due to the leverage requirement additional €400 were made available to enterprises and other users until 2023.[252]

Slovenian Regional Development Fund (SRDF) has two strategic directions one being used by the as a policy tool for the grant management with the public tenders for loans and being a tool for the European development processes with functions of the certifying authority and as preparation and implementation of projects co-financed from the EU and outside the EU budget. The grant programmes are forms in the scope of entrepreneurship, agriculture and forestry, financing of municipalities, prefinancing of the EU funded projects, incentives to projects with in the areas of the Italian and Hungarian minorities while the fund also acts as a guarantees provider for approved bank loans for entities of various legal and organizational forms.

Innovation infrastructure and equipment

Innovation infrastructure consists of technology parks, business and university incubators, one-stop-shops - SPOT, and similar. In terms of new developments, from April 2021 the VEGA EuroHPC Supercomputer, part of a supercomputer centre, is operating at PETA scale level. The project has clear orientation towards research that includes fields of artificial intelligence, processing big data (smart cities, IoT...), medicine, new materials, mechanical engineering and other advanced science areas while it is to be seen how this will spill over to the business and commercialisation.

At a more general level, the Research Infrastructure Roadmap 2011-2020 (last updated 2016), noted the major challenge was as being depreciation of the investments of previous years, due to low levels of funding from both national and EU sources. Irrespective of this, Slovenia has been able to participate in a good number of infrastructure projects since 2011, for example CESSDA, PRACE, DARIAH, ESS, SHARE, CERIC, ELIXIR in EATRIS. The main challenge therefore is which models of funding and support could be used to sustain and augment this participation in the next period, given concerns regarding maintenance and depreciation of equipment.

The **subjects of the innovative environment** (SIO) are entrepreneurial and university incubators, business accelerators, technology parks and others related organizations that promote the creation of new businesses, especially those that are important for greater competitiveness, higher added value and more even regional development of entrepreneurship[253]. Key activities of the SIO are to inform and educate entrepreneurs or potential entrepreneurs, to validate business ideas and perform diagnostics, mentor entrepreneurs and accelerate business ideas. Under national funding, the subjects of the innovative environment are supported with financial incentives for entrepreneurs or would-be

[252] SID (2021) About SID Bank and Financing. Source: https://www.sid.si/en/about/about-sid-bank

[253] SPIRIT (2020) Predstavitev Subjektov inovativnega okolja (SIO) in uspešnih podjetniških zgodb, ki so prejeli podporo od sledn jih. SPIRIT, Ljubljana.

entrepreneurs. The SIO network has financed over 500 businesses cases in 2020, representing a major management and implementation task. Detailed evaluations of the SIO network need to address the different focuses of these arrangements and evaluate their level of innovation and business success.

Interviews conducted in the study have shown that technology parks and incubators in the country have issues related to ownership, financing and management. Some infrastructure is owned by municipalities or other bodies and technology parks and incubators often must pay rent or repay the loans used for construction. This may hinder their ability to actively pursue their core business of supporting start-ups and technology development.

On the other hand, some technology parks and incubators have sold most of their premises to fund projects. Their management is often focused on financial management of institutions rather than developing communities around support services and their branding. There is a third possibility where incubators and accelerators are developed from private funds.

Some technology parks and incubators, depending on location, may lack critical mass for local engagement as they note different rates of business creation and lower potential for businesses to employ skilled personnel. Any discussions on performance would need to take note of regional disparities, while different management and financing mechanisms should be made available for the SIO network to function.

SPOT is a one-stop-shop offering comprehensive support and free public services for business entities. SPOT brings together the institutions providing assistance, information and advice to companies and business entities.

Industrial system - business

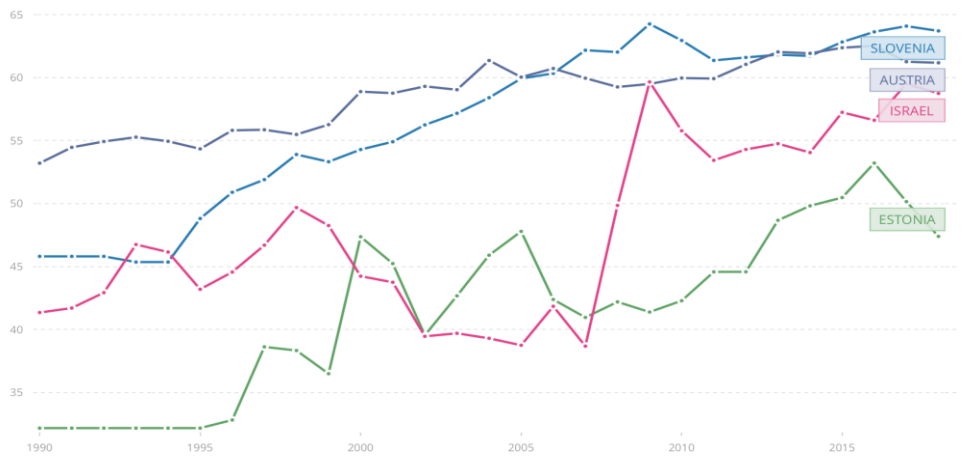
Of the total **23,590 researchers in Slovenia, 14,356 were employed in the business sector**. The government sector employed 3,232 researchers, the higher education sector 5,877 researchers and the private non-profit sector 126 researchers[254].

The European Innovation Scoreboard[255] reveals that Slovenia performed well in the category of Firm Investments, but still lagged behind the strong Innovators. Performance in the Innovators dimension declined by 25.6%. Same goes for performance in Linkages, where Slovenia declined for 22.2% while the EU average increased by 3.0 % between 2012 and 2019. Non-R&D Innovation Expenditure results show very strong decreases for Slovenia, same as for Croatia, Portugal and Turkey. When looking at Medium and high-tech exports as a percentage of manufactured exports Slovenia performed well in comparison to Estonia, Austria, Israel.

[254] SURS (2019) In 2018 gross domestic expenditure on research and development in Slovenia amounted to 2.0% of GDP. Source: https://www.stat.si/StatWeb/en/news/Index/8441

[255] European Commission, (2020a) European innovation scoreboard 2020, Source: https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en

Figure 36 - Medium and high-tech exports as a % manufactured exports

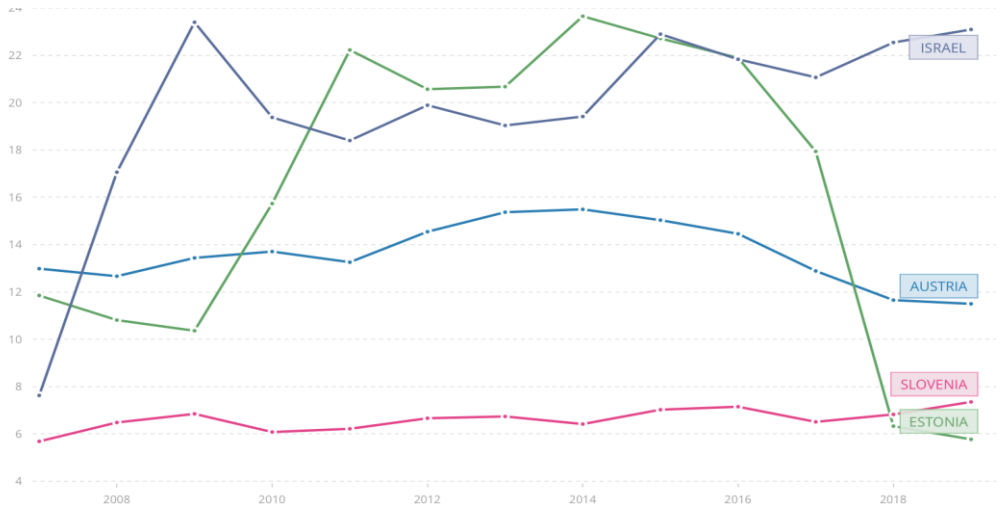


Source: World bank[256]

The average value of the high technology exports for Slovenia during 2007 and 2019 was 1.628,7 million U.S. dollars with a minimum of 1.260,21 million U.S. dollars in 2010 and a maximum of 2.333,33 million U.S. dollars in 2019. This ranks Slovenia to 25th place among European (not EU) countries or 44th place in the global ranking[257].

Slovenian performance in high tech export as a % of manufactured exports shows a different picture then compared to overall medium and high-tech exports as a % manufactured exports. Here the performance of Slovenia is weak also when compared to Austria and Israel while Estonian performance dropped significantly in 2016/2017 and is even lower than Slovenian performance in 2018.

Figure 37 - High-technology exports as a % manufactured exports



[256] World bank (2021) Medium and high-tech exports as % manufactured exports. Source: https://data.worldbank.org/indicator/TX.MNF.TECH.ZS.UN?end=2018&locations=SI-EE-AT-IL&start=1990&view=chart

[257] Global economy (2021): High tech exports - Country rankings. Source: https://www.theglobaleconomy.com/rankings/High_tech_exports/

Source: World bank[258]

Slovene companies (particularly the large ones) have lower value-added in the global value chains than seen from the country. As explained before, country is small, with an open economy and is relatively strongly involved in global value chains. Still, production of motor vehicles and metal products represents a high share of GVC integration [259], with lower added value. This results in businesses lacking capacity to invest in research and innovation. After several years of decline, investments in R&D slipped below the EU average and are much lower than in the leading innovator countries[260]. Investments decreased both in the public sector by 2016 and in the private sector in 2015-2017 [261]. The business sector invests the most in research and development, and until 2015 this was a significant source of research and development investment growth (see chapter 3.2).

The analysis conducted by the Chamber of Commerce and Industry of Slovenia[262] shows that more innovative companies innovate more openly than others and that they actively cooperate with various stakeholders in the innovation ecosystem. Continuous innovation processes are still at the forefront in the business sector. One positive development is that more than one third of product/service sales in the last three years resulted from in-house development and innovation in companies. Many companies have innovation strategies and many employ internal innovation systems based on different innovation methods and approaches. Some companies, mostly larger ones, are encouraged by open innovation movement and launch their own departments connecting and developing products with use of different open innovation techniques.

An observation from the interviews in this study is that companies, regardless of size, lack knowledge about structuring their in-house innovation strategies, models and processes. The same applies to researchers, who have strong expert knowledge, but lack entrepreneurial skills, and this makes collaboration between businesses and researchers more difficult. Public higher education institutions continue to provide formal courses that seldom include entrepreneurship or any other subjects relevant for start-ups[263]. It is worth noting that SPIRIT is working on providing support for sustainable business strategic transformation of companies and cooperates with Chamber of Commerce to promote it. An observation from the interviews refers to the need to facilitate long-term collaboration projects between businesses, researchers and research institutions that would give them enough time and space to identify the knowledge potential, scope potential areas and options for close collaboration, to structure that collaboration and then carry it through to completion.

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[258] World bank (2021) High-technology exports as % manufactured exports. Source: https://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS?locations=AT-EE-IL-SI

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

[260] Ibid.

[261] Ibid.

[262] Chamber of Commerce and Industry of Slovenia (2020) Takšno je dejansko stanje inovativnosti v slovenskem gospodarstvu. Glas gospodrastva, december 2020. Source: https://www.gzs.si/Portals/SN-informacije-Pomoc/Vsebine/GG/2020/December/gg_12_lores.pdf

[263] ABC Accelerator, (2018) SOUTH-EAST EUROPE STARTUP REPORT 2018. Source: https://www.startup.si/en-us/strategy-and-goals/documents/southeast-europe-startup-report-2018

Annex 4 List of relevant legal and policy documents

Legal framework

The **Public Finance Act** (PFA) Official Gazette RS, 11/11 - official consolidated text, 14/13 - correction, 101/13 , 55/15 - FISP, 96/15 - ZIPRS1617, 13/18 and 195/20 - US).

The act regulates the composition, preparation and execution of the state budget and the municipal budgets. The law also prescribes management of state and municipal property, state or municipal borrowing, guarantees of the state or municipalities, management of their debts, accounting and internal control of public finances and budget inspection. The provisions of the Act also relate to the direct users of the budget.

As a key tools for the fiscal management of the state the law gives a frame to the National Development Policy Program, forecasts of macroeconomic aggregates and preparation of the fiscal scenarios, forecasts of revenues or receipts and expenditures and assures preparation of the medium-term fiscal strategy.

The legal framework for private sector innovation in Slovenia greatly relies on the **Supportive Environment for Entrepreneurship Act** (ZPOP-1), Official Gazette RS, 102/07, 57/12, 82/13, 17/15, 27/17, 13/18). This act, introduced in 2007, has been improved several times, with the most recent changes done in 2018.

The **key objectives** of the law are to establish an effective support environment at local, provincial and national levels, create awareness of the importance of entrepreneurship for economic development, fulfil the creative entrepreneurial potential of citizens, increase the opportunities for setting up new businesses, stimulating their growth, creating new jobs, accelerate the exploitation of entrepreneurial and innovation potential, establish an effective support environment for potential entrepreneurs and operating companies at all stages of their development, increase access to comprehensive support services and to promote networking between research and education organisations and the business community.

The law states that **industrial policy,** as the basic planning document in entrepreneurship and innovation at national level, **incentives for entrepreneurship and innovation** (regional incentives, micro, small and medium-sized enterprises (SMEs), risk capital, research, development and innovation, training, incentives under the "de minimis" rule and other incentives) and the **ministry responsible for the economy** with the **Public Agency for Investment, Technological Development, Entrepreneurship and Internationalization** (SPIRIT) **are the key tools for achieving the objectives** of the law.

The public agency, **SPIRIT**, is set up according to this act to:

- **Formulate, develop and implement measures to promote entrepreneurship** and provide an effective supportive environment for entrepreneurship in accordance with the guidelines and policies of the ministry responsible for the economy;
- **Implement measures to promote entrepreneurship**, the business environment and to create a positive climate for the development of entrepreneurship;

- Implement measures in the field of education and training for entrepreneurship;
- Be **involved in European Union programmes and other international funding opportunities** in the field of promoting entrepreneurship and competitiveness for the transfer of knowledge and good practices; and
- Decide on the **selection of projects and grant financial incentives** for the implementation of projects in the field of support services, and to conclude financing agreements with selected applicants.

The **public fund for the promotion of entrepreneurship** is developing the support mechanisms for:

- the provision of services and start-up capital for the faster start-up and start-up of new businesses with direct incentives for the initial financing of business projects in the start-up and start-up phase,
- providing more favourable sources of financing for development investments of companies with subsidies, favourable financial resources and guarantees,
- Encouraging private investment and financing of entrepreneurial projects at all stages of development with equity, by providing favourable credit sources and guarantees for investors.

The public fund for the promotion of entrepreneurship implements the measures in the form of services, direct financial incentives and indirect financial incentives through commercial banks, venture capital companies and other financial institutions, innovative environment and other legal entities of public and private law, or in cooperation with them.

The Research and Development Activity Act (ZRRD) (Official Gazette 22/06 61/06, 112/07 , 9/11 , 57/12, 21/18 and 9/19) sets out the principles and objectives of research and development policy and regulates the implementation of these activities financed from the national budget and other sources (e.g European programs and funds, local communities and the economy). The law aims at achieving Slovenia's social and economic development goals by setting up principles for the transition of Slovenia to a knowledge-based society, which sets research and development activities as a development priority.

The law sets grounds to create new knowledge and insights and to transfer internationally available knowledge for the public and economic benefit to improve the social well-being. The law strengthens the capacity of the knowledge to support the social and technological progress as the main source to increase labour productivity and national competitiveness in the global space which should improve quality of life and consolidate national identity.

The objectives of the law are to:

- increase the social importance and efficiency of research and development activities by establishing a polycentric model of science development and networking of research organizations in the field of science, education and economy;
- create conditions for autonomous and professionally independent guidance, evaluation and monitoring of research and development activities;
- promote the functioning of development cores in science, economy and society in areas that are the basis of long-term economic and social development;

- develop human resources while ensuring equal opportunities for women and men and developing research creativity by increasing the role of science in staff education, especially in universities;
- increase the total volume of funds and investments in research and development, which will be achieved by directing public funds to strategic development areas that will encourage an increase in the volume of entrepreneurial investments;
- promote international and interdisciplinary cooperation.

The **Public Funds Act** (ZJS) (Official gazette RS, 77/08, 8/10 and in 61/20 – ZDLGPE) (1) regulates a **public fund** as a possible form a legal person under public law, but it does not cover mutual funds, pension funds and legal persons of private law. According to this act, a public fund is a legal entity of public law established by the founder for the implementation of the policy in a certain field and it is established for the special-purpose assets.

The public funds are established for **promoting development** in a given field, **implementation of** social, cultural, environmental, housing, spatial, agricultural, nature protection, mining or other **policies** of the founder, **settlement of long-term liabilities** of the founder, **real estate management** of the founder, **promoting creativity** in science, culture and education through the awarding of prizes, scholarships, tuition fees, project funding and other forms of incentives and for other activities specified by law. Most relevant for this project, this Act is used for the establishment and regulation of the **Slovene enterprise fund**.

The **Venture Capital Companies Act** – ZTDK (Official gazette RS, 92/07, 57/09) regulates the status, investments and control of venture capital companies having their registered office and management in Slovenia. **Venture capital,** according to this Act, is seen as **equity investments in companies whose securities are not traded and have not been traded on a regulated market and whose securities are invested according to the principle of active management in the form of capital increase through contributions or the establishment of a company**.

Venture capital can be invested with several purposes: firstly, **financing the development of the initial concept of the company's business model** (seed capital) secondly, **financing of product or service development and initial marketing** (start-up capital) or, lastly, **financing of further development** of the company to increase production capacity, develop the market, products or services and provide additional working capital (expansion capital). Venture capital is thus not an investment the purpose of which is to rehabilitate companies.

According to the Act, a venture capital company is a company which is in accordance with the regulations governing companies and is established in the legal form of a dual company, a limited liability company, a joint stock company or a limited partnership. A venture capital company may, for the sole purpose of making a profit, invest, manage and dispose of venture capital and perform the following operations: invest available cash in the form of ownership shares in other companies, in debt securities and deposits with banks; grant a loan or guarantee or mezzanine capital on market terms to companies in which it participates with venture capital; or take loans.

The **Investment Promotion Act** – (ZSInv) (Official gazette RS, 13/18) determines the forms of investment incentives, the conditions, criteria and procedure for granting investment incentives, as well as activities for the promotion of investments and internationalisation of companies. The Act provides the basis for the public bodies to use subsidies, loan guarantees, interest rate subsidies and purchase of real estate owned by a self-governing local community at a price lower than the market price as incentives.

The **Promotion of Foreign Direct Investment and the Internationalisation of Enterprises Act – (**ZSTNIIP) (Official gazette RS, 86/04, 78/06, 107/06, 11/11, 57/12, 17/15) aimed to **promote incoming foreign direct investment** and to attract foreign investors to invest in Slovenia through efficient use of public funds to promote economic development of the country. The main aim was **to improve Slovenia's competitiveness in international trade** through efficient use of public and private financial resources and to reduce costs and risks for residents entering markets outside the territory of Slovenia. In 2018 it was replaced **by Investment Promotion Act** (ZSInv) (Official gazette RS, 13/18) which defines the forms of investment incentives, conditions, criteria and procedure for granting investment incentives, as well as activities for investment promotion and internationalization of companies. It includes, among others, provisions for Public Agency for promotion of investment and internationalization and activities for internationalisation, including the possibility to open an office of the Public Agency abroad and the obligation of preparation of a 5-year programme of promotion of the internationalisation of companies.

Based on Investment and Promotion Act, **financial incentives for investment may be provided** both for domestic and foreign investments in the state budget and from other domestic and international sources when objectives and conditions of **new employment, transfer of knowledge and technologies, harmonious regional development and synergistic effects of connecting foreign investors with Slovenian companies** are met.

Based on the **Corporate Income Tax Act** (ZDDPO-2) (Official Gazzette RS 117/06 , 56/08 , 76/08 , 5/09, 96/09 , 110/09 - ZDavP-2B, 43/10 , 59/11 , 24/12 , 30/12 , 94/12 , 81/13 , 50/14 , 23/15 , 82/15 , 68/16 , 69/17 , 79/18 and 66/19), article) 55 and **Personal Income Tax Act** (Official Gazzette RS 48/90, 8/91, 14/92 - ZOMZO, 7/93 , 18/96, 91/98, 1/99, 117/06, 117/06, 24/08, 101/13 and 22/14, article 61), taxpayers can claim a reduction of the tax base in the amount of 100% of the amount paid for the investments in research and development during the tax period. The taxpayer may not claim deductions for the part of such investments financed from the budget of the Republic of Slovenia or the EU budget if these funds have the nature of a grant. For investments in equipment and intangible assets, relief is excluded by the application of the general investment tax relief (MF, 2017).

The main **rules on the application of tax relief for investments in research and development** in articles 5, 6 and 7 that specify[264] are the following:

- Types and content of investments that are considered investments in research and development;

[264] Ministrstvo za finance (2017) DAVČNE OLAJŠAVE ZA VLAGANJA V RAZISKAVE IN RAZVOJ, Smernice za zagotavljanje večje davčne gotovosti pri uveljavljanju davčnih olajšav za vlaganja v raziskave in razvoj, pripravljene v sodelovanju MGRT in FURS in Vprašanja in odgovori glede davčnih olajšav za vlaganje v raziskave in razvoj pripravljeni na FURS, Podrobnejši opis. Republika Slovenija, Ministrstvo za finance, Finančna Uprava Republike Slovenije.

- Types of costs that may be included in the amount of investments in research and development; and
- Additional defining criteria or criteria for assessing investments in research and development.

The Ministry of Economic Development and Technology published four opinions assessing research and development activities or R&D projects and programmes in tax relief for investments in R&D and assured the translation of the OECD Frascati Manual 2015. The translated and proofread working translation has been approved by the OECD as a working tool. Definitions, criteria and conditions for claiming R&D incentives are derived from existing European Union rules, such as the Community Framework for State Aid for Research and Development and Innovation (2006 / C 323/01 - Community Framework) and Commission Regulation (EU) no. 651/2014 (Regulation). The definitions of research and development as spelled out in Article 5 of the Rules (i.e. basic research, industrial research, experimental development) are taken from the Community Framework in Chapter 2.2. Definitions. The Community Framework also lists the OECD Frascati Manual as an aid in classifying the various activities (MF, 2017).

The Industrial Property Act (Official Gazette RS, No. 51/06, 100/13 and 23/20) determines the types of industrial property rights and procedures for granting and registering of the rights regulated, judicial protection of rights and representation of parties in proceedings. Industrial property rights can exist in the form of a patent, an additional protection certificate, a model, a trademark and a geographical indication.

The **Regulation on development planning documents and procedures for the preparation of the draft state budget** (Official Gazette 54/10 and 35/18) set up the methods for preparation, implementation and monitoring of development planning documents, policy formulation and determination of national development priorities, preparation of a budget memorandum and procedures and documents for the preparation of the state budget, its amendments and supplementary budget and other documents related to these acts.

The regulation also applies to the **preparation of government positions on development planning documents at the level of the European Union and international organisations** and other obligations at the international level while is also applies to the preparation of proposals for financial plans of indirect users of the budget.

The regulation sets up **principles** for the preparation and implementation of the government development policies which need to be prepared respecting principle of development priorities, economic, social, environmental, and spatial possibilities and constraints, principle of continuity and principle of cooperation with interested public and stakeholders.

The table below summarises the key elements of the legal system in Slovenia focusing on the objectives and tools for each of the Acts mentioned above.

Table 26 - – Key elements of the legal system in Slovenia

	Objectives	Tools
Public Finance Act	• Regulates the composition, preparation and execution of the state budget and the municipal budgets. • Management of state and municipal property, state or municipal borrowing, guarantees of the state or municipalities, management of their debts, accounting and internal control of public finances and budget inspection. • Provides the frame for the direct users of the budget.	• National Development Policy Program, • Forecasts of macroeconomic aggregates and preparation of the fiscal scenarios, • Forecasts of revenues or receipts and expenditures • Medium-term fiscal strategy.
Supportive Environment for the Entrepreneurship Act	• Establish support environment • Create awareness of the importance of entrepreneurship • Increase opportunities for new businesses, stimulating growth and job creation • Accelerate exploitation of entrepreneurial and innovation potential • Comprehensive support services • Promote networking between research and education organizations and the business community	• Industrial policy • Incentives for entrepreneurship and innovation • Public Agency for Investment, Technological Development, Entrepreneurship and Internationalization (SPIRIT) • Public fund for the promotion of entrepreneurship
Research and Development Activity Act	• increase the social importance and efficiency of research and development activities by establishing a polycentric model of science development and networking of research organizations in the field of science, education and economy; • create conditions for autonomous and professionally independent guidance, evaluation and monitoring of research and development activities;	• Research and Innovation Strategy of Slovenia. • Council for Science and Technology of the Republic of Slovenia • Funds for financing research and development • Non - governmental organizations in the public interest • Databases • public research institute and public infrastructure institute

	• promote the functioning of development cores in science, economy and society in areas that are the basis of long-term economic and social development; • develop human resources while ensuring equal opportunities for women and men and developing research creativity by increasing the role of science in staff education, especially in universities; • increase the total volume of funds and investments in research and development, which will be achieved by directing public funds to strategic development areas that will encourage an increase in the volume of entrepreneurial investments; • promote international and interdisciplinary cooperation.	• cooperation with universities and independent higher education institutions • Provision of public service on the basis of a concession
Public Funds Act	• Promote the development and implementation of the policy in each field/policy • Settlement of long-term liabilities of the founder • Real estate management of the founder • Promoting creativity in specific policy/sector	• Prizes • Scholarships • Tuition fees • Project funding and • Other forms of incentives
Venture Capital Companies	• Enabling equity investments in companies with the purpose of financing seed capital, start-up capital, expansion capital	• Invest available cash in the form of ownership shares in other companies • In debt securities and deposits with banks • Grant a loan or guarantee or mezzanine capital on market terms to companies in which it participates with venture capital • Take loans

Investment Promotion Act	• investment incentives and activities for investment promotion and internationalization of companies • operation of Public Agency for promotion of investment and internationalization, including possibility to open an office abroad • obligation of preparation of a 5-year programme of promotion of the internationalization of companies	• Free offer of information • Advisory or other services to investors, both domestic and foreign • Marketing and promotion of Slovenia and opportunities for investments • Granting financial incentives for investment and other similar tools
Supportive Environment for the Entrepreneurship Act	• Establish support environment • Create awareness of the importance of entrepreneurship • Increase opportunities for new businesses, stimulating growth and job creation • Accelerate exploitation of entrepreneurial and innovation potential • Comprehensive support services • Promote networking between research and education organizations and the business community	• Industrial policy • Incentives for entrepreneurship and innovation • Public Agency for Investment, Technological Development, Entrepreneurship and Internationalization (SPIRIT)
Industrial Property Act	• to protect industrial property rights	• Industrial property rights are a patent, an additional protection certificate, a model, a trademark, and a geographical indication.
Regulation on development planning documents and procedures for the preparation	• principle of development priorities, • principle of economic, social, environmental, and spatial possibilities and constraints, • principle of continuity and • principle of cooperation with interested public and stakeholders.	• Development Strategy of Slovenia • Public consultation process • responsibility for the coherence of government development policies) • Procedures for preparing and amending the state budget

of the draft state budget		

Policy framework

The vision of the **Industrial Policy of Slovenia** (adopted by the Government in 2013) is to support entrepreneurship and innovation and development of promising technological and industrial areas that respond to societal challenges, create conditions for continuous restructuring of existing industry into energy, material, environmentally and socially efficient knowledge industry and innovation for new, more sustainable and better jobs and greater involvement in international business flows.

The **general objective** of the policy is to restructure the existing industry into an energy, material, environmentally and socially efficient knowledge and innovation industry for new, more sustainable and better jobs and greater involvement in international business flows. This shall be measured using an indicator of increase in value added per employee from 60% to 80% of the EU-27 average. The table below covers in more detail the specific objectives of the Industrial Policy of Slovenia and its related indicators.

Table 27 - Specific objectives of the Industrial Policy of Slovenia

Objectives	Indicator
Improve the competitiveness of the business environment.	• IMD - baseline 2012: 51/59 countries • WB-Doing Business - starting point 2012: 37/183 countries
Improve access to affordable funding to support the development and growth of businesses in all stages of development.	• Financial market development - rise on the WEF scale (starting point 2012-13: 128/144 countries) • Value of earmarked funds to support the growth and development of enterprises with appropriate financial conditions
Promote innovation and entrepreneurial investment in research and technological development. Connecting stakeholders from research and development to the market into various forms of clustering and effective organization of knowledge institutions, research, executive agencies, chambers and companies throughout the value chain (e.g. between researchers and companies, between manufacturers of individual parts to market placement).	• Better technological preparedness - increase in the WEF scale (starting point 2012-13: 34/144 countries) • Higher share of medium and high technology-intensive products in total exports (IMAD)

Positive impact on sustainable economic and social development - socially responsible corporate governance, high ethical standards and promotion of promising technological and industrial areas that respond to societal challenges.	● Increase in the share of technologically more demanding industries in value added (IMAD) ● Emission intensity of the economy, volume of production of emission-intensive industries, energy intensity in manufacturing, share of RES, intensity of logging (summarized according to IMAD, Development Report 2012), volume of the 'environmental goods and services' sector, share of eco-innovations, number of companies included in the EMAS scheme, material efficiency of the economy, green jobs, number of green patent applications with the EPO, share of green public procurement
Orientation towards active internationalization of the economy in order to increase the involvement of the economy in international business flows.	● Increase in exports (SORS) ● Increase in foreign direct investment (BS, OECD)
Development of creative, innovative, entrepreneurial and competent staff and adaptation of the education system to the needs of industry (e.g. promoting the mobility of staff from universities to industry and vice versa).	● Increase in employment, especially of highly educated and professionally qualified staff, and decrease in structural unemployment (SORS) ● Strengthening entrepreneurship - rising on the GEM scale (starting point TEA - early entrepreneurial activity, 2012: 54/54 countries)

Tools foreseen by the policy may be grouped in several areas:

- Improving the business environment;
- Strengthening entrepreneurship and innovation - Focusing support on new, innovative and growing companies;
- Responding to societal challenges - Focusing support on technological and industrial prospects areas; and
- Activities for long-term industry development.

As presented in the **Resolution on the Research and Innovation Strategy of Slovenia 2011–2020** (Official Gazette RS, 43/11), Slovenia aimed to set up, by 2020, a responsive research and innovation system co-created by all stakeholders and open to the world. This system will be firmly anchored in society and its services will be responding to the needs and desires of citizens, addressing the major societal challenges of the future such as climate change, energy, resource scarcity, health and aging. As a result, the reputation and attractiveness of the work of researchers, developers and innovators will increase in society.

The **goal** of the strategy is to establish a modern research and innovation system that will enable higher quality of life for all through the means of critical reflection on society,

effective solutions for social challenges, raising added value per employee and providing more and better jobs.

The Research and Innovation Strategy of Slovenia uses the following tools:

- **Well-coordinated policy planning, implementation and evaluation process** among all stakeholders involved in the innovation system, as well as ongoing adaptation of institutions in the fields of research, technology and innovation to changes in the environment;
- **Autonomy and responsibility of public research organisations**;
- **Knowledge transfer**;
- **R&D cooperation in the EU and worldwide**;
- **Public funding of research and development**;
- Ethics in research and in researchers;
- Establishing capacity to support research and innovation:
    - strengthening human resources, specialization,
    - development of research infrastructure,
    - development of entrepreneurial-innovation infrastructure,
    - information infrastructure in support of the innovation system;
- Innovative economy:
    - promoting private investment in research and development,
    - more innovative start-ups,
    - faster growth of innovative companies,
    - strengthening the innovation capacity of companies;
- Promotion of science, creativity and innovation in society and education.

The **Smart Specialisation Strategy of Slovenia** from December 2017 focuses on "sustainable technologies and services for a healthy life," which should position Slovenia as a green, active, healthy and digital region with superior conditions for creation and innovation, focused on the development of medium- and high-tech solutions in niche areas. In priority niche areas, Slovenia will move from a follower to a co-creator of global trends, which is the mission of S4. The key target S4 variable is the increase in value added per employee, which will be measured at the level of individual areas of application. At the aggregate level, the success of S4 implementation will be reflected in (until 2023):

- Increased share of high-tech products in exports (an increase from 22.3% to the EU-15 average of 26.5%);
- Increased share of exports of services with a high share of knowledge in total exports (from 21.4% to 33%, which means halving the gap to the EU average);
- Raise overall entrepreneurial activity from the current 11% to at least the level of the EU average, i.e. 12.8%.

Key principles or tools for strategy implementation are:

- Consistency of the package with regard to the level of technological development, over time and according to the size of the projects;
- A comprehensive approach that comprehensively addresses the areas of RDI, infrastructure, human resources, demand-side measures, regulation and internationalisation;

- A strategic approach with clearly defined priorities and a tailored governance structure;
- Complementarity with other financial instruments (leverage) and between grants and repayable forms of support;
- The focus of S4 is on technologies and areas whose results can be expected in the period to 2020 and are mainly tied to the existing economic structure and its potential, but it also supports emerging industries and areas. The share of the latter in the funding structure, including funding for research and development in the context of promoting entrepreneurship, will be targeted at approximately 20%;
- Tailored response depending on the specifics of individual priority areas.

The **National strategy of Open Access to Scientific Publications and Research Data in Slovenia 2015–2020** from September 2015 sets the following objectives:

- In 2018, 80 percent of scientific publications funded from national funds published in 2017, will be openly available;
- In 2021, all scientific publications funded from national funds published in 2020, will be openly available;
- Implementation of the pilot program Open Access to Research Data from 2017 to 2020;
- Analysis of the results of the pilot program;
- Based on the experience of the Open Research Pilot in Horizon 2020 and the pilot program Open Access to Research Data, the policy making and the conditions for its implementation in the next period (after 2020) will be developed.

The **Programme for the Development of the Innovation System** adopted by MEDT in January 2021 sets up 3 pillars to strengthen the response to challenges:

1. First pillar: Coordination of the supporting environment for innovation activity;
2. Second pillar: Supporting businesses in establishing and strengthening international cooperation and exchanges;
3. Third - horizontal pillar: Financial incentives both in Slovenia and in the EU to promote innovation development in Slovenian companies.

Table 28 - The tools of the Programme for the Development of the Innovation System

Pillar	Tools
Coordination of the supporting environment for innovation activity	• Coordination • System of use of the research equipment • Monitoring of ecosystem performance • Monitoring trends and strategic document planning
Supporting businesses in establishing and strengthening international cooperation, and exchange	• Conferences, consultations, seminars, workshops and other promotional activities

	● Cooperation with the existing and new networks and other innovation stakeholders ● Innovation radar ● Representatives' network abroad
Horizontal: Financial incentives both in Slovenia and in the EU to promote innovation development in Slovenian companies	● Organisation of international events ● Integration in RDI, custody of international projects

Source: Programme for the Development of the Innovation System

Table 29 - Key elements of the policy framework in Slovenia

Policy	Objectives	Tools
Industrial policy of Slovenia	• The general objective of the policy is to restructure the existing industry into an energy, material, environmentally and socially efficient knowledge and innovation industry for new, more sustainable and better jobs and greater involvement in international business flows.	• Improving the business environment • Strengthening entrepreneurship and innovation - focusing support on new, innovative and growing companies • Responding to societal challenges - focusing support on prospective technological and industrial areas • Activities for long-term industry development
Resolution on the Research and Innovation Strategy of Slovenia 2011–2020	• The goal of the strategy is to establish a modern research and innovation system that will enable a higher quality of life for all through critical reflection on society, effective solutions for social challenges and by raising added value per employee and providing more and better jobs.	• Well-coordinated policy planning, implementation and evaluation process among all stakeholders involved in the innovation system • Autonomy and responsibility of public research organizations • Knowledge transfer • R&D cooperation in the EU and worldwide • Public funding of research and development • Ethics in research and in researchers • Establishing capacity to support research and innovation • Innovative economy • Promotion of science, creativity and innovation in society and education
Smart Specialization Strategy of Slovenia	• SUSTAINABLE TECHNOLOGIES AND SERVICES FOR A HEALTHY LIFE, which should position Slovenia as a green, active, healthy and digital region with superior conditions for creation and innovation, focused on the development of medium- and high-tech solutions in niche areas.	• Consistency in financing and instruments • A comprehensive approach that comprehensively addresses the areas of RDI, infrastructure, human resources, demand-side measures, regulation and internationalization • A strategic approach with clearly defined priorities and a tailored governance structure

	• In priority niche areas Slovenia will move from a follower to a co-creator of global trends, which is the mission of S4.
	• The key target S4 variable is the increase in value added per employee, which will be measured at the level of individual areas of application. At the aggregate level, the success of the S4 implementation will be reflected in (until 2023):
	  ○ Increased share of high-tech products in exports (an increase from 22.3% to the EU-15 average of 26.5%);
	  ○ Increased share of exports of services with a high share of knowledge in total exports (from 21.4% to 33%, which means halving the gap to the EU average);
	  ○ Raise overall entrepreneurial activity from the current 11% to at least the level of the EU average, i.e. 12.8%.
		• Complementarity with other financial instruments (leverage) and between grants and repayable forms of support
		• The focus of S4 is on technologies and areas whose results can be expected in the period up to 2020 and are mainly tied to the existing economic structure and its potential, but it also supports emerging industries and areas
		• Tailored response depending on the specifics of individual priority areas

National strategy of Open Access to Scientific Publications and Research Data in Slovenia 2015–2020	• In 2018, 80 percent of scientific publications funded from national funds published in 2017, will be openly available • In 2021, all scientific publications funded from national funds published in 2020, will be openly available • Implementation of the pilot program Open Access to Research Data from 2017 to 2020 and analysis of the results of the pilot program	• Open access to scientific information is in the interest of society, interest of the economy • Open access to scientific information as a part of open science • Scientific information as a national scientific heritage • Copyright management on scientific information • Evaluation of science to promote open access to scientific information

	• Policy making based on experience of the Open Research Pilot in Horizon 2020 and the pilot program Open Access to Research Data	
Programme for the Development of the Innovation System	• Coordination of the support environment for innovation • Supporting companies in establishing and strengthening international cooperation and exchange • Horizontal: Financial incentives both in Slovenia and in the EU to promote innovation development in Slovenian companies	• Coordination • System of use of the research equipment • Conferences, consultations, seminars, workshops and other promotional activities • Analytics and KPI layout for monitoring the performance of ecosystems • Trend monitoring and strategic document planning

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