European Commission

Analytical Background Report
Specific Support to Slovenia

Horizon 2020 Policy Support Facility

EUROPEAN COMMISSION

Directorate-General for Research and Innovation
Directorate – Policy development and coordination
Unit A4 - Analysis and monitoring of national research and innovation policies

Contact: (H2020 PSF specific support to Slovenia):
Andrea Hajas, Unit A4 - (Andrea.HAJAS@ec.europa.eu)

Contact (H2020 PSF coordination team):
Román Arjona Chief Economist and Head of Unit A4 - (Roman.Arjona-Gracia@ec.europa.eu)
Stéphane Vankalck, H2020 PSF Head of Sector, Unit A4 - (Stephane.Vankalck@ec.europa.eu)
Diana Senczyszyn, H2020 PSF Team Leader, Unit A4 - (Diana.Senczyszyn@ec.euopra.eu)

RTD-PUBLICATIONS@ec.europa.eu

European Commission
B-1049 Brussels

EUROPEAN COMMISSION

Analytical background Report Specific Support to Slovenia

Horizon 2020 Policy Support Facility

Maja Bučar

with Paresa Markianidou and
Erika Vaiginiene (Technopolis Group)

2017 Directorate-General for Research and Innovation EN

EUROPE DIRECT is a service to help you find answers to your questions about the European Union

Freephone number (*):
00 800 6 7 8 9 10 11

(*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you)

Luxembourg: Publications Office of the European Union, 2017.

Table of contents

List of Tables

List of figures

1 INTRODUCTION

The background report provides an overview of the Slovenian R&I system with a focus on the elements which are most relevant with regards to the science base and its cooperation with the business sector as well as with the internationalisation. It includes a brief introduction of the macro-economic framework, especially the recent events, relevant to the research field, as well as a description of the R&D system, with the elements of the legal system, strategies and policy processes. This is followed by a presentation of the basic data on R&D and innovation, providing an overview of the main actors in Slovenian NIS: from business sector R&D and innovation activity to public R&D at the higher education institutions (HEI) and public research institutes. With the application of bibliometrics, the main parameters of the R&D system outputs are presented.

The Slovenian R&D sector has been among the most important recipients of the EU structural funds, so both the experience of the financial perspective 2007-2013 as well as the basics of Smart Specialisation Strategy are presented.

The promotion of science-industry cooperation has been a priority in several policy documents. Data on experience and the policy measures so far provides the background to new policy advice in this area. The barriers identified by existing analyses are described.

The participation of the Slovenian research sector in international scientific cooperation is presented at three levels. The most important is the cooperation within ERA but Slovenia also participates in other international initiatives and has a broad bilateral network. Besides data, key policy elements in the area of internationalisation are presented.

1.1 Macro-economic framework

Slovenia is among the smaller EU member countries with its 2 million inhabitants and GDP in current prices in 2015 amounting to 38,570 million EUR or €18,700 p. c. (SORS, 2016). The average annual growth of 3% of GDP in 2014 and 2015 was achieved in an environment of increased foreign demand, improved economic competitiveness and stronger government investment. The positive economic trends have continued in 2016 and GDP growth during the first half of the year (2.5% when compared to the same period in 2015 – SORS, 2016a) surpasses the careful optimism of various 2016 forecasts (IMF: 1.9%; IMAD: 2.3% and EC: 2.2%).

Up to 2008 Slovenia was growing relatively successfully and closing the gap with the EU average GDP. Yet, financial and economic crises hit the country hard and exposed in particular the delays in structural reforms. In 2009, Slovenia's GDP decreased by almost 8%; in 2010 and 2011 it stagnated, while again the country faced a GDP drop in 2012 (-2.7%) and 2013 (-1.1%). The government debt increased to 80.9% in 2014[1]; it peaked at 83.1% in 2015 and is expected to fall to 80.2% by the end of 2016 (ECFIN 2016).

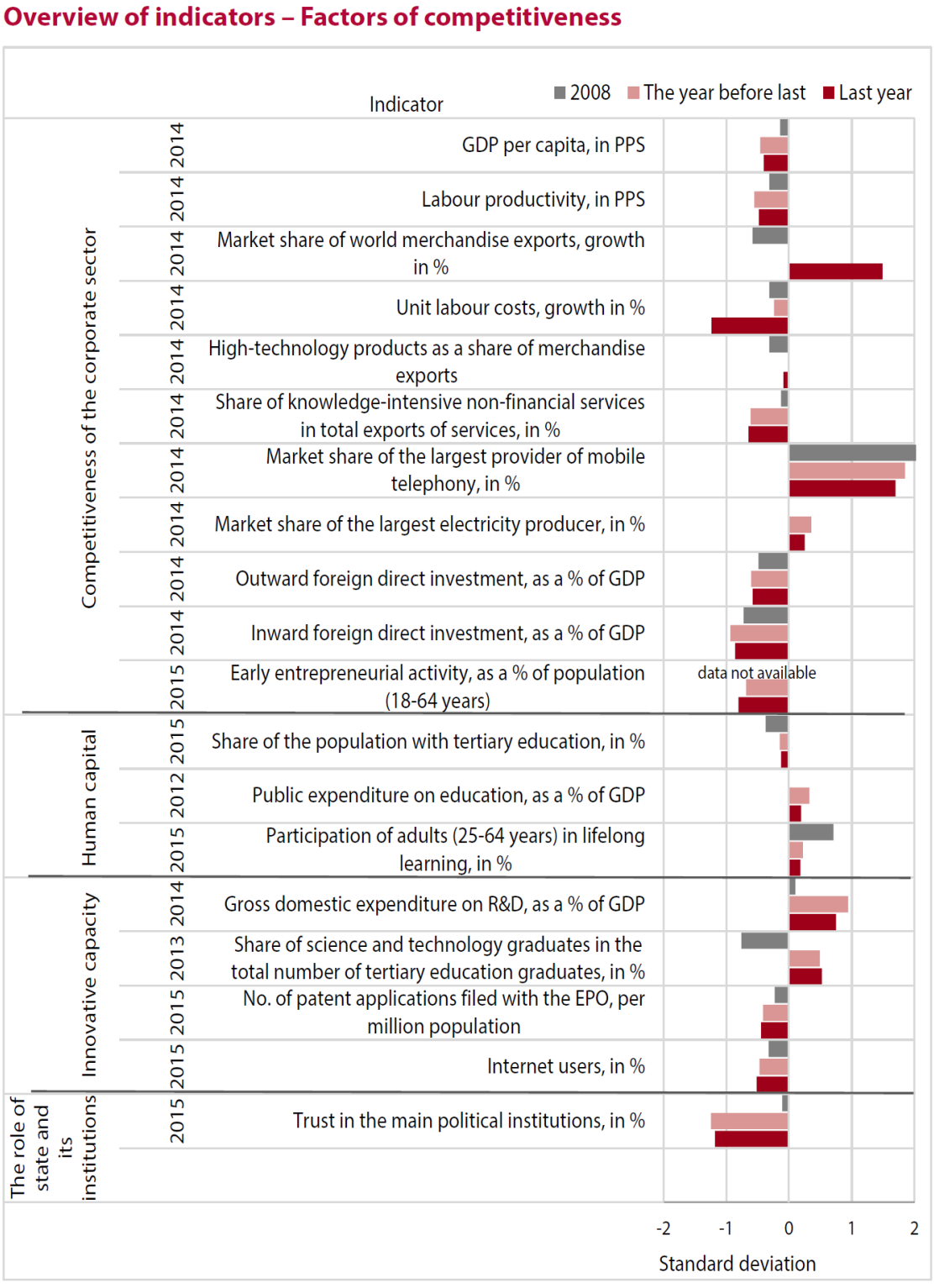
Following a 41% decrease in the period 2009–2012, investments started to increase only as recently as 2013; this rise was primarily supported by an investment in a major energy facility[2] and by the increased drawing of EU funds, mostly earmarked for public infrastructure. In 2014, the growth in these investments accelerated due to the end of the financing period under the 2007–2013 financial perspective and they remained at a similar level in 2015 (IMAD, 2016).

The financial sector is gradually stabilising, yet more needs to be done to secure access to credit to SMEs: the banks are still behaving rather conservatively when it comes to lending to the business sector. With the gradual privatisation, the influx of foreign investment has increased in late 2015 and early 2016, which should have a positive impact on the dynamics of business restructuring (IMAD, 2016).

[1] Mostly on account of the restructuring of the financial sector, where the government bailed out several banks by becoming a major shareholder.

[2] This refers to a 600 MW thermoelectric plant, constructed by Slovenian Electricity Holding, where the total costs of €1.4 bn exceeded the budget by more than 50%. Part of the financing was provided by EIB, with the government issuing a guarantee for the loan (info based on various media reports).

Figure 1: Basic economic indicators, 2008 and 2015



Source: Calculations by IMAD.
Note: The table shows Slovenia's position relative to the unweighted arithmetic average of the EU Member States. It was calculated with regard to the set of countries for which data for individual indicators were available; Cyprus, Malta, Luxembourg and Croatia were excluded from the analysis due to a lack of data. The data in the table are for 2008 and the last year for which data for EU Member States were available (the last year is indicated in the table). A positive indicator value means above-average development relative to the EU, while a negative value indicates that Slovenia lags behind the EU average on that indicator.

Source: IMAD 2016

The deceleration of economic performance after 2008 left direct consequences also on the labour market. As seen from data from the Slovenian Office of Statistics (ILO methodology) (SORS, 2015a)[3] in 2008Q1, Slovenia's level of unemployment was 5.1 %. By 2010, it amounted up to 7.1%. The "unemployment peak" was reached in 2013Q1, when the level of unemployment increased up to 11.1%. From that point forward, the rate of unemployment has been gradually decreasing (in 2016Q2 it was 7.8%, SORS 2016).

The economic situation of the country also influenced the political stability of Slovenia. In 2011, Slovenia, for the first time in its history, had early elections. Yet, the government appointed in 2012 was replaced by a new government in 2013, only to face an early election again in July 2014. Several changes of the government only increased the negative trends, since implementations of the austerity programmes were slow and inconsistent. The impact of the crisis is still felt in many sectors, where the savings of public funds were the harshest, including in higher education and RDI.

With positive growth of GDP, several austerity measures have been gradually relaxed, yet the 2017 and 2018 budgets, passed by the government, only include a small increase in the allocation of funds for R&D. More additional resources are expected by the sector from the ESIF, since RDI is high on the list of priorities for the financial perspective 2014-2020.

1.2 Major structural features of the Slovenian economy

Agriculture accounted for 2.4% of gross value added in 2015, industry for 27.3%, construction for 5.5% and services for 64.9%. The most important manufacturing sectors are metal and metal products (18.7% of sold production in value for industrial products in 2015), electrical appliances (12.3%), motor vehicles (12.1%) and pharmaceutical products (approx. 10%[4]). As for services, the most important sectors are the wholesale and retail trade (20.4%), public services (16.5%), transport, storage and communications (6.7%), professional, scientific and technical activities (10.0%), real estate and business activities (6.9%), while financial intermediation and information communication each account for 4.2% (SORS, 2016).

Slovenia's economy is highly dependent on international trade. The ratio of the trade of products and services to GDP is 68.8% for imports and 77.9% for exports and is one of the highest in the region. In the early 1990s, Slovenia, faced with the loss of Yugoslav markets and the breakdown of transport and communications to south-eastern Europe, re-orientated trade towards the EU and associated countries; these now account for over two thirds of Slovenia's trade. The most important trading partners are Germany, Italy and Austria. Pre-transition trade links have not disappeared, with former Yugoslav republics still accounting for 15.8% of Slovenian exports in 2016.

In the period 2008–2012, Slovenia experienced one of the largest declines in the EU in terms of the share in the global merchandise trade (−22%), which was partly a consequence of the regional and product structures of the country's exports. In 2013, however, these negative dynamics turned positive and this trend continued in the following years. During the period 2014-2016, Slovenia was one of the EU countries with the highest growth in world market share.

In terms of factor intensity, the market shares of all product groups expanded in 2013–2014, the most important SITC sections being medicinal and pharmaceutical products, iron and steel, non-ferrous metals, manufactures of metals, specialised machinery for particular industries, road vehicles, miscellaneous manufactured articles, petroleum and petroleum products (IMAD, 2016).

Since 2009, the share of high-technology products has also been constantly strengthening, owing to the growth in the absolute values of their exports. This was mainly underpinned by a growth in pharmaceutical exports, which had been above average until 2013 before slowing notably in 2014[5]. The share of high-technology products in merchandise exports therefore also fell slightly. Medium-technology products otherwise still account for the largest share in the merchandise export structure.

After a modest improvement in 2010–2013, the stock of inward FDI rose more notably in Slovenia in 2014 for the first time in a long period (by 13.9%). Outward FDI stock, having been decreasing

[3] Database on labour statistics http://pxweb.stat.si/pxweb/Dialog/Saveshow.asp .
[4] Due to a small number of producers, the Statistical office does not publish the figures for pharmaceutical production, so this is an estimate, based on business news.
[5] This was primarily caused by the EU sanctions against Russia, traditionally an important export market for the Slovenian pharmaceutical industry.

in 2010–2013, rose slightly in 2014 (by 2.6%) but was still 13.5% below its 2009 peak. The equity capital inflows of inward FDI rose notably in 2014 and 2015: in 2014 they amounted to EUR 1,447.0 million and in the first ten months of 2015 to EUR 1,184.8 million, compared with only EUR 1,354.6 million reached in the entire previous five year period (2008–2012). This is primarily due to the renewal of the privatisation process and the generally higher sales of equity stakes in Slovenian companies. Slovenia remains among the EU countries with the lowest stock of inward FDI and the smallest increase in inward FDI stock as a share of GDP over the long term (IMAD, 2016).

1.3 Framework conditions for research and innovation

Over the years, Slovenia has established all of the major components of a national innovation system. The public segment of the research sector is composed of national research institutes and research units at the universities. Most of the business research is implemented within research units in business enterprises but centres of excellence and competence centres are also statistically included as business research entities. The innovation eco-system consists of various support agencies and numerous intermediary organisations like technology parks, centres of excellence and competence, business and university incubators, regional development agencies, etc. as bridging institutions, with more or less active roles, depending on the financial support of the government.

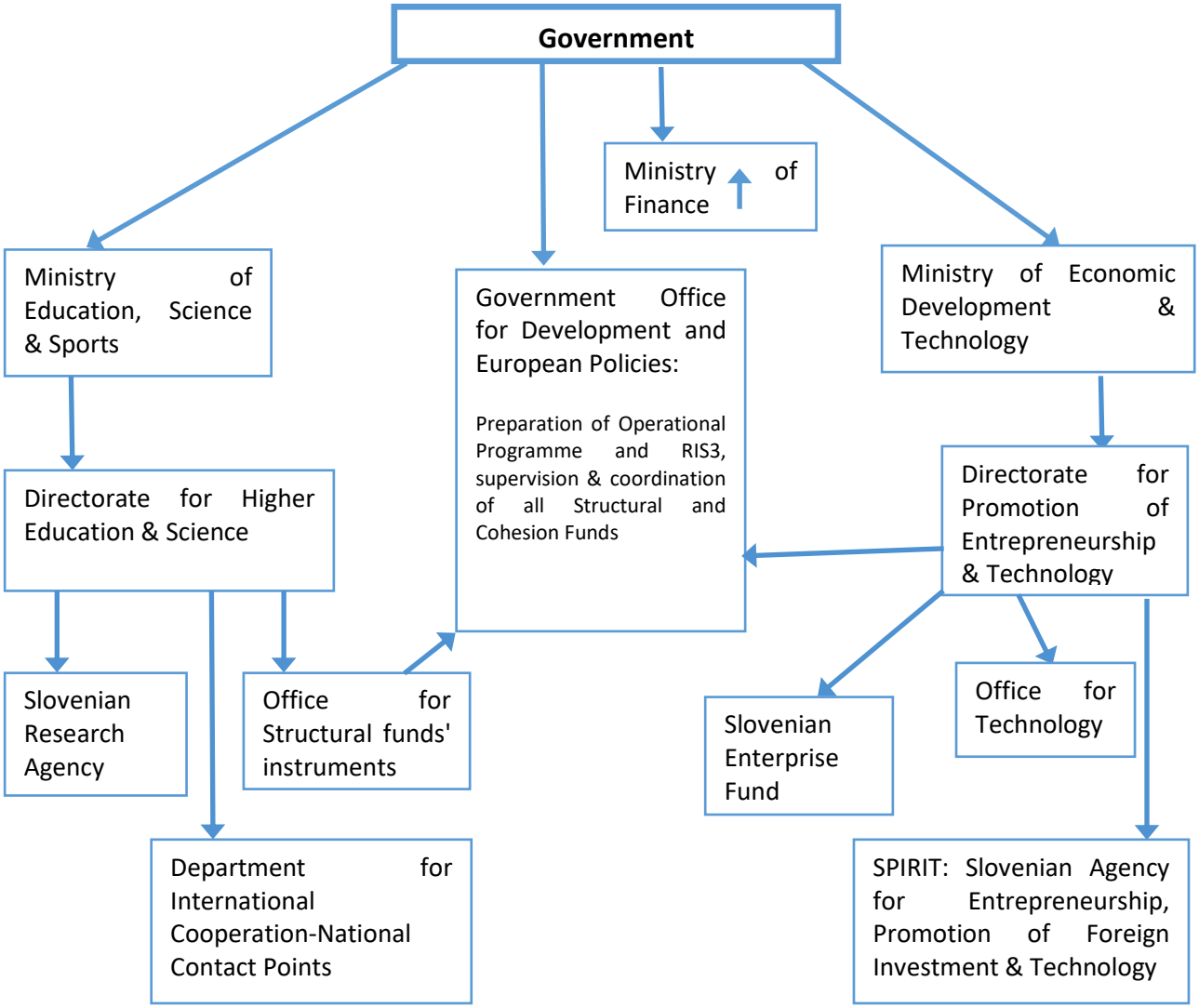
A number of government bodies are engaged in STI policy making (see the picture below), resulting in a complex system of support measures both for public as well as private R&D and innovation. In recent years, various innovative financial mechanisms have also been developed, from more traditional venture funds and business angles to newer forms of crowd funding. The major problem of the Slovenian NIS, however, remains the lack of networking of this elaborate scheme, reflected in its complex organisational structure, low intensity and quality of linkages and cooperation among individual actors in the system.

The top legislative bodies in the field of RDI are the National Assembly (Državni zbor) and its committee on Science and Technology. The Ministry of Education, Science and Sport (MESS)[6] and the Ministry for Economic Development and Technology (MEDT)[7] are responsible for the implementation of RDI policies. While MESS is responsible for the preparation of the main policy documents, support measures and all of the activities in the area of science, especially in the public domain, the MEDT is responsible for the technology development and innovation support, with primary attention to the business sector. The division of responsibilities has so far changed several times: especially with frequent government changes in the recent past. Up to 2011, Slovenia had a Ministry of Higher education, Science and Technology. In an attempt to lower the number of ministries, this ministry was merged with the Ministry of Education and Sports and the Ministry of Culture. The technology section was moved to the Ministry of Economic Development and Technology. Eventually, Culture was able to get its own ministry, but Science remains with the Ministry of Education and Sports. The practical implication of this organisational scheme is that much of R&D policy is with MESS, while what remained of technology and innovation policy is within the entrepreneurship promotion under MEDT.

In the beginning of March 2014, the Government re-established a special Government Office for Development and European Cohesion Policy (GODC)[8], which has as a primary task the management of the EU structural and cohesion funds.

[6] http://www.mizs.gov.si/en/
[7] http://www.mgrt.gov.si/en/
[8] http://www.svrk.gov.si/en/

Figure 2:. Organogram – Governance of R&D (including structural funds for R&D)



In addition to the reorganisations which took place, the efficiency and the quality of the governance is affected by frequent personnel changes: both ministries have had five different ministers / state secretaries during this period and the GODC has had three different heads within its first year of functioning.

The main science policy advice body is the National Council for Science and Technology (SZT), which is, according to the Law on Research and Development (2002, with amendments in 2006), composed of fourteen members who are nominated and nine non-elective members regarding their position. Out of 14 nominated members, 6 represent the research community, 6 the business community, one is representing the labour unions and one the general public. The group of 9 "non-elective" members of SZT is composed of the President of the Slovenian Academy of Science and Arts (SASA), the rectors of the four Universities, the representative of the Chamber of Commerce and Industry as well as the Minister of Education, Science and Sport, the Minister of Finance and the Minister of Economic Development and Technology. The Council for Science and Technology has a mandate to prepare and accept the guidelines for the National Research and Development Programme (NRDP) [9], the main strategy document in the area of research and innovation. The SZT played an important role in the preparation of the Research and Innovation Strategy of Slovenia 2011–2020 (RISS- the current strategic programme). The current Council was appointed in July 2014, with a mandate of four years.

According to the Law on Research and Development (2002, with amendments in 2006), the ministry responsible for science needs to prepare the *draft text* of this basic policy document in the area of R&D on the basis of the *guidelines* prepared by the National Council for Science and Technology. Various stakeholders may be involved in the preparation of the text and the Ministry can commission different experts[10]. Once the draft of the national research and development programme is prepared, the law requests the draft be open for public discussion among different stakeholders. The Slovenian Chamber of Commerce and Industry is usually asked to organise the debate on behalf of the business sector, being the forum for business to express its opinions on various government policies.

The coordination of the Directors of Research Institutes (KORSIS) has to present its comments and propose changes and amendments to various policy documents. The Rectors' Conference acts on behalf of universities. All of these bodies have a consultative function but no formal powers in the process of accepting the policy documents. During the discussion at government level, all ministries are invited to comment, especially the Ministry of Finance and Ministry of Economy. The Ministry of Finance needs to check the resources available and the dynamics of R&D financing. The Ministry of Economy must check the compatibility of R&D policy with the innovation policy and the policy to support entrepreneurship.

The process ends with the approval of the national programme by Parliament. All other documents, like the annual programmes of the MESS, of the Slovenian Research Agency and other intermediary institutions should follow the stipulations of this document. The implementation of the national programme is regularly monitored and evaluated.

The current national research programme, called RISS, was adopted in 2011[11]. RISS defined the R&D priorities for the next decade (2011–2020) as follows:

- Better integration of research and innovation;
- Publicly funded sciences and scientists shall contribute to economic and social restructuring;
- Enhancing/ensuring closer cooperation between PROs and the business sector;
- Increasing scientific excellence, partly by increasing competitiveness within S&T stakeholders and partly by providing necessary resources, both human and financial.

The political changes contributed to the relatively slow implementation of RISS. The current Government (from 2014 on) is strongly committed to RISS 2011–2020 but they face a significant challenge in catching up with the implementation process, especially because the situation in the field of RDI has changed significantly. While RISS 2011–2020 planned for a continuous increase of

[9] The current national research and development programme is called Research and Innovation Strategy of Slovenia - RISS.

[10] The 2011-2020 RISS was also prepared on the basis of the evaluation of the Slovenian innovation system by OECD (2012) and ERAC (2010).

[11] See detailed description of RISS in ERAWATCH Country Report 2012: https://rio.jrc.ec.europa.eu/en/library/erawatch-country-report-slovenia-2012

the public financing of RDI activities, the austerity measures in the last years decreased the level of RDI finance. Also, according to the implementation report, only 10 of the 69 measures planned have been implemented so far; 41 are in the implementation process and 18 have not been started (RISS implementation report, 2016).

One of the most important framework conditions for RISS implementation is the new Law on RDI, as foreseen in the strategy. At the end of 2015 the government appointed a new expert group (the second one) in order to finalise the new draft for the Law on RDI. Yet, the progress of the working group is slow which is also due to the disagreement between the MESS and MEDT, related to the need to combine research and innovation within the same legal text. The MEDT feels that technology and innovation are sufficiently addressed in their Programme for the Promotion of Entrepreneurship. This is a step away from the basic philosophy of RISS, where the name itself already suggests a close coordination of the research and innovation policy. However, as the RISS was adopted at the level of Parliament, any change would require not only a ministry decision but also both the Government's and Parliament's agreement. Still, it is planned to have a new law prepared and adopted in 2017.

At the level of implementation, the Law on R&D (2002, and amendments in 2006) provided two special public agencies: the **Slovenian Research Agency** (SRA) and the **Slovenian Technology Agency** (TIA). The SRA, which is responsible for the execution of public research financing, for the professional and independent selection/evaluation process of projects and programmes and the monitoring of research programmes and projects implementation, was established in 2004. The TIA, which was established in 2006 and was entitled to promote technology development and co-finance business RDI, was merged with the Public Agency for Entrepreneurship and Foreign Investments (PAEFI – also entitled to perform some RDI programmes) on 1 January 2013 into a newly-established agency, **SPIRIT** (see more on SPIRIT further in the text). Most of the programmes that the TIA was implementing in the financial period 2007-2013 had been either stopped or significantly modified, since SPIRIT is primarily the agency devoted to the promotion of entrepreneurship and foreign investment and not to business R&D.

The SRA[12] is in charge of the distribution of public research funding according to the policies decided by the MESS and the government. The basic mechanism of funding is the distribution of grants to selected research programmes / projects and other activities[13]. Each of the regular programmes has its selection and evaluation system pre-specified. The SRA's programme consists of:

- long-term financing of research programmes, known as "Research programme groups" (three to six year contracts, awarded to a group of researchers for their programme of basic research),
- basic and applied research projects' funding,
- targeted research projects,
- a young researchers programme,
- support to the research infrastructure,
- institutional funding of the public research institutes, established by the government,
- financing of the participation of Slovenian researchers in international research networks and organisations,
- co-financing of international research conferences and other events,
- international and bilateral R&D cooperation, etc.

The SRA's planned annual budget experienced significant cuts: while in 2010 its budget was 184.8 million EUR, it was cut to 133.1 million EUR in 2015 and slightly increased in 2016 to 142.9 million EUR.[14]

The SRA is not only very important as the main financier of public sector research but also in setting the standards for the evaluation of individual researchers' work. Their Act on the conditions to be met by the programme / project coordinator has an important impact on the focus of individual researchers. The criteria in the Act regulates how individual outputs (scientific papers,

[12] http://www.arrs.si
[13] The breakdown of financing for 2015 is provided in section 2.3
[14] A detailed description of SRA, as well as data on the financing of research are available in the Annual Report of SRA 2015 https://www.arrs.gov.si/en/gradivo/dokum/inc/ARRS-Annual-Report-2015.pdf .

monographs, visiting lectures, etc.) are valued in one's bibliography. By attaching significant importance to the bibliography, especially the publication of papers in SCI / SSCI cited journals in the previous Act, publication activity in the Slovenian science community has increased significantly. The newest version of the Act has modified slightly to give more credit to the publication of monographs as well. The Agency also lowered the entry conditions somewhat and increased the importance of the peer review in its evaluation processes in mid-2016. The changes in the Act were debated among the scientific community but a common position is very difficult to reach, since in different fields different outputs are considered as the most relevant (in natural science, only the high-impact factor of SCI journals counts, while in humanities the books play a much more significant role). These regulations are not to be underestimated, since the researchers rationally adjust their focus in accordance with the criteria: if publications are the main criteria, this affects their readiness and interest for cooperation with the business sector. So far, the cooperation criteria has never been introduced directly, not even for the applied research projects.

Several of the innovation and entrepreneurship support measures of the Ministry of Economic Development and Technology (MEDT) are carried out by **SPIRIT** (http://www.spiritslovenia.si/en). As mentioned, SPIRIT was created by a merger of several specialised agencies and has taken on board their various instruments. They provide support to technology parks, university incubators and are used to implement small business voucher schemes and mobility schemes. Yet, the focus of the agency is the promotion of entrepreneurship and technology; R&D support is only of secondary importance.

The more important actor in technology restructuring is the **Slovenian Enterprise Fund** (SEF– http://www.podjetniskisklad.si/en), which is an independent agency, dealing mostly with co-financing and subsidising the investments in new technologies by the SMEs and helping the establishments of start-ups. With the ERDF's contribution and the European Investment Fund, the SEF has successfully expanded its operation. It offers start-up incentives (grants) for establishing an enterprise, seed capital (convertible loans and capital investments) for the entry and expansion on the market, venture capital (mezzanine capital) for rapid global growth, micro-credits for specific target groups and guarantees for bank loans with an interest rate subsidy for current operation and further growth. It operates through annual calls for all its "products". In 2016, the SEF provided €137m of various financial support measures, of which €38m focused on start-up / young enterprises and €99m for enterprises older than 5 years (SEF 2016). What is particularly appreciated by the business community is the stability of the instruments and the transparency of the functioning of the SEF.

Another relatively new actor in the area of providing financial support is the SID Bank - **Slovenian Export and Development Bank**.[15] With its financial services, the SID Bank supports investments in research and the development of technological environment and technology. The SID Bank refinances credits of banks and other financial institutions, co-finances transactions and investments or finances projects directly.

It is difficult to assess the effectiveness of SID, since it provides very little information on the recipients of its support. The Bank maintains its policy of non-disclosure of data. Also, no evaluation of the success rate of the supported projects has been publicly available.

Figure 3: SWOT of the Slovenian innovation ecosystem, 2016

STRENGTHS	WEAKNESSES

[15] More on http://www.sid.si/en-gb/About-SID-Bank

• Relatively high business sector R&D investment. • Several high-quality research units in public sector R&D, with good publication and citation record and international recognition. • Extensive higher education sector with high enrolment and potential for further improvement of human resources. • Comprehensive institutional network with main elements of the National Innovation System. • Good information support system for public R&D sector (COBISS, SICRIS). • High participation of public research sector and SMEs in various Horizon2020 calls.	• Business R&D investment concentrated on a small number of sectors. • Fragmentation and low level of cooperation within the public R&D sector - small research units. • High share of R&D and innovation inactive SMEs, especially in service sector. • Insufficient and complicated instruments for business R&D and innovation support. • Implementation deficit – a discrepancy between good strategic papers and commitments and their implementation. • Lack of coordination and transparency of work of intermediary institutions as well of the ministries / government offices.
OPPORTUNITIES	**THREATS**
• Availability of additional resources through the EU Structural funds for R&D and innovation measures. • Design of new policy documents in R&D and innovation areas, where priority setting will be strengthened due to Smart Specialisation Strategy (RIS3).	• Continuation of the public finance problems, which resulted in lower financial support to R&D and innovation. • Increased brain drain due to the growing mobility of the younger generation. • Maintenance of the existing under-utilised RDI system due to insufficient political commitment. • Pressure of various interest groups to preserve status quo. • Overall imbedded system inaction and resistance to change.

Source: own assessment

2 R&D INPUTS AND POLICY FRAMEWORK

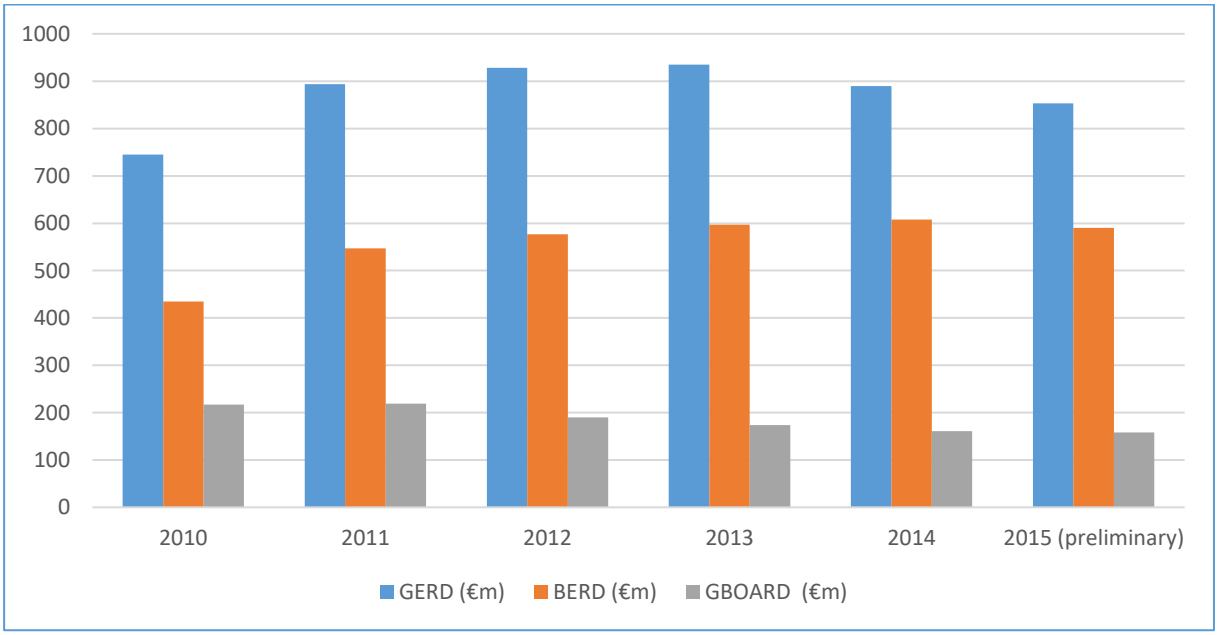
The RDI performers in Slovenia can be divided into three groups: **universities and higher education institutions (HEIs), public research organisations (PROs)** and **research units within business enterprises**. The business sector is both the major funder as well as the major performer of R&D. The PRO sector is relatively large and outweighs the higher education sector (HES). This stems from a past structure in which PROs were the main actors and HEIs were primarily focused on teaching. The role of private non-profit R&D is minimal, both in terms of the number of researchers in this sector as well as in terms of the funding and performance of R&D.

Slovenia maintains a public information system on its R&D organisations - SICRIS[16], where all the organisations which received public finance at some point since 1995 are listed. According to this database, there are 888 R&D organisations registered in the system. Data on organisations, individual researchers, programmes and projects is regularly collected and analysed.

2.1 Volume and composition of GERD

RISS (2011) had set a very high target for the investment in RDI at 3.6% of GDP. Later the government revised the figure to 3% in the National Reform Programme. Yet the trend of declining GBOARD has only been stopped in 2016 and a slight increase is planned for 2017 and 2018, not enough to meet the desired target. In 2016, the business sector has also reduced its financing of R&D and can no longer be counted as the source of growing funds.

Figure 4: R&D funding in €m, 2010-2015



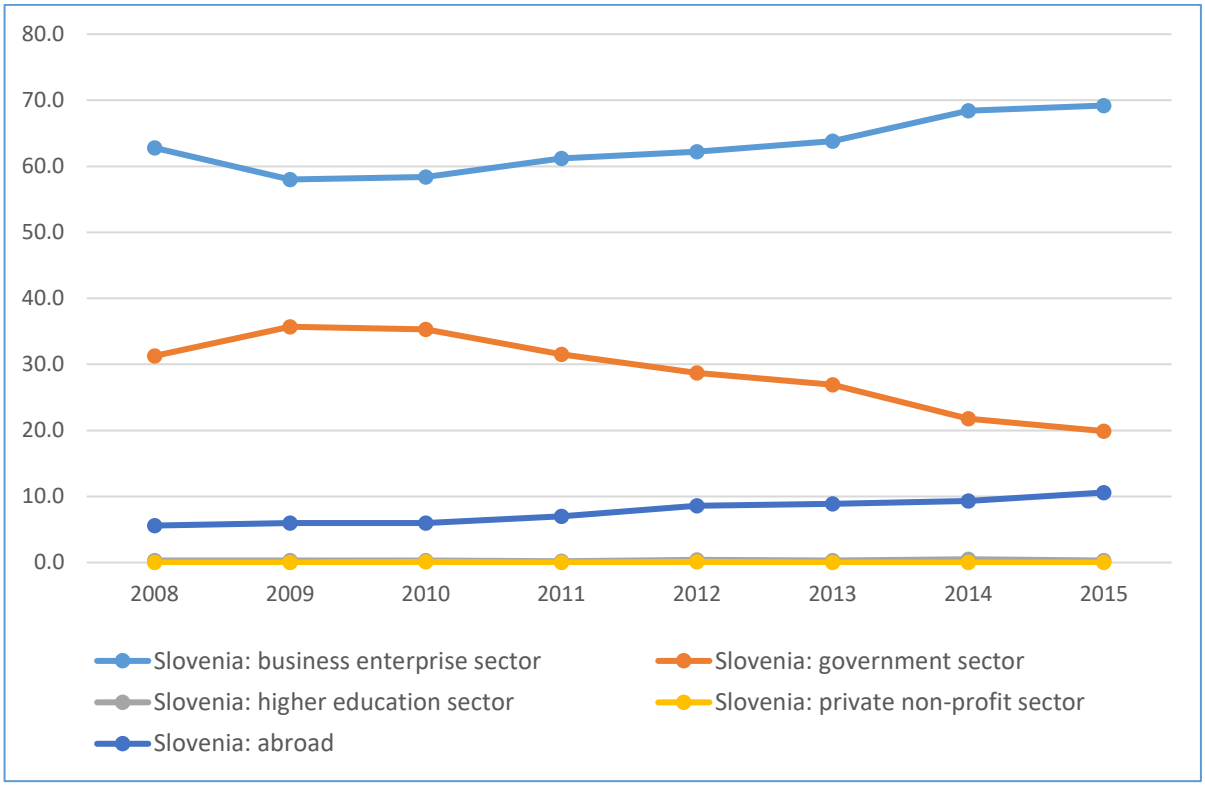
Source: Eurostat

A decline in GBOARD can be explained by harsh austerity measures, adopted by the Slovenian government to reduce the high budget deficit. If in the first years after the economic and financial crisis it was hoped that the RDI sector would be able to avoid the cuts and in view of the optimistic RISS scenario, the years after 2012 show a steep decline in funding, coinciding with the end of the support from structural funds in 2015.

Slovenian public R&D financing is mostly bottom-up, especially the funds channelled through SRA. The top-down priority setting was never really implemented and in all the national research programmes, the priorities were very broadly defined. Probably closest to the top-down policy are the instruments co-financed by structural funds, especially in the current financial perspective due to the RIS3.

Figure 5: GERD by source of funds (%)

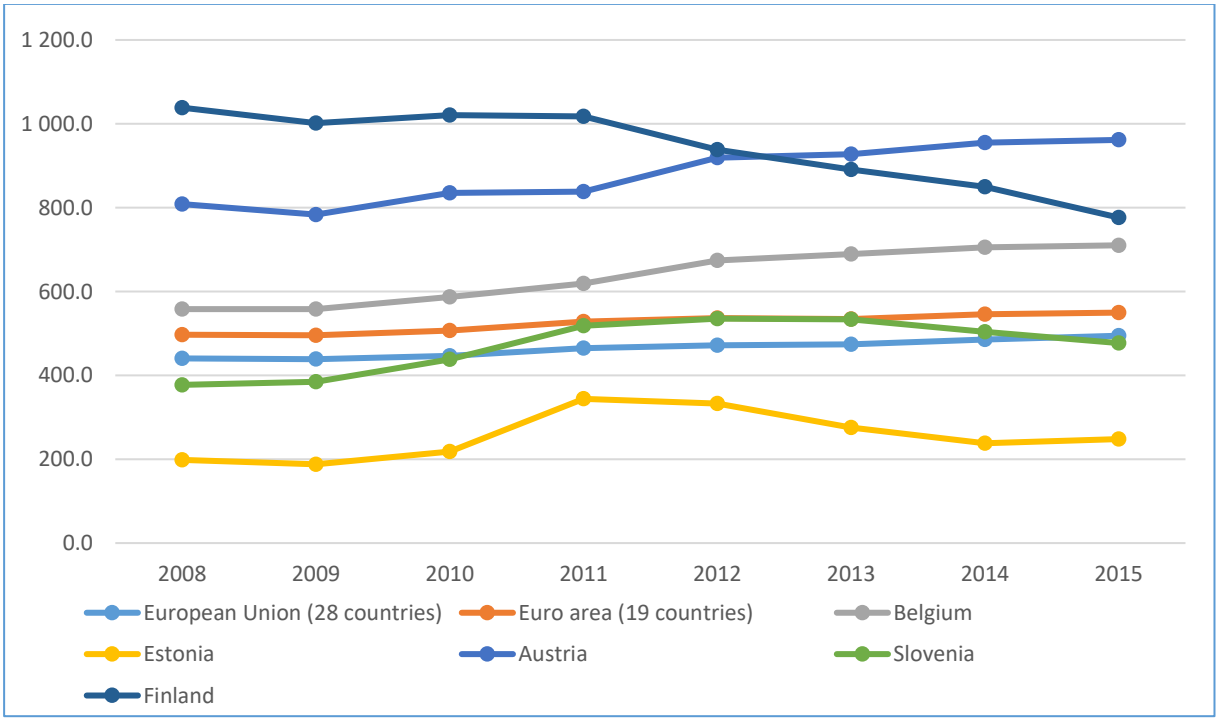
[16] http://www.sicris.si/public/jqm/cris.aspx?lang=eng&opdescr=home



Source: Eurostat

In comparison to EU28 and to selected countries, Slovenian per capita investment in R&D lags behind the more advanced countries like Finland, Austria and Belgium. The trend of increasing funding from 2008 to 2013 resulted in reaching EU(28) as well as EU(19) average, yet the drop occurred after 2014 had moved Slovenia slightly below again. Still, in comparison with another EU-13 country, Estonia, Slovenian expenditure on R&D is significantly higher.

Figure 6: GERD by PPS per inhabitant at constant 2005 prices



Source: Eurostat

2.1.1 Recent trends in funding and performance by sectors

As observed in Figure 4, the total R&D expenditure was increasing in the period 2008-2012 both in nominal values (up to €928.3m in 2012) and as a percentage of GDP (2.58% that same year). The business sector increased its investment which grew in real terms by 47.4%. However, the GERD stalled in 2013 at the level of previous year and decreased in 2014 (€890m or 2.39% of GDP) and 2015 (€853m or 2.21% of GDP) (EUROSTAT and SORS data).

The Government R&D budget (GBOARD) decreased at an even faster pace during the period from 2011 to 2014. In 2014, it amounted to €161.3m or 0.43% of GDP, which is the lowest amount in the last ten years (SORS 2015). The funding from abroad however, records a small but constant increase which is still much below the EU average. In part, this can be explained by the relatively low presence of the FDI in Slovenia.

Table 1: GERD by Abroad (%)

Table	2008	2009	2010	2011	2012	2013	2014	2015
EU-28	8.8	8.4	8.9	9.2	9.7	9.9	10	n.d.
Euro area (19 countries)	7.2	7	7.3	7.5	7.9	8.4	8.5	n.d.
Belgium	12.3	12.1	13.3	13	13	13.2	n.d.	n.d.
Estonia	9.4	11.3	11.4	11.9	10	10.3	12.5	12.2
Austria	16.4	16.8	16.1	16.9	16.1	16.6	16.1	15.9
Slovenia	5.6	6	6	7	8.6	8.9	9.3	10.6
Finland	6.6	6.6	6.9	6.5	8.8	11.5	17.3	14.5

Source: Eurostat

Table 2: Total intramural R&D expenditure (GERD) by fields of science (Million euro)

Table	2008	2009	2010	2011	2012	2013	2014
Natural sciences	249.461	249.551	283.475	331.672	324.955	326.048	317.603
Engineering and technology	282.13	307.491	360.857	444.146	480.431	501.748	464.722
Medical and health sciences	20.489	21.869	23.068	22.984	24.473	25.885	27.051
Agricultural sciences	8.214	7.435	9.093	21.187	22.564	19.283	19.165
Social sciences	36.283	41.879	41.037	44.774	47.88	36.572	37.219
Humanities	20.372	28.658	28.414	29.449	28.002	25.471	24.471

Source: Eurostat

Looking at the R&D expenditures according to socio-economic objectives, **a clear dominance of industrial production and technology can be observed.** In view of the high share of the business sector in funding R&D this can be expected and is also reflected in Table 3.

Table 3: Total intramural R&D expenditure (GERD) by socio-economic objectives according to NABS 2007 (Million euro)

Table	2008	2009	2010	2011	2012	2013	2014
Exploration and exploitation of the earth	11.474	8.029	9.85	14.515	14.81	8.485	9.259
Environment	13.759	17.507	18.867	22.987	21.442	23.23	23.52
Exploration and exploitation of space	0.032	0.064	0.903	0.572	3.454	4.609	1.013
Transport, telecommunication and other infrastructures	51.451	45.598	48.309	32.121	47.428	51.181	43.465
Energy	18.597	27.587	33.994	63.566	41.448	45.497	44.924
Industrial production and technology	262.877	273.402	314.019	339.648	395.134	429.268	406.689
Health	84.337	82.375	104.468	108.609	97.863	96.911	100.43
Agriculture	11.173	12.652	12.79	15.465	17.986	16.357	16.358
Education	12.445	14.468	13.356	10.418	10.711	18.876	10.648
Culture, recreation, religion and mass media	2.175	3.205	2.653	5.394	3.467	3.95	3.012
Political and social systems, structures and processes	6.396	6.379	5.709	5.307	4.32	5.794	4.645
General advancement of knowledge: R&D financed from other sources than GUF	141.743	165.022	180.283	275.316	270.2	230.718	226.269
Defence	0.488	0.596	0.742	0.295	0.02	0.131	0
Total R&D appropriations	**616.949**	**656.882**	**745.942**	**894.213**	**928.306**	**935.006**	**890.232**

Source: Eurostat

2.1.2 Business R&D structure and trends

By 2014, the business sector funded 68.1% of the total R&D expenditure (GERD); in 2015 it was 69.1%, with most of these resources going back to the business sector (96.6%, representing 85% of the overall business R&D expenditure). As an R&D performer, the business sector was also able to draw on government funds (7.7% of total funds) and funds from abroad (6.7%).

The increase in business R&D was at least partly due to higher R&D tax subsidies (20% in 2006, 40% in 2010 and 100% in 2012). In 2014, these subsidies accounted for €228.6m (IMAD, 2016b). Nearly a third of this amount was claimed by the pharmaceutical industry. While only 10% of those eligible for tax subsidies were large companies, they received two thirds. On the other end, micro enterprises represented more than half of those that claimed subsidies but they only accounted for less than one tenth of the amount, showing their good use of this tax scheme however. With the increase in R&D investment, the employment of researchers in the business sector also grew, reaching 48.8% of all researchers (FTE) by 2015.

Table 4: Business enterprise R&D expenditure (BERD) by economic activity (NACE Rev. 2) (Million euro)

Sectors	2008	2009	2010	2011	2012	2013	2014
Agriculture, forestry and fishing	0	0.228	0.273	0.424	0.551	0	0.009
Mining and quarrying	3.451	5.454	5.311	5.741	4.471	4.606	3.407
Manufacturing	329.365	334.454	394.835	451.049	432.056	465.529	454.965
Electricity, gas, steam etc.	0.084	0.965	1.004	2.637	4.175	2.791	2.678
Services of the business economy	64.893	82.771	103.37	196.212	257.067	239.08	223.56
Public administration and defence	0.056	0.083	0.105	0.335	0.358	0.259	0.576
Human health and social work activities	0.371	0.395	0.505	1.663	1.335	0.291	0.128
Arts, entertainment and recreation	0.01	0.008	0	0	0	0	0.009
Other service activities	0	0	0	1.106	1.577	1.293	0.944
Total - all NACE activities	**398.274**	**424.399**	**505.817**	**660.484**	**703.098**	**715.538**	**688.518**

Source: Eurostat

Though official data on their R&D expenditures in the local branches are scarce, Slovenia hosts a number of large multinational pharmaceutical companies, like Bayer Pharma Investments, Belimed and Lek/Sandoz (Novartis Pharma). The largest recent FDI inflows are the post-privatisation takeovers (Goodyear, Ljubljana Airport, Helios, Mahle). Three Slovenian companies – KRKA, ranked

217 (Pharmaceuticals & Biotechnology), Gorenje, ranked 593 and HELIOS, ranked 956 (Construction & Materials) – are included in the EU Industrial R&D Investment Scoreboard 2016.[17]

Table 5: Business enterprise R&D expenditure in selected countries (Million euro)

Table	2008	2009	2010	2011	2012	2013	2014	2015
EU-28	151,716.208	146,614.36	152,775.771	164,187.704	171,748.018	174,253.933	182,462.768	191,195.332
Euro area (19 countries)	115,047.011	113,829.427	118,064.954	126,636.171	132,046.952	133,105.335	138,553.399	141,494.46
Belgium	4,650.011	4,574.767	5,027.7	5,613.4	6,493.3	6,745.547	7,032.52	7,247.08
Estonia	89.879	88.207	116.763	242.845	218.997	155.6	124.829	139.4
Austria	5,232.63	5,092.902	5,520.422	5,692.841	6,540.457	6,778.42	7,152.704	7,396.6
Slovenia	398.274	424.399	505.817	660.484	703.098	715.538	688.518	650.579
Finland	5,101.986	4,847.164	4,854.463	5,047.428	4,694.997	4,602.4	4,409.5	4,047.3

Source: Eurostat

66% of the total R&D in the business sector is performed in the manufacturing sector and 32.4% in services, which is a considerable structural change since 2008, when the share was 82.7% and 16.3% respectively. Within the services sector, 72.7% of R&D is done by scientific, technical and other business activities; another significant R&D performer is information & communications, especially software activity in services (21%).

Within manufacturing, traditionally the most important industry is the pharmaceutical one, with nearly €163m (35.7% of the R&D in the manufacturing sector), followed by electrical appliances (16.8%), motor vehicles (10.6%) and the computer, optical and electronic industry (8.9%).

Table 6: GERD- Business enterprise sector (Purchasing power standard (PPS) per inhabitant at constant 2005 prices)

Table	2008	2009	2010	2011	2012	2013	2014	2015
EU-28	275.9	268	273.6	290.5	296.6	298.1	307.4	313.4
Euro area (19 MS)	313.1	304.9	313.3	333	341.5	338.3	346.8	348.6
Belgium	380.9	368.7	394.4	425.3	478.1	487.1	502.6	511
Estonia	85.8	84	109.7	217.3	191.4	131.3	103.6	114.3
Austria	560.4	533.5	571.4	576.7	647.1	656.8	676.5	681
Slovenia	243.6	248.5	297	382.9	405.4	408.4	389.4	364.1
Finland	771.1	715.6	710.8	717.3	644.9	613.6	575.3	517.7

Source: Eurostat

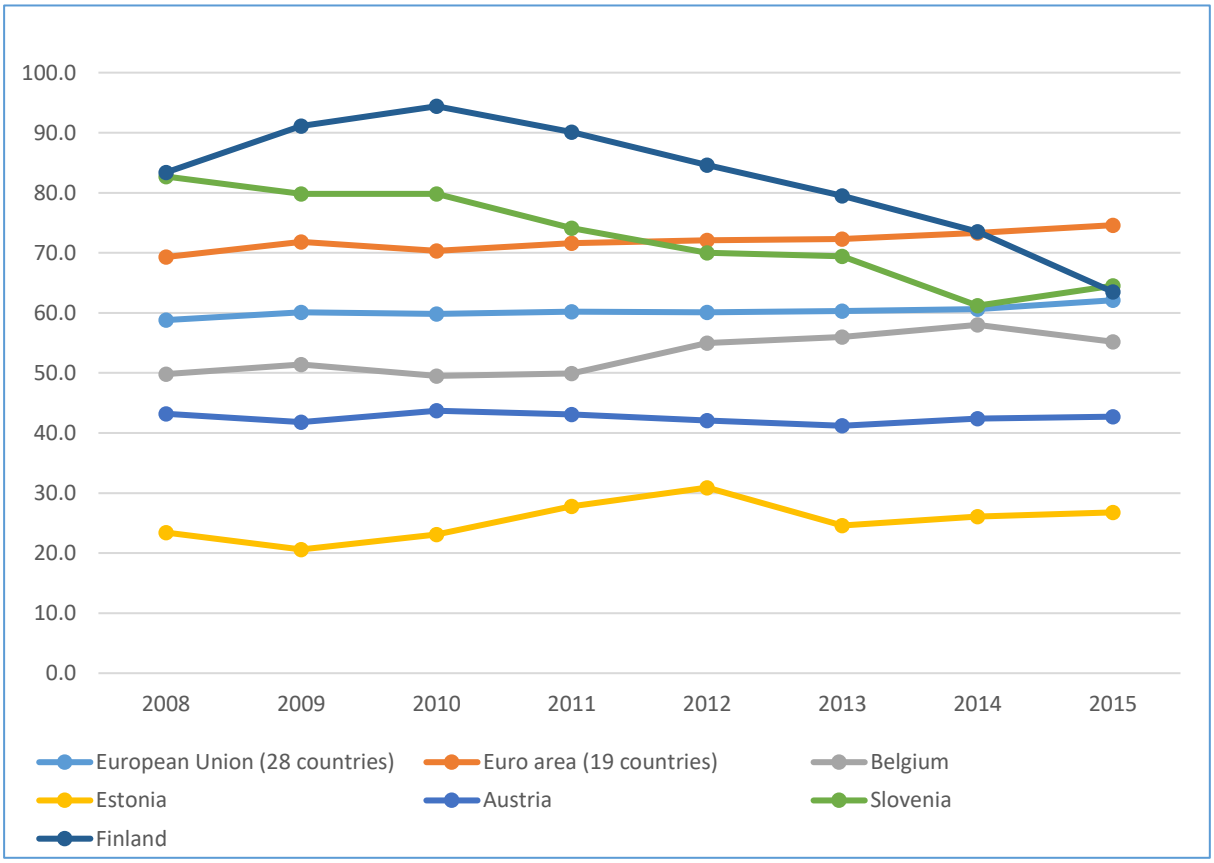
[17] http://iri.jrc.ec.europa.eu/scoreboard16.html#modal-two

In comparison with selected countries, the Slovenian business sector investment in R&D is still relatively modest in absolute figures, yet on a per capita basis it exceeds the EU(28) and EU(19) average. Its importance is also reflected in relation to Estonia - with a more than three times higher amount! In addition to other data, this reflects the R&D intensity of some of the business enterprises, especially those focused on global markets.

2.1.3 Public sector (PRO & HEI) R&D

The decline in public financing was experienced both in the funding of the basic research as well as in funding applied projects. PRO received €47.5m from SRA[18] in 2011 and in 2014 only €40.17m. The drop was significant for HES as well, where the funding dropped from €56.43m to €43.84m. Even more drastic was the drop in financing of the applied projects: nearly 45% for both HES and PRO and fewer funds were distributed by the SRA[19]. The drop in financing also affected the level of employment of researchers in both sectors, as can be seen in Tables 8–10.

Figure 7: GERD - Government sector (Purchasing power standard (PPS) per inhabitant at constant 2005 prices)



Source: Eurostat

In the government sector, there are 15 institutes that are government-founded and are entitled to the institutional funding. These institutes are:

- Agricultural Institute of Slovenia;
- Educational Research Institute;
- GeoZS, Geological Survey of Slovenia;
- IER, Institute for Economic Research;
- Institute for Hydraulic Research;
- IJS, Jozef Stefan Institute;
- IMT, Institute of Metals and Technology;

[18] These funds were directed to research programmes, basic research projects, post-doctoral research and young researchers: categories, which SRA categorises as basic research funding.

[19] This includes financing of applied projects and targeted research projects.

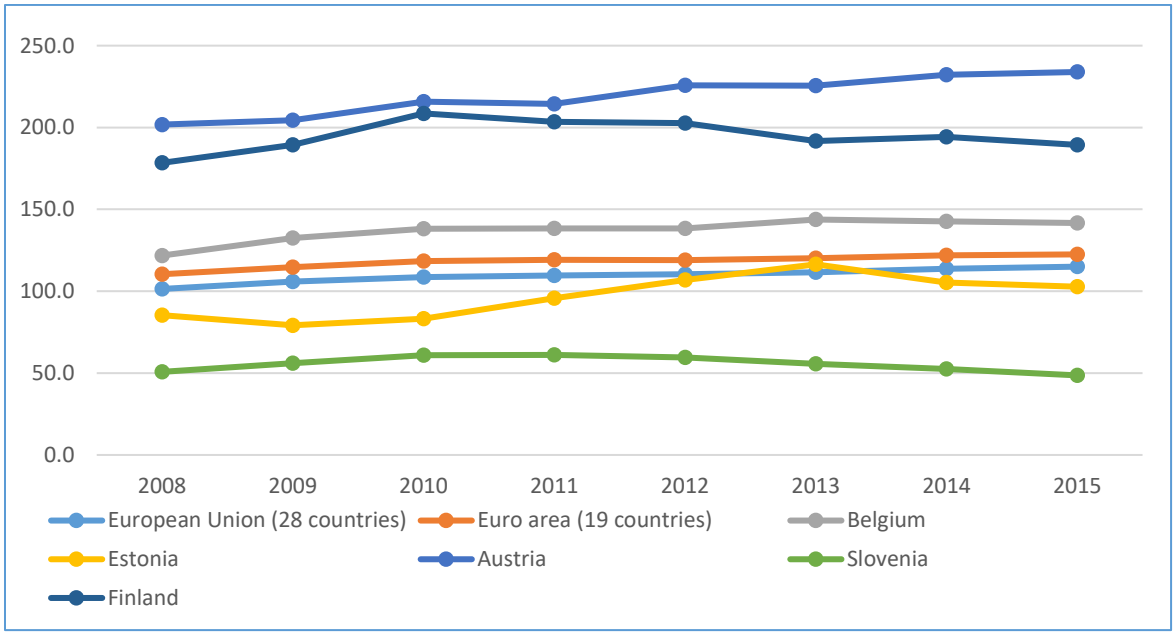
- INV, Institute for Ethnic Studies;
- INZ, Institute of Contemporary History;
- National Institute of Chemistry;
- NIB, National Institute of Biology;
- Slovenian Forestry Institute;
- UI, Urban Planning Institute;
- ZAG, National Building and Civil Engineering Institute; and
- ZRC SAZU, Scientific Research Centre of SASA.

The amount of institutional funding covers between 10-30% of the total budgets of these institutes. They obtain most of the funding through other modes of SRA financing (programme & project funding, infrastructure funding, etc.), from the business sector and abroad.

There are several types of higher education institutions, namely **universities, faculties, art academies and independent higher education institutions**. As of June 2016, there are four universities (University of Ljubljana, University of Maribor, University of Primorska and University of Nova Gorica), a public independent institution of higher education (Faculty of Information Studies, Novo mesto), one International Association of Universities (EMUNI-EURO Mediterranean University) and 44 private higher education institutions in Slovenia[20]. In 2015, 10.2% of the total R&D was performed by HEIs. Most of the funding was received from the government (66%), 19% of the funds were received from abroad and only 11% from business sector.

One of the problems of research at HEIs is the fragmentation of research teams, since it is common that research activity is performed by the academic staff in addition to the teaching. The law allows a top-up of up to 20% of salary for the research activity (100% comes from teaching, and an additional maximum 20% from research, subject to available funding). Relatively few people are employed at HEIs as full time researchers.

Figure 8: GERD - Higher Education sector (Purchasing power standard (PPS) per inhabitant at constant 2005 prices)



Source: Eurostat

[20] Ljubljana University (https://www.uni-lj.si/eng/) in particular, being the biggest and the oldest, is highly decentralised and faculties have a high level of independence in how they manage their affairs. This makes centralised strategies difficult if not impossible to implement. The finances the universities and other HEIs receive are calculated according to the enrolment, number of programmes and technical requirements of the study programmes and are allocated to individual faculties within the university. Research funds need to be obtained individually by faculties via application to programmes / projects of SRA (there is no institutional funding for research). In practice this means that the University collects funds from the faculties for its own functioning.

The comparison with selected countries reveals that the GBAORD as a percentage of total general government expenditure is in the case of Slovenia the lowest, suggesting a significant step back from the planned government policy in the area of R&D.

Table 7: Total GBAORD as a % of total general government expenditure (Percentage of government expenditure)

Table	2008	2009	2010	2011	2012	2013	2014	2015
EU-28	1.49	1.49	1.45	1.45	1.38	1.41	1.39	1.36
Euro area (19 countries)	1.57	1.56	1.52	1.52	1.43	1.44	1.42	1.39
Belgium	1.32	1.21	1.22	1.16	1.15	1.16	1.24	1.16
Estonia	1.59	1.48	1.72	2.02	2.07	2.12	1.87	1.75
Austria	1.37	1.39	1.46	1.55	1.51	1.58	1.53	1.58
Slovenia	1.14	1.4	1.22	1.19	1.09	0.81	0.87	0.85
Finland	1.94	1.95	2.02	1.94	1.84	1.73	1.68	1.66

Source: Eurostat

2.2 Number and composition of research personnel

2.2.1 Basic data

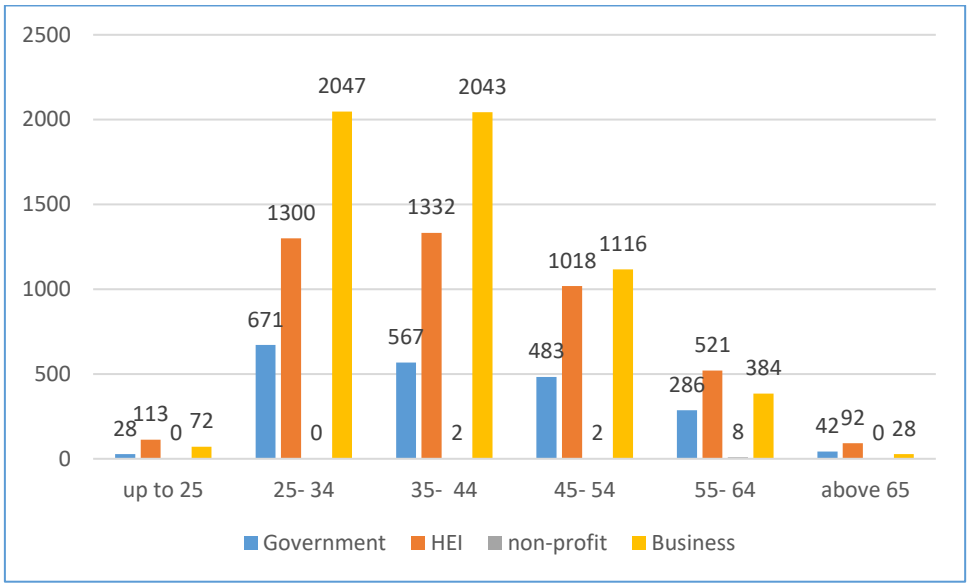
Table 8: Total R&D personnel by sectors of performance (Full-time equivalent (FTE))

Table	2008	2009	2010	2011	2012	2013	2014	2015
All sectors	11,594	12,410	12,940	15,269	14,974	15,229	14,866	14,225
Business enterprise sector	6,205	6,785	7,056	9,622	9,451	9,811	9,696	9,222
Government sector	3,260	3,252	3,141	2,628	2,579	2,596	2,490	2,437
Higher education sector	2,106	2,354	2,727	3,003	2,926	2,805	2,667	2,555
Private non-profit sector	23	19	16	16	18	17	13	11

Source: Eurostat

With the fluctuations in financing, the employment of R&D personnel is also fluctuating. The drop in numbers first started in the government sector and affected HEIs and recently the business sector, from 2011. A detailed look at the age structure of researchers reveals that the most significant drop in the number of researchers is in the age group 25-34[21], the younger researchers' category. The IMAD (2016b) assessed that "the reduction of jobs for young researchers lowers the efficiency of public funds invested in their education and at the same time jeopardises the future development of research institutions, their international competitiveness and transfer of knowledge to the business sector and deepens the gap in the age structure of researchers."

Figure 9: Researchers (head count) by sector of employment and age class, 2014



Source: SORS

Table 9: Number of researchers by sectors of performance (Full-time equivalent (FTE))

Table	2008	2009	2010	2011	2012	2013	2014	2015
All sectors	7,032	7,446	7,703	8,774	8,884	8,707	8,574	7,900
Business enterprise sector	3,058	3,278	3,389	4,510	4,618	4,664	4,637	4,191
Government sector	2,156	2,171	2,036	1,817	1,850	1,825	1,744	1,629
Higher education sector	1,795	1,978	2,262	2,431	2,398	2,201	2,180	2,069
Private non-profit sector	23	19	16	16	18	17	13	11

Source: Eurostat

[21] In this age group, 4432 researchers were employed in 2011. Their number had dropped in 2014 to 4018, with the biggest decline in the HEI (351) (SORS database).

Table 10: Number of female researchers by sectors of performance (Full-time equivalent (FTE))

Table	2008	2009	2010	2011	2012	2013	2014	2015
All sectors	2,326	2,513	2,668	3,094	3,020	3,017	2,973	n.d.
Business enterprise sector	695	739	793	1,162	1,130	1,197	1,194	n.d.
Government sector	903	930	900	854	871	859	845	n.d.
Higher education sector	720	838	969	1,069	1,014	956	933	n.d.
Private non-profit sector	8	6	6	9	5	5	1	n.d.

Source: Eurostat

Table 11: Total R&D personnel by fields of science (Full-time equivalent (FTE))

	2008	2009	2010	2011	2012	2013	2014	2015
Natural sciences	3,884	3,747	3,674	4,548	4,392	4,493	n.d.	n.d.
Engineering and technology	5,504	6,222	6,551	7,511	7,495	7,773	n.d.	n.d.
Medical and health sciences	604	692	804	919	911	1,011	n.d.	n.d.
Agricultural sciences	318	285	345	481	569	484	n.d.	n.d.
Social sciences	801	836	918	1,082	930	902	n.d.	n.d.
Humanities	487	629	647	727	675	565	n.d.	n.d.
Total	11,594	12,410	12,940	15,269	14,974	15,229	14,866	14,225

Source: Eurostat

2.2.2 Young researchers – recent trends

The Young Researchers Programme is one of the most successful activities in the area of education and training for R&D and innovation. The Programme was already set up in 1985 and has over the years worked successfully in bringing young people into research. The impact was so significant that it actually lowered the average age of researchers in the public research sector in Slovenia by the end of the century.

The programme finances young people, selected by higher education institutions and public research institutes to be potential candidates for researchers, during their M.A. or PhD. studies. During their studies they have a supervisor in this institution and take part in the research as junior assistants. The SRA pays for their salary, tuition fees as well as mentorship costs. The

Slovenian Research Agency initially provides financing for around 1200 young researchers every year, representing around 850 to 900 FTEs (full-time equivalents for young researchers on full salary). Between 200 and 250 new young researchers completed the training programme, which was opened after 2004 to foreign candidates as well. The instrument has seen certain modifications in terms of conditionality but most serious was the cut in financing during the crisis. From the peak financing of over 30 million EUR the funding had dropped to 17.8 million in 2015, providing for only 178 new young researchers to be selected for funding (altogether the figure dropped from 1200 to 940 in 2015).

In addition to the drop in financing of the programme itself, the high number of young researchers completed their education (and thus the end of their funding under the Young Researchers' programme) during the period of the most serious cuts of funding for research projects. This meant that a high number of young researchers lost their employment at the end of their training. As a response to this, the MESS launched a special measure for early career employment, yet the resources available were relatively modest with regard to the number of those leaving.

In 2014 and 2015, the government launched a special instrument to subsidise the employment of researchers with PhDs within the research organisations and dedicated €1m to this. One of the conditions was that the institution interested in such a researcher should cover one third of their yearly salary, while two thirds would be provided by the SRA. In 2015, 37 young PhDs were selected for co-financing. This figure does not compare well with the 414 researchers in the 25-34 age group who have lost their jobs since 2011. A new, somewhat changed call was published in the end of September 2016 by MESS. The instrument is aimed at research projects where the employment of researchers at the beginning of their careers will be stimulated. Their research work should be stimulating the cooperation between the PRO and enterprises, yet not necessarily directly beneficial to a single enterprise. During the time of the implementation of the project, the researcher needs to spend a minimum of one quarter of the project duration working in the enterprise. The total value of the call is €10m for the period 2017-2020, since the majority of the funding is from ESIF (MESS, 2016).

Based on the above Young Researchers measure in 2001, a special window exclusively for young researchers from the business sector was introduced. The annual call for Young Researchers from Business was implemented by the Technology Agency (TIA) and supplemented with resources from ESF. Young researchers from the business sector participated in research work during their postgraduate studies on basic research or R&D applied research projects, related to the needs of their company. What was also specific in the case of young researchers from the business sector was the fact that the candidates for PhDs worked with two mentors: one from the company and one from the HEI where the studies take place. This assured the relevance of the research for the company and thus contributed to the further employability of the young researcher. The TIA covered the salary, social contributions, material and non-material costs for research and doctoral studies. The funds for the training of young researchers were allocated for a fixed-term, up to a maximum of four years and six months for a PhD programme (doctorate). The expansion of the programme had been significant once the additional funds from ESF had been channelled towards this measure, in spite of cited administrative difficulties with the implementation.

Table 12: Number of young researchers from industry accepted for financial support, 2007- 2010 (MEDT data)

Year	Number of Young Researchers from Industry
Generation 2007	63
Generation 2008	69
Generation 2009	128
Generation 2010	140
ALL	**400**

Source: MEDT, 2016

The measure had received rather positive reviews (IER, 2010), not only as a direct contribution of new highly skilled human resources to the business R&D but also indirectly as a very good channel for developing the contacts between the business R&D and the public sector R&D units (HEI primarily). During their studies the young researchers got familiar with the research potential of the HEI and could initiate joint projects with their employer. In a separate analysis on industry-science cooperation (Bučar and Rojec, 2014), the role of young researchers from business enterprises was singled out as the most important instrument in promoting / initiating the cooperation of business enterprises with HEIs and PROs.

During 2011, the government decided to merge previously separate instruments of Young Researchers from the Business Sector and Support to Mobility schemes into a single measure called, "Strengthening the research capabilities of business enterprises" (KROP). The idea was that the enterprise can combine different ways of increasing its capabilities: by enrolling some of its staff in the education process (doctoral studies) and/or invite researchers from public sector institutions for a specified period to work in the research departments of an enterprise. Another mobility option was to engage research staff from a bigger enterprise in an SME, again for a specified period. The mobility schemes were based on part compensation of the researcher's salary. The instrument, for which €20m were allocated, was co-financed from ESF in the amount of 85%.

Yet, the instrument was stopped at the end of the financial period 2007-2013: the last call was published in 2013 by MEDT. Since that date no mobility scheme or a scheme for young researchers from the business sector has been financed.

Table 13: Results of the public calls for support of business enterprise research capability upgrading, 2011, 2012, 2013 (MEDT data)

	Number of groups	No. of supported employment	A1 (Young researchers)	A2	A3	A4	A5
KROP 2011	61	465	87	30	75	273	x
KROP 2012	62	179	42	26	49	62	x
KROP 2013	51	309	11	33	78	78	109
ALL	**174**	**953**	**140**	**89**	**202**	**413**	**109**

Source: MEDT, 2016b

Legend:

A1: Young researchers

A2: Employment of researchers from PROs.

A3: Employment of researchers and experts from Slovenia and abroad;

A4 (2011): Redeployment of employed researchers in a new R&D team.

A4 (2012, 2013): Employment of graduate students, who were to complete their studies within 6 months from the date of submission of the application or employment of registered unemployed.

A5 (2013): Redeployment of employed researchers in a new R&D team.

At the end of 2016, SPIRIT issued a call for support of a new instrument, aimed at the strengthening of competencies and the innovation potential of business enterprises. Within several objectives, the primary focus being on the promotion of innovation through co-funding of RDI projects; the strengthening of research capabilities with a combination of mobility and education / training is also listed among eligible activities. Yet due to the duration of up to 18 months, such an instrument is no substitute for young researchers from the business sector.

2.3 Key instruments

The key instruments in the RDI sphere need to be divided among those focusing primarily on the **funding of public research units** (and administered primarily via SRA) and the instruments are designed to promote R&D in business units. The instruments designed to promote cooperation between the two will be described in chapters 3 and 4.

The main instruments that SRA has been using for years in financing the HEIs and PROs are:

A. Research programmes

B. Basic and applied research projects

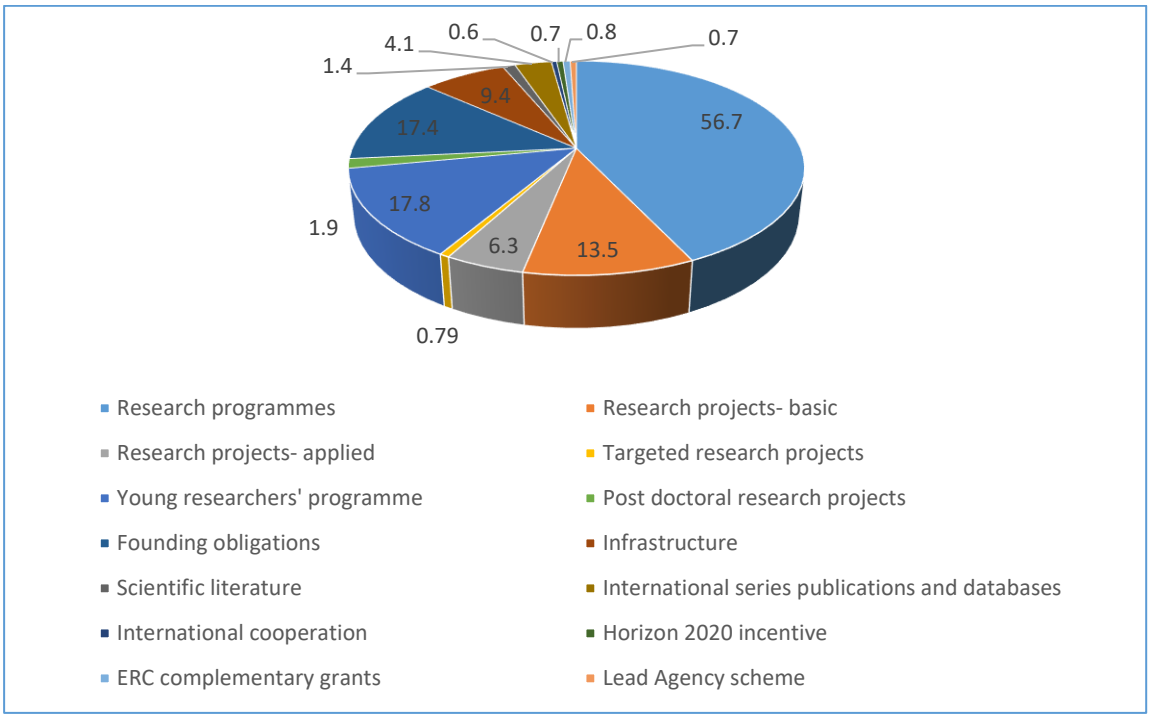
C. Targeted research projects

D. Young researchers (already described)

E. Institutional financing

F. Research infrastructure financing

Figure 10: SRA distribution of funds according to programmes/projects, 2015



A) The largest share of the basic research is funded through *"Research Programme Funding"*, (commonly known as research groups - RPG), a system established in 1999 to secure stability in funding of the basic research. The funding is allocated on the basis of a public call issued by the SRA but since it provides long-term support (up to 6 years), it is more stable than typical research project funding (1–2 years).

The RPG funding is a subject of debate among the evaluators of the Slovenian research system. Some claim this is a competitive funding scheme, since there are periodical calls and the applications are submitted by the existing and (a very small number) of new research groups. The applications (research proposals) are evaluated with the assistance of external evaluators. However, on the other hand, the RGPs are a long-term instrument, since once a research group is selected for funding it can re-apply to all subsequent calls. Since the data shows that there is practically no exit flow, the external evaluators (ERAC team in particular[22]) determined that RGPs in fact constitute semi-institutional or at least not fully competitive funding.

This type of programme fits well into "responsive mode" funding where funding is provided directly to research teams to carry out specific projects of their own choosing. The system provides for the

[22] Their assessment of RGPs was the following: "A very low rejection rate of research groups suggests that the system is actually a system of soft funding." (ERAC, 2010, p. 22; http://www.arhiv.mvzt.gov.si/fileadmin/mvzt.gov.si/pageuploads/pdf/znanost/ang_verzija/Slovenia_OMC_Report-FINAL_dec.pdf)

formation of research groups within specific science disciplines. The evaluation process is spelled out by the Slovenian Research Agency, which is responsible for monitoring and administering programmes. So far, bibliometric criteria have been favoured, especially scientific articles and citation indexes. Increasingly, however, the SRA is requesting information on the socio-economic relevance of the research and data on contractual research as an additional positive reference for a particular research team.

In 2015, the Slovenian Research Agency funded RGPs in the amount of €56.6 million or more than 42.6% of total disbursement of research funding (SRA financial report for 2015).

B) Another major scheme for financing is called "Basic and Applied projects", also operated by the Slovenian Research Agency. This scheme funds basic, applied and post-doctoral research projects of shorter periods (up to three years). While in the past the calls were issued by the SRA on a regular annual basis, during the last few years this has no longer been the practice. In 2011, the scheme was not launched at all. In 2013, the selection results of the 2012 call were issued. The 2014 call was launched in December only, so that the co-financing started in December 2015.

Such environments hinder the planning of R&D activities in research institutions and cause insecurity and instability in the employment of researchers, who depend on project financing (especially more junior researchers, who have not been able to join research programme groups). The decline in the financing of applied projects also has significant implications for the cooperation of public R&D units with the business sector, since this is the only SRA instrument aimed at the promotion of joint research projects.

Prior to the budget cuts, the total funding amounted to more than €37 million or more than 20% of the Agency's whole budget. In 2015, the basic projects received €13.4 m, applied projects €6.3 m and post-doctoral projects €1.9 m, altogether 16.9% of the SRA budget.

C) The SRA's more targeted funding mode is used for commissioning specific research to assist in public policy. These schemes are known as *Targeted Research Programmes*. The thematic priorities are specified by each of the interested ministries, with the aim of the scheme being the provision of scientific support to policy-makers in the preparation of their programmes and policies or in the evaluation of the existing work programmes. The instrument is opened to all ministries: half of the funding needs to be provided by the ministry(ies) and the other half is provided by the SRA. Targeted research projects run from one to three years. In 2010 (for the period 2010–2012), €7.2 million were allocated to Targeted Research Programmes. The programme suffered from serious budget cuts and no calls were issued in 2013-2015. Only a minor call for a project in the field of agriculture was run in 2014/15 with a total value of €0.76 m. But in 2016, the SRA was able to re-activate the instrument and a call was issued in the spring of 2016 for a total value of €1.58 m for 26 projects with a duration of one to three years. Among the funders besides the SRA were the MESS, the MEDT, the GODC, the Ministry of Finance, the Ministry of Culture, Parliament, the Ministry of Health, the Ministry of Environment and the Government Office for Chemicals. The Ministry of Agriculture funded its own TRP on food security with a total value of €3 m, two thirds coming from the Ministry and one third from the SRA for a period of three years.

E) According to the provisions of the Law on Research and Development (Official Gazette of the Republic of Slovenia 96/02 and 115/02), institutional funding is the obligation of the founder (the Government) towards public research and infrastructural institutes[23]. Through these funds, the Slovenian Research Agency covers the fixed operating costs of the research or infrastructural activities of these institutions.

The institutional funding provided under the founder's obligations comprises part of the administrative costs, fixed operating costs and the fixed costs of maintaining and repairing property and equipment. Depending on the individual institute, this covers between 10-30% of their basic running costs and represents in 2015 €17.4 m or 13.1% of the total SRA budget.

F) The SRA also provides resources for *research infrastructure*, both for the national one as well as for the co-financing of Slovenian participation in ESFRI. The fluctuation of financing is relatively high, with a slight increase in 2015 to €9.4 m. In 2016, the revised ESFRI Road Map was integrated in the Slovenian research infrastructure programme.

Besides the SRA, the funding of public research units is provided through the MESS for the instruments under its direct supervision. Typically, these would be instruments, co-financed from

[23] The infrastructure institutes are the Institute of Information Science, which operates the Information System on Slovenian Science [SICRIS] and the Co-operative Online Bibliographic System and Services [COBISS].

the EU Structural Funds and would not constitute a standard type of support but would be designed specifically within each financial perspective (see detailed description under chapter 4).

Slovenia started early with developing a system of **R&I measures for the business sector**, which is characterised by frequent changes of the types of measures and at least until 2007 was chronically underfinanced. Some of the first of such instruments were the **technology centres** (from 1994), which were independent legal entities established by several companies for the purposes of R&D in a specific field or branch, as well as for the provision of R&D equipment subsequently made available to companies for their development projects. After 2000, in Slovenia the **cluster initiative** began. The total 2003 budget for cluster policy was approximately €1.5 million. In total, 29 projects related to clustering were supported: 3 pilot cluster projects, 13 early stage clusters and an additional 13 cluster initiatives, bringing together 350 companies and 40 education/research institutes. With the change of Government at the end of 2004, the cluster support programme was discontinued in spite of a positive evaluation.

In 2005, the Ministry of Higher Education, Science and Technology in cooperation with the Chamber of Industry and Commerce introduced **technology platforms**. The MHEST offered a financial subsidy for the establishment of the platforms and their participation at the EU level. 12 technology platforms were formed in 2005. In 2008 and 2009 technology, platforms were supported through two measures: one directed specifically to their functioning and the other, significantly larger, to joint research projects, initiated by the technology platforms. Since that time, the activities of technology platforms have only been supported indirectly, by the application of the group of enterprises and institutes to other calls.

The Ministry of Economy through PAEFI launched the measure of **technology parks**[24]. Here, too, the modes of financing have changed several times since their establishment. With support from the European Regional Development Fund, construction of new premises and new research infrastructure investments were implemented during the financial period of 2004–2006 and also partially during 2007–2013. Currently, the support to technology parks is provided at a minimal level through SPIRIT via the programme on innovation infrastructure. Four parks are functional, the biggest being Ljubljana Technology park (http://www.tp-lj.si/en/), where over 300 enterprises are located.

The most comprehensive support system probably existed with the instruments of the Cohesion Policy 2007–2013[25]. The funding was provided for basic research via MHEST (**Centres of excellence**-COs) and for applied research through the Technology agency (TIA), MHEST (**Competence Centres**-CCs). The Ministry of Economy via the Slovene Enterprise Fund and PAEFI provided support to start ups and to the introduction of new technologies, incubators and technology parks. The Ministry of Economy funded **Development Centres**, which were to be the last element in the funding chain – already providing ground for test production. This means that during this period the entire process chain from basic research to entry to the market was covered, at least in theory.[26] Also, several of these instruments supported public-private partnership (especially centres of excellence and competence centres). Neither of the three instruments are continued within the financial perspective 2014-2020, since a set of new instruments have been developed to follow the RIS3 more closely. The evaluation of the centres of excellence and centres of competence was carried out in 2014, where the impact of both was assessed positively (Bučar et al., 2014). What was singled out as a problem was the short period of financing for such a complex endeavour.

The most important measure which was adopted for the indirect financial support for private R&D was the **tax relief/subsidy** that was introduced in 2006 and expanded in 2010 and 2012.[27] Initially, the R&D investments were tax deductible to a maximum of 20% of their total value (OG 117/2006). This was changed in 2010, so the enterprises could reduce their taxable income for corporate tax by 40% of their investments in R&D. An additional positive discrimination was introduced with the clause that the enterprises can have an additional 20% of tax deduction, if investing in R&D in regions with a development gap of more than 15% below the average for Slovenia. The eligible costs comprised the purchase of equipment and new technology for the purposes of R&D, the cost of labour in R&D activities and the purchase of licences. In 2012, the Government decided that the tax subsidy for R&D investments should be expanded to 100%. In 2014, these subsidies accounted for €228.6m (IMAD, 2016). Nearly a third of this amount was

[24] Predecessor to SPIRIT.
[25] For full coverage of instruments during 2007-2013 see also chapter 4.
[26] In practice, the system was less successful due to the lack of coordination in the implementation of individual measures, with some more market-focused measures already completed prior to the results obtained from more »up-stream« measures.
[27] There is unofficial data that the level of tax subsidies for R&D in 2014 amounted to 0.6% of GDP (around €228 million).

claimed by the pharmaceutical industry. While only 10% of those eligible for tax subsidies were large companies, they received two thirds of the subsidies. At the other end of the scale, micro enterprises represented more than half of those that claimed subsidies but they only accounted for less than one tenth of the amount, showing their good use of this tax scheme. In 2015, the government wanted to curb the level of subsidy. This was met by substantial resistance by the business sector, so the subsidy was left but much stricter rules were applied by the tax authorities in accepting the claims. The tax subsidy is regulated by the Ministry of Finance and in practice controlled by the Tax office. The MEDT however issued a series of detailed instructions as to what can and cannot be considered as R&D investment, following the specification of the Frascatti manual.

3 RESEARCH, DEVELOPMENT AND INNOVATION PERFORMANCE

3.1 Basic innovation data (CIS 2012-2014)

The European Innovation Scoreboard 2016 lists Slovenia as a *Strong Innovator*. Innovation performance has been steadily increasing with minor declines in 2013 and 2015. Slovenia's relative performance to the EU has improved from 90% in 2008 to 93% in 2015.

Table 14: Summary Innovation Index

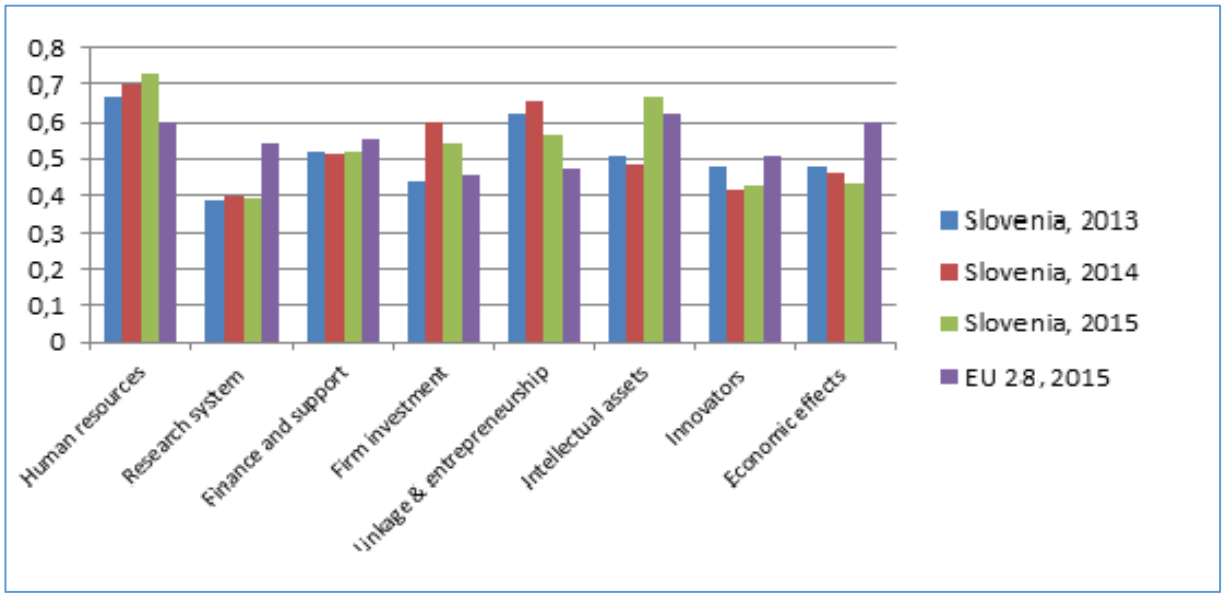
	2012	2013	2014	2015
EU	0.519	0.521	0.523	0.521
Belgium	0.592	0.596	0.607	0.602
Estonia	0.505	0.490	0.479	0.448
Austria	0.581	0.604	0.599	0.591
Slovenia	0.491	0.476	0.498	0.485
Finland	0.651	0.642	0.658	0.649

Source: European Innovation Scoreboard, 2016

As observed in the Summary Innovation Index, the position of Slovenia is relatively stable, which in view of the improved investment in R&D by the business sector as well as the numerous instruments introduced within the financial perspective 2007-2013, is discouraging. What needs to be taken into account is a certain time lag between the inputs and outputs, since some of the scoreboard indicators are based on relatively old data. Particular relative strengths are in international scientific co-publications, new doctorate graduates and public/private co-publications. Strong relative weaknesses are observed for venture capital investments, license and patent revenues from abroad and non-EU doctorate students (see Figure 10).

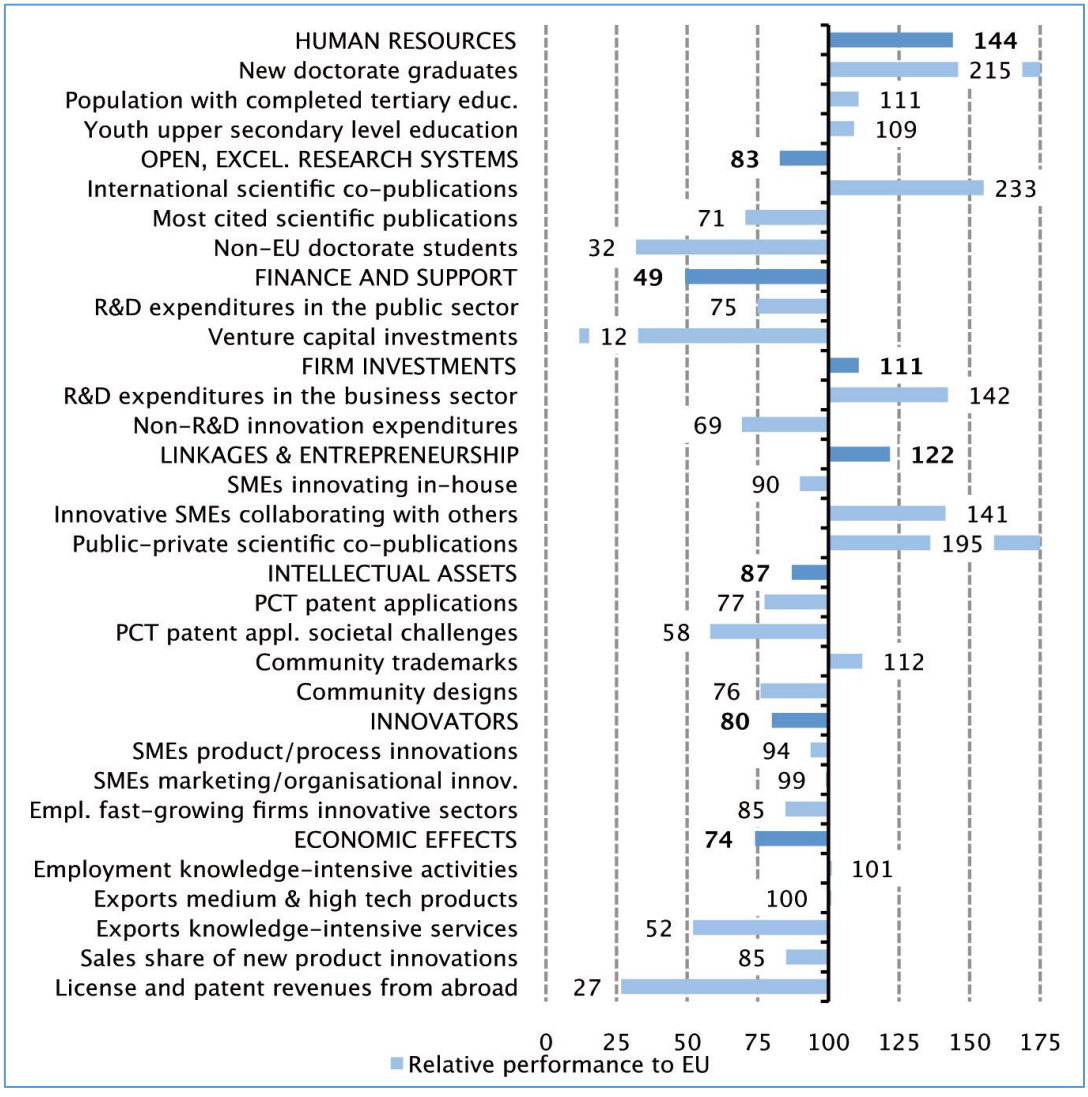
According to the Innovation Output Indicator (IOI), which is based on four components (patents, employment in knowledge-intensive activities, trade in knowledge-based goods and services and innovativeness of high growth enterprises) and five sub-indicators (EC, 2016). Slovenia underperforms in these categories in relation to the EU average. Especially significant is the gap between the relatively high R&D intensity and low innovation output (see EC, 2016, p. 76, Figure 1-3-9). This gap has been identified by several evaluations of the Slovenian RDI (OECD, 2012, ERAC, 2010).

Figure 11: Innovation activity of Slovenia and EU28



Source: European Innovation Scoreboard, 2015

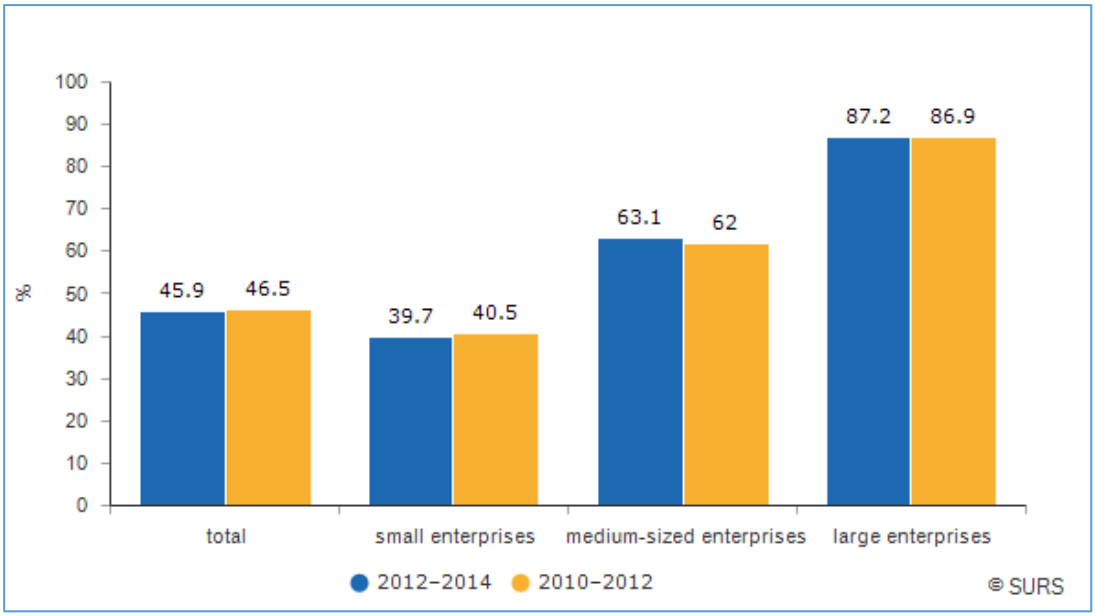
Figure 12: Slovenia in the European Innovation Scoreboard, 2016



Source: European Innovation Scoreboard, 2016

Slow progress is also reflected in the data of CIS 2012-2014[28]. The innovation activity increased slightly with the medium and large enterprises and is lower in the small enterprises, bringing the overall figure slightly under the data for the 2010-2012 period.

Figure 13: Enterprises with innovation activity by class size, Slovenia



Source: SURS, 2016

Still, in relation to previous CIS data we can observe two interesting changes. More and more enterprises are reporting that they have introduced both technological and non-technological innovation. Also, service sector enterprises have increased their innovation activity. While some data on the types of innovation introduced is available, the break-down by industry for the last CIS (2012-2014) is not yet available.

Table 15: Innovation activity of the enterprises by class size, Slovenia, 2012–2014 — Number of companies

Size	Enterprises - total	Enterprises with innovation activity			
		Total	Only technological	Only non-technological	Technological and non-technological
Small	3,231	1,282	327	424	532
Medium-sized	761	480	112	92	277
Large	164	143	19	18	107
Total	**4,157**	**1,906**	**457**	**534**	**915**

Source: SURS, 2016

[28] Data was collected from the official site of the Slovenian Statistical Office, since EUROSTAT data has not been updated with the latest CIS.

Table 16: Innovation activity of the enterprises by activities, Slovenia, 2012–2014 — Number of companies

Sectors	Enterprises - total	Enterprises with innovation activity			
		Total	Only technological	Only non-technological	Technological and non-technological
Industry	2,172	1,068	277	258	533
Manufacturing	1,987	990	265	225	499
Services	1,984	838	181	276	381
Total	**4,157**	**1,906**	**457**	**534**	**915**

Source: SURS

3.2 Publications and citations

This section describes Slovenia's bibliometric profile. It is based on data extracted from SCImago showing Slovenia's aggregate number of publication count, citable documents, citations, self-citations, citations per document and H-index (timeframe 2011-2015). The Slovenian Research Agency mostly relies on the data analysed by SICRIS[29], a system developed by the Institute of Information Science and SRA. All the research organisations are monitored as well as individual researchers. The bibliometric score that SICRIS in combination with COBISS[30] provides for individual researchers is an important evaluation criteria when applying for research projects as well as when seeking promotion at HEI or in PROs. The professional careers are significantly shaped by their score in COBISS, not only the overall score but also in specific categories (international journals in SCI/ SSCI, minimum number of citations, etc.)[31] Indirectly, this is an important policy instrument, since the grading system of papers in journals, manuscripts, citations, etc. effects individuals' decisions as to the type of research they get engaged in. To publish in internationally acclaimed journals brings the highest points in COBISS, so that is the end focus of the researchers. Ever since this system was introduced, the number of publications has increased significantly.

Slovenia's subject areas with the highest number of publication counts are Medicine (5308), Engineering (4770) and Physics and Astronomy (4251) respectively. The number of publication counts for the subject area of Medicine has slightly increased over the period considered. However, the number of publication counts for the subject areas of Engineering and Physics and Astronomy has slightly decreased over the past five years. Conversely, Dentistry (76), Multidisciplinary (165) and Nursing (184) account for the three lowest subject areas in terms of publication counts.

Concerning the aggregate number of citable documents (timeframe 2011-2015), the subject areas of Medicine (4983), Engineering (4685) and Physics and Astronomy (4189) have the highest amount of citable documents. The number of citable documents for the subject area of Medicine has slightly increased from 2011 to 2015, while the opposite is the case for Engineering and Physics and Astronomy. On the other hand, Dentistry (74), Multidisciplinary (156) and Nursing (173) rank last once again in this measurement.

When considering the aggregate numbers of citations (timeframe 2011-2015), the subject areas of Physics and Astronomy (32821), Medicine (29969) and Biochemistry, Genetics and Molecular Biology (23356) are the highest ranked. Nonetheless, there is substantial distance in the amounts of citations between the first two subject areas and the third. On the other hand, the subject areas

[29] http://www.sicris.si/about/cris.aspx?lang=eng
[30] http://www.cobiss.si/cobiss_eng.html
[31] The following web page explains in detail the methodology applied: http://scimet.izum.si/methodology

that show the lowest sum of citations for the considered period are Dentistry (341), Decision Sciences (654) and Veterinary Sciences (821).

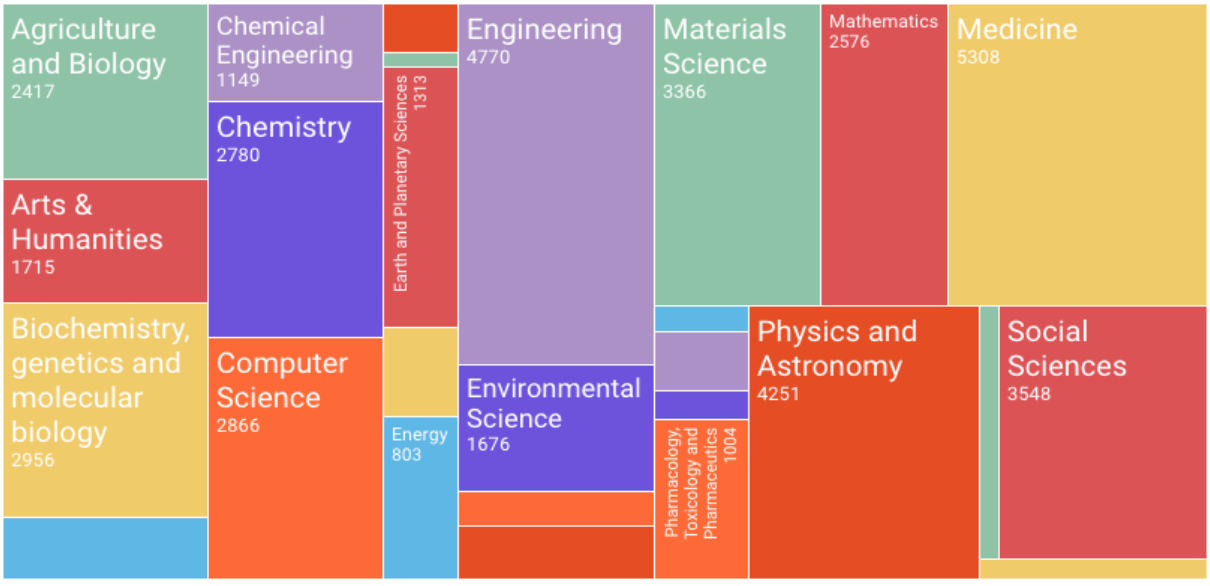
Regarding the sum of self-citations, the subject areas of Physics and Astronomy (5715), Medicine (4089) and Engineering (3851) account for the highest values for the considered timeframe. Overall, these three subject areas have been decreasing for the past five years. Nonetheless, Physics and Astronomy presented the highest values in 2011. However, Dentistry (46), Veterinary Science (143) and Nursing (156) present the lowest total values for the past five years.

For the average citations per document, the subject areas that present the highest averages are Multidisciplinary (19,8), Neuroscience (9,0), Immunology and Microbiology (8,7). The subject area of Multidisciplinary shows a substantial difference with the next subject area (Neuroscience), accounting for more than double the average. On the other hand, the top performers for the previous measurements rank considerably lower. Indeed, Physics and Astronomy only amounts to 7,4, Medicine finds itself at 5,7, while Engineering skims the bottom of the rankings at 2,9. On the other hand, the subject area of Dentistry performs relatively better with respect to its average citations per document. Furthermore, the subject areas of Social Sciences (1,2), Arts & Humanities (1,2) and Economics, Econometrics and Finance (1,9) ranked last when considering the average citations per document.

Finally, the aggregate average of h-indexes shows that the subject areas of Medicine (132), Physics and Astronomy (125), Biochemistry, Genetics and Molecular Biology (120) are at the top of the ranking of this measurement. Equally, the subject areas that present the lowest aggregate average of h-index are Dentistry (24), Economics, Econometrics and Finance (26) and Veterinary Science (28).

In conclusion, the subject areas of Medicine, Engineering and Physics and Astronomy stand out as Slovenia's top performing fields. Figure 12 (total intramural R&D expenditure) shows that Natural Sciences, Engineering and Technology and Medical and Health Sciences, are among the fields that benefit from the highest levels of expenditure. Nonetheless, Dentistry, Veterinary Science and Nursing account for the worst performing subject areas for Slovenia, regardless of such investments in Medical and Health Sciences.

Figure 14: Publication count (2011-2015)



Source: SCImago

This section presents the bibliometric indicators collected/calculated for Slovenia and 4 additional benchmark countries including Austria, Belgium, Finland and Estonia. The selection of benchmarking countries was based partly on the size of the country and partly because policies in selected countries have often been analysed by Slovenian researchers. The bibliometric data, retrieved in December 2016 from the SCImago Journal and country ranks, covers a 5-year period from 2011 to 2015 for the journals and country scientific indicators developed from information contained in the Scopus database. These journals are grouped by subject area (27 major thematic

areas) and deliver the total number of documents, citable documents, citations, self-citations, citations per document and H-index. Specialisation was calculated for the period 2007-2016 using the data from Scopus.

Specialisation: Table 17 shows specialisations by subject area compared to the world using counts of peer reviewed publications and reviews from 2007 to 2016. According to the data, Slovenia's specialised subject areas are Arts & Humanities; Business, Management and Accounting; Materials Science; Physics and Astronomy and Social Sciences. Slovenia's under-specialised subject areas are Dentistry; Immunology and Microbiology; Medicine; Multidisciplinary; Neuroscience; Nursing and Psychology (in the timeframe 2007-2016).

Among its specialised subject areas, Slovenia stands out in Materials Science, Mathematics and Physics and Astronomy. Indeed, for these specific subject areas, Slovenia has an advantage compared to the benchmarked countries. Concerning the **Materials Science** subject area, Slovenia is the only specialised country. While Austria remains around field average, Belgium, Finland and Estonia are all under-specialised. Moreover, Slovenia is again the only specialised country among the benchmarked countries in the subject area of **Mathematics**. However, other countries are around field average with the exception of Estonia which is under-specialised. Finally, for the subject area of **Physics and Astronomy**, Slovenia and Estonia are specialised while Austria, Belgium and Finland are around field average.

However, among its under-specialised subject areas, Slovenia performs the worst in Immunology and Microbiology, Multidisciplinary, Neuroscience, Nursing and Psychology. Among the aforementioned subject areas, Slovenia performs less well compared to the benchmarked countries in the subject areas of Immunology and Microbiology, Neuroscience and Psychology. In fact, Slovenia is the only under-specialised country when compared to the benchmarks for the aforementioned subject areas.

Slovenia stays within the world average in the subject areas of Agriculture & Biology; Biochemistry, Genetics and Molecular Biology; Chemical Engineering; Chemistry; Computer Science; Decision Science; Earth and Planetary Sciences; Economics, Econometrics and Finance; Energy; Engineering; Environmental Science; Health Professions; Pharmacology and Veterinary Science.

Together, Slovenia and benchmarked countries do not perform well in the subject areas of Chemical Engineering, Chemistry, Computer Science, Economics, Energy, Engineering, Medicine, Multidisciplinary and Pharmacology.

Overall, Slovenia's publication count is the second lowest among benchmarked countries. Nonetheless, it specialises in six subject areas which is the same amount as Austria and Estonia, whereas Belgium and Finland have seven and eight specialisations respectively.

Table 17: Specialisation by subject area (2007-2016)

Country	SI	AT	BE	FI	EE
Agriculture & Biology	8	14	22	34	61
Arts & Humanities	37	-35	19	-12	62
Biochemistry, Genetics and Molecular Biology	-20	21	19	10	8
Business, Management and Accounting	26	-17	-17	55	-5
Chemical Engineering	-12	-43	-32	-19	-44
Chemistry	13	-13	-10	-23	-12
Computer Science	18	-4	-14	15	-40
Decision Science	-15	21	33	40	-41
Dentistry	-58	-33	-21	38	-86
Earth and Planetary Sciences	9	37	9	36	61
Economics, Econometrics and Finance	-4	13	18	10	-23
Energy	-10	-26	-38	-10	-6
Engineering	2	-40	-43	-33	-37
Environmental Science	17	13	6	45	59
Health Professions	-10	3	24	10	-36
Immunology and Microbiology	-25	32	37	12	2
Materials Science	24	-16	-26	-22	-25
Mathematics	39	16	-8	-5	-39
Medicine	-41	10	13	-5	-42
Multidisciplinary	-57	-12	-37	-24	1

Country	SI	AT	BE	FI	EE
Neuroscience	**-62**	25	28	21	-6
Nursing	**-78**	**-35**	**-23**	25	**-40**
Pharmacology, Toxicology and Pharmaceutics	1	**-24**	14	**-34**	**-38**
Physics and Astronomy	25	17	5	11	23
Psychology	**-64**	-9	41	20	7
Social Sciences	43	**-32**	4	17	49
Veterinary Science	16	30	53	**-40**	**-27**

Source: own calculations based on Scopus

Notes: Specialisation indices are calculated based on the relative weight of the peer reviewed publications and reviews of Slovenia and benchmark countries compared to the weight in the world with transformations applied to the measure in order to centre the indices around zero and fix their range between -100 and 100 (based on logarithmic and hyperbolic tangent functions). Large positive (resp. negative) values illustrate high (low) specialisation in the subject area.

Citations per publication**:**

3 shows the average amount of citations per publication for Slovenia as well as benchmark countries Austria, Belgium, Estonia and Finland (in the timeframe 2011-2015). According to data collected from SCImago, Slovenia has the lowest average relative to benchmarks, accounting for 4.3 for all subject categories. On the other hand, Belgium has the highest average, accounting for 7.1 for all subject areas.

Slovenia's highest average citations per document (>8) are in the fields of Neuroscience (9), Immunology (8.7) and Biochemistry, Genetics and Molecular Biology (8.1). Its lowest averages (<2) are in the areas of Social Sciences (1.2), Arts & Humanities (1.2) and Economics, Econometrics, and Finance (1.9).

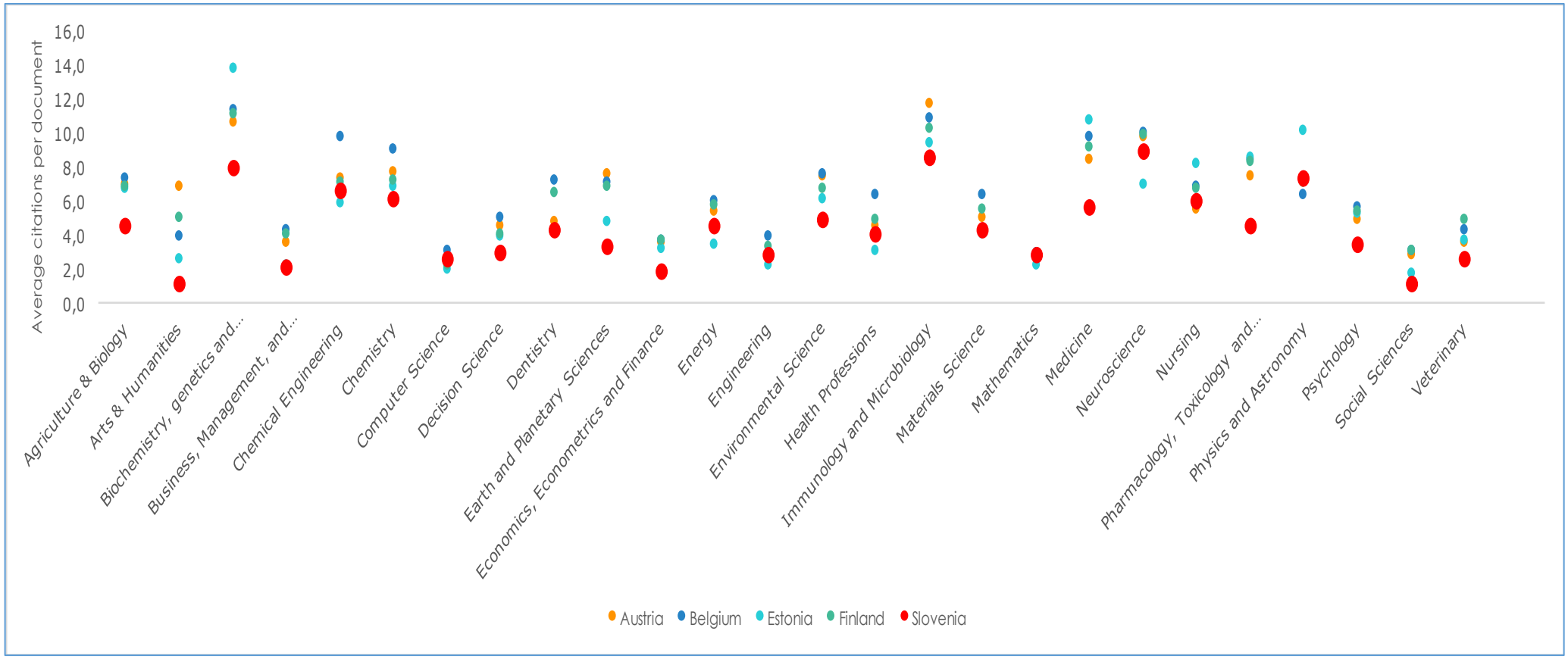
Even though Slovenia ranks last in terms of the average citations per document for all subject areas (19 of 27), it ranks second last in the fields of **Computer Science, Engineering, Health Professions, Energy, Nursing, Chemical Engineering, Physics and Astronomy and Neuroscience**.

The narrowest gap between Slovenia and the highest ranked country is in **Neurosciences**. Indeed, Belgium has an average of 10.1 citations per document while Slovenia has an average of 9. In this case, Estonia lags behind with an average of 7.1. Moreover, a similar observation can be made for **Computer Science**.

The widest gap between Slovenia and the second last benchmark country is in the **multidisciplinary** field. It performs substantially worse at 19.8 average citations per document compared to Austria at 39.5 average citations. In comparison, the highest ranked country for this particular field is Belgium at 57.9 average citations per document.

In general, Slovenia has a low average of citations per publication compared to the benchmarked countries.

Figure 15: Average citations per document (2011-2015)



Source: SCImago

H-Index:

16 represents the average of the number of H-index for Slovenia, Austria, Belgium, Finland and Estonia (the period of 2011-2015). According to the data, Slovenia does not have a clear advantage compared to the benchmarked countries. In fact, it has the second lowest average after Estonia of all subject categories, while Belgium has the highest. On the other hand, Slovenia has the lowest average of H-index in the fields of **Agriculture & Biology; Arts & Humanities; Biochemistry, Genetics and Molecular Biology; Earth and Planetary Sciences; Psychology and Social Sciences**.

Slovenia's output is highest (>100) in the fields of **Medicine, Physics and Astronomy, Biochemistry**, **Genetics and Molecular Biology and Chemistry**. However, it has a low average of H-index (<30) in the fields of **Dentistry; Economics, Econometrics and Finance; Veterinary and Decision Science**.

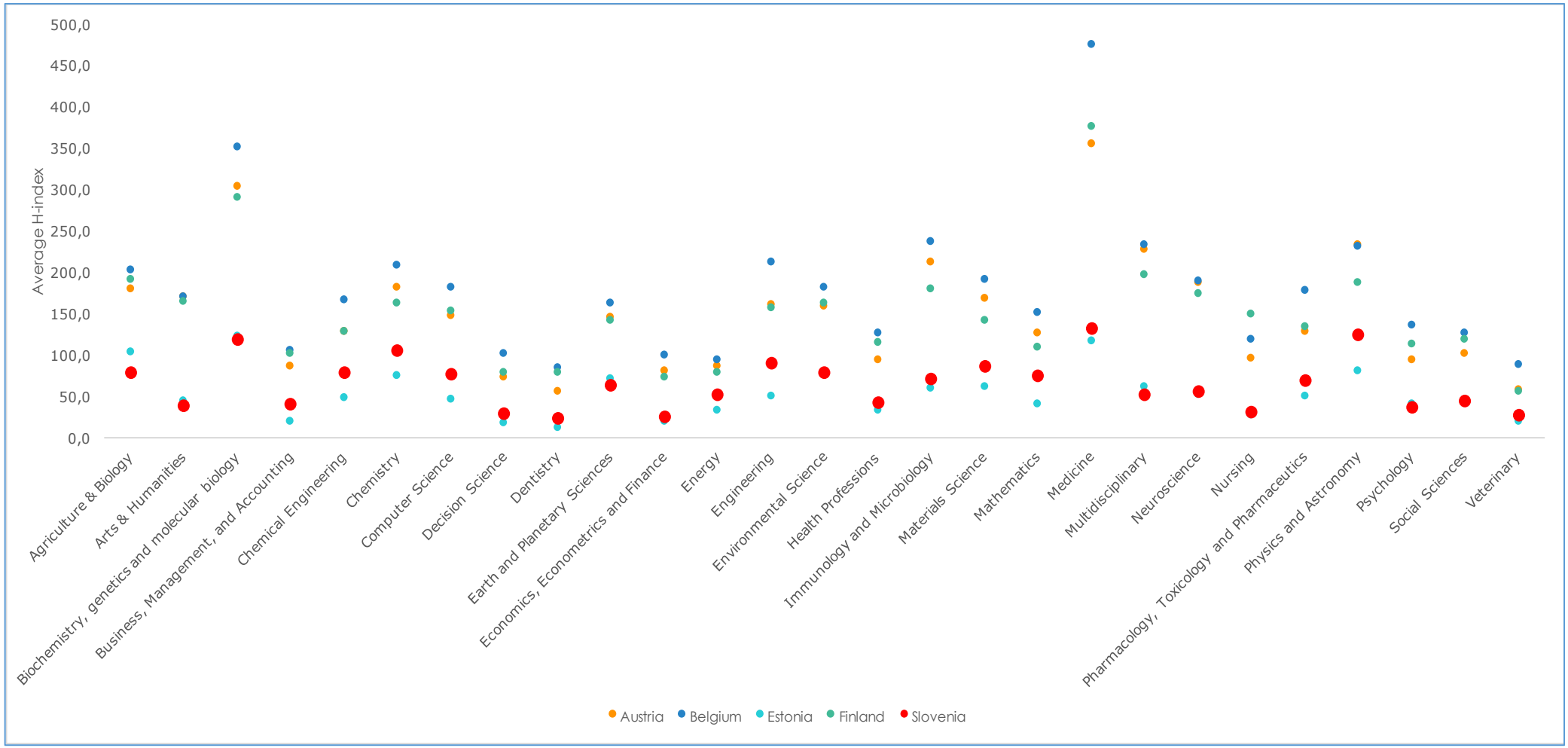
Slovenia's highest H-index average is in **Medicine** at 132. Nonetheless, Belgium ranks first at an H-index of 475 for this subject area. Slovenia's lowest average is in **Dentistry,** accounting for 24, while Belgium has the highest H-index for this subject area at 84.

Overall, there is a gap between the averages for all subject areas of Austria (487), Belgium (593) and Finland (479), Estonia (185) and Slovenia (204). This is relevant especially in the fields of **Arts & Humanities; Biochemistry, Genetics and Molecular Biology; Earth and Planetary Sciences; Environmental Sciences; Immunology and Microbiology; Medicine; Neuroscience; Psychology and Social Sciences.**

In general, the subject areas of **Veterinary Science and Dentistry** show the lowest total average for all five countries accounting for 50.4 and 51.2 respectively. On the other hand, **Medicine and Biochemistry, Genetics and Molecular Biology** mark the highest averages with 237.8 and 291.4 respectively.

In general, Slovenia performs poorly with regards to the average of H-index alongside Estonia, while Belgium has the highest overall average. Austria and Finland share the second place.

Figure 16: Average of H-index (2011-2015) — Source SCImago



Source: Scimago

Notes: The H-index is a country's number of articles (h) that have received at least h citations. It quantifies both the country's scientific productivity and scientific impact and it is also applicable to scientists, journals, etc. (Scimago, 2016).

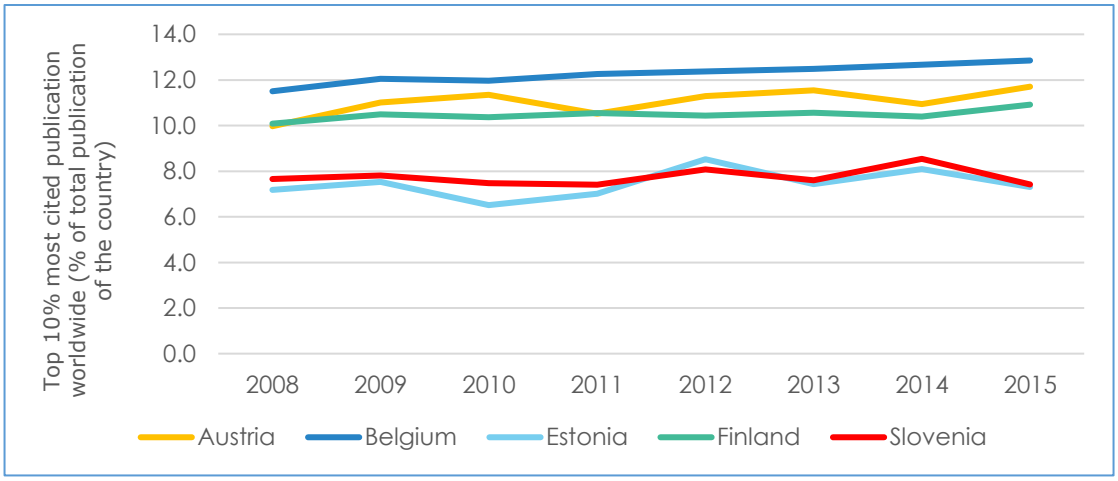
Scientific publications among the top 10% most cited publications worldwide: Figure 17 shows data collected from the Centre for Science and Technology Studies (CWTS) for the Innovation Union Scoreboard publication of 2016. It compares the amount of scientific publications among the top 10% most cited publications worldwide as a % of the total scientific publications for Slovenia and benchmarks (timeframe 2008-2015).

According to the data, Slovenia's top 10% most cited publications among its total volume of publications has remained stable with only a slightly negative average annual growth rate of -0.4%. Most notably, in 2008, Slovenia had 7.7% of its scientific publications among the 10% most cited publications. This figure slightly increased in 2009 but decreased over the two following years. For the period of 2012 to 2015, Slovenia's percentage fluctuated between 7.4 and 8.5. Austria's percentage for this indicator, as well as Belgium's has steadily increased for this time period. However, the former's figures have been progressing more erratically than the latter's. Nonetheless, both have experienced a positive average annual growth of 2%. Finland's figures have been fluctuating between 10.4% and 10.6% between 2008 and 2014, until they suddenly rose to 10.9%. This explains Finland's positive average annual growth of 1%.

In 2015, Slovenia and Estonia had a comparatively low percentage compared to the other benchmark countries, at 7.4% and 7.3% respectively. Belgium had the highest percentage of scientific publications among the top 10% most cited publications worldwide.

Overall Slovenia, alongside Estonia, performed relatively lower than the other benchmarked countries. Indeed, in 2015, their respective values accounted for 7.4% and 7.3%. This is below the EU average, which accounts for 10.5%.

Figure 17: Scientific publications among the top 10% most cited publications worldwide as a % of the total scientific publications of the country



Source: IUS, 2016

3.3 Patenting, industrial design and trademarks

European patents granted by field of technology (Slovenia & Benchmarks): Table 18 shows the number of granted European patents by field of technology per million inhabitants. The field of technologies includes Electrical Engineering, Instruments, Chemistry, Mechanical Engineering and Other fields, which each comprise subcategories. Data was collected for Slovenia and benchmark countries from the EPO statistics database and weighed upon respective populations (timeframe 2006-2015).

The technology sub-field for which Slovenia has the most granted patents (per million population) is in Pharmaceuticals, followed closely by Organic Fine Chemistry, with 33 and 32 respectively over the period of 2006-2015. As a matter of fact, Chemistry is the technology field within Slovenia which shows the highest number of granted patents, accounting for 83. However, it does not show patents in IT methods for management (Electrical Engineering) and Micro-structural and Nano-technology (Chemistry). Nevertheless, the Instruments Technology field is Slovenia's lowest figure for European patents granted, amounting to 22.

With regards to the total number of patents in absolute terms, Slovenia ranks fourth before Estonia, with 29 granted patents per million inhabitants for all technology fields. Finland ranks first in terms of the total number of patents. Nonetheless, there is a considerable gap between the top

three (Finland, Austria and Belgium). To illustrate, Belgium's total number of granted patents is 3,73 times higher than Slovenia's.

Table 18: European patents granted 2006-2015 by field of technology per million inhabitants (absolute values)

Field of technology [1]		Austria	Belgium	Estonia	Finland	Slovenia
Electrical engineering	Electrical machinery, apparatus, energy	74 (617)	18 (199)	3 (4)	50 (267)	15 (31)
	Audio-visual technology	16 (137)	9 (93)	0 (0)	35 (186)	1 (3)
	Telecommunications	5 (46)	7 (81)	0 (0)	240 (1288)	0 (1)
	Digital communication	5 (45)	3 (38)	2 (3)	189 (1013)	2 (5)
	Basic communication processes	5 (43)	4 (45)	0 (0)	22 (116)	2 (4)
	Computer technology	12 (97)	12 (135)	2 (2)	67 (359)	3 (6)
	IT methods for management	1 (5)	0 (1)	0 (0)	1 (5)	0 (0)
	Semiconductors	13 (107)	11 (124)	0 (0)	6 (32)	0 (1)
	Total	131 (1097)	66 (716)	7 (9)	609 (3266)	25 (51)
Instruments	Optics	9 (72)	14 (157)	0 (0)	13 (68)	2 (5)
	Measurement	28 (236)	21 (234)	3 (4)	46 (247)	7 (15)
	Analysis of biological materials	4 (31)	10 (105)	2 (3)	9 (49)	1 (2)
	Control	22 (186)	4 (45)	0 (0)	12 (62)	1 (3)
	Medical technology	39 (331)	18 (200)	5 (7)	36 (194)	10 (20)
	Total	102 (856)	68 (741)	11 (14)	116 (620)	22 (45)
Chemistry	Organic fine chemistry	8 (69)	47 (509)	2 (2)	11 (57)	32 (65)
	Biotechnology	20 (165)	41 (447)	5 (7)	19 (102)	8 (17)
	Pharmaceuticals	14 (120)	31 (343)	5 (6)	13 (69)	33 (68)
	Macromolecular chemistry, polymers	28 (237)	29 (313)	0 (0)	46 (249)	0 (1)
	Food chemistry	4 (37)	9 (97)	2 (2)	9 (47)	2 (4)
	Basic materials chemistry	9 (72)	17 (184)	1 (1)	12 (63)	1 (2)
	Materials, metallurgy	35 (296)	13 (145)	2 (2)	21 (112)	1 (2)
	Surface technology, coating	14 (117)	10 (111)	0 (0)	15 (80)	2 (4)
	Micro-structural and nano-technology	0 (2)	0 (5)	0 (0)	1 (3)	0 (0)
	Chemical engineering	21 (180)	16 (178)	2 (3)	35 (190)	2 (4)
	Environmental technology	12 (103)	10 (110)	1 (1)	19 (103)	1 (2)
	Total	167 (1398)	224 (2442)	18 (24)	200 (1075)	83 (169)
Mechanical engineering	Handling	51 (426)	17 (190)	2 (3)	89 (478)	8 (17)
	Machine tools	56 (472)	7 (75)	1 (1)	26 (140)	6 (12)

Field of technology [1]		Austria	Belgium	Estonia	Finland	Slovenia
	Engines, pumps, turbines	25 (207)	13 (142)	2 (3)	25 (134)	1 (2)
	Textile and paper machines	28 (235)	40 (439)	1 (1)	86 (459)	2 (5)
	Other special machines	48 (404)	45 (489)	1 (1)	41 (219)	2 (5)
	Thermal processes and apparatus	16 (130)	15 (160)	1 (1)	17 (90)	1 (3)
	Mechanical elements	34 (287)	10 (106)	1 (1)	17 (90)	4 (8)
	Transport	59 (497)	19 (209)	1 (1)	38 (205)	5 (10)
	Total	317 (2658)	166 (1810)	9 (12)	338 (1815)	30 (62)
Other fields	Furniture, games	52 (438)	20 (223)	0 (0)	11 (59)	3 (7)
	Other consumer goods	24 (201)	39 (420)	0 (0)	10 (53)	11 (22)
	Civil engineering	83 (695)	30 (325)	2 (3)	39 (209)	12 (24)
	Total	159 (1334)	89 (968)	2 (3)	60 (321)	26 (53)

Source: EPO statistics

Design Applications (Slovenia & Benchmarks): Table 19 shows community design applications per million inhabitants extracted from Eurostat. Data provides information for Austria, Belgium, Estonia, Finland and Slovenia (timeframe 2003-2016).

From 2003 to 2014, Slovenia shows a steady increase in the number of design applications per million inhabitants, from 3 to 50. Similar trends are observed in benchmarked countries. From 2014 to 2015, Slovenia's number of design applications decreased to 41. With the exception of Estonia, a similar decreasing trend is to be noted in other countries. Slovenia was especially marked by a 37% decrease during this period.

In 2016, Slovenia ranked third among benchmark countries with 41 community design applications per million inhabitants, ahead of Belgium (34) and Estonia (29). Nonetheless, there is a substantial distance, in absolute values, between the amount of design applications made by Slovenia and Estonia and those made by Austria, Belgium and Finland. Finland ranks third at 232 applications, while Slovenia and Estonia accounted for 66 and 56 respectively. Thus, Slovenia has in 2016, 3.5 times less applications than Finland and 5.9 times less than Austria.

In conclusion, Slovenia shows the second highest increase in community design applications per million inhabitants between 2003 and 2015, after Estonia. Nevertheless, both countries still show a considerably lower number of community design applications in absolute values compared to the other benchmarked countries.

Trademark Applications (Slovenia & Benchmarks): The European Union trademarks (EUTM) applications per million inhabitants by class (Nice classification) counts 46 different classes (timeframe 1996-2016). The Nice classification wherein Slovenia shows the highest number of trademark applications is in Advertising, Business Management, Business Administration and Office functions. In 2015, this figure accounted for 58 applications per million inhabitants.

Compared to the benchmarks, Slovenia has the lowest number of trademark applications. At 251 trademark applications, Slovenia follows Belgium. This represents a difference of 57 applications with Belgium (ranked fourth among the benchmarks) in 2015. However, there is a substantial distance between Slovenia and Austria, as the latter shows the highest number of trademark applications per million inhabitants for that year. The difference between the two countries was substantial in 2015, seeing that Austria's values account for 2.4 times Slovenia's.

Table 19: Community design applications per million inhabitants (absolute values)

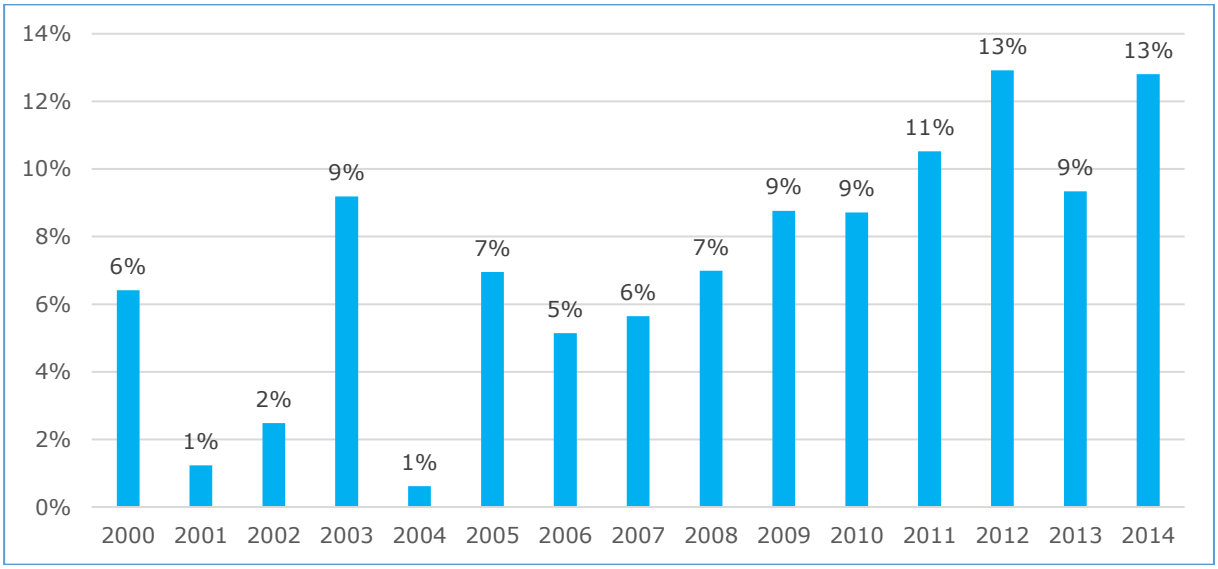
Year	Belgium	Estonia	Austria	Slovenia	Finland
2003	15 (159)	N/A	24 (191)	3 (6)	21 (111)
2004	24 (247)	4 (5)	33 (267)	14 (27)	30 (157)
2005	28 (294)	2 (3)	38 (309)	9 (18)	37 (193)
2006	27 (284)	9 (12)	43 (357)	19 (38)	35 (184)
2007	31 (326)	7 (10)	50 (416)	20 (40)	36 (188)
2008	28 (302)	11 (15)	46 (379)	23 (47)	38 (201)
2009	31 (330)	17 (23)	49 (407)	28 (56)	42 (226)
2010	33 (360)	23 (31)	49 (408)	30 (61)	45 (242)
2011	33 (361)	30 (40)	53 (447)	32 (66)	44 (234)
2012	31 (341)	27 (36)	56 (472)	36 (75)	52 (280)
2013	34 (376)	35 (46)	57 (484)	43 (88)	58 (315)
2014	34 (386)	25 (33)	59 (501)	50 (104)	58 (314)
2015	34 (377)	29 (38)	50 (427)	41 (84)	54 (294)

Source Eurostat (29.11.16)

In absolute terms, Austria shows the highest number of trademark applications accounting for 2531 in 2016. Comparatively, Slovenia's value is 8.55 times lower than the former. There is a considerable gap between Estonia and Slovenia and Austria, Belgium and Slovenia. Nonetheless, between 2011 and 2015, Slovenia represents the highest growth of trademark applications per million inhabitants compared to the benchmarked countries. Conversely, Austria shows the lowest growth for the same time period.

Public sector patenting (as a % share) (Slovenia only): The indicator of the share of public sector patenting is based on data extracted from Patstat. The numerator is composed of patents (applications and grants) of inventors and applicants from the public sector, including universities, non-governmental organisations, non-profit governmental organisations and hospitals. Those are the public sector stakeholders distinguished within the Patstat database (and more specifically the EEE-PPAT data enhancement of Patstat). The denominator is patents (applications and grants) with at least one Slovenian inventor or applicant. The timeframe is 2000-2014.

Figure 18: Patents by public Slovenian inventors and applicants (2000-2014)



Source: Own extract based on PATSTAT

From 2000 to 2014, the overall share of public sector patents has recorded a 5% average annual growth. Essentially, in absolute terms, the number of public sector patents is low, ranging from a minimum of 1 to a maximum of 23 between 2000 and 2014. In conclusion, the number of public Slovenian inventors and applicants is substantially lower than its private counterparts. It is however important to note, these figures do not account for the inventors and applicants that apply as individuals, even though they may be affiliated to the public sector and hence the research may have been at least partially funded by public sector institutions.

4 IMPACT OF EU STRUCTURAL FUNDS ON R&D&I

4.1 Experience of financial perspective 2007-2013

In the 2007-13 period, the Structural Funds were implemented in Slovenia through three operational programmes (OP)[32]:

- Operational Programme for Strengthening Regional Development Potential (OPSRDP), co-funded by the European Regional Development Fund (ERDF); SF budget of €1.7b; 42.4% of total SF.
- Operational Programme for Human Resources Development (OPHRD), co-funded by the European Social Fund; SF budget of €755m; 18% of total SF.
- Operational Programme of Environmental and Transport Infrastructure Development (OPETIP) co-funded by the ERDF and Cohesion Funds; SF budget of €1.64b; 38.9% of total SF.

It was planned to allocate €1.25 billion or 30.5% of total Structural Funds available to Slovenia, to the guideline: "improving knowledge and innovation for growth". Of this total, around €1.01 billion was foreseen for investments in innovation and R&D. This meant that the funds available for RDI have been significantly larger than at any time since the Slovenian independence.[33]

The instruments used during the period 2007-2013 were either completely new or re-designed existing ones but with significantly increased funding, coming from SF[34]. They have, however, addressed specific needs, identified in particular in the business sector R&D.

Among the re-designed instruments were the following ones funded by SF:

- Support to young researchers from industry (European Social Fund - ESF)
- Support to the mobility of researchers from public research organisations (PROs) to business R&D units (ESF)[35];
- Support to centres of excellence (substantially revised instruments and a new call, so not an automatic continuation of CoExcellence from the previous period); (European Regional Development Fund - ERDF)
- Innovation vouchers (revised instrument) (ERDF)
- Support to SMEs for investment in new technology (ERDF);
- Support to start-ups in innovation environment (ERDF);
- Support to R&D activities in SMEs (ERDF).

Among the most important new instruments were:

- support to competence centres (ERDF);
- support to joint development and investment projects (ERDF)[36];
- support to strategic R&D projects with the business sector (ERDF)[37];
- support to development centres (ERDF)[38];
- different voucher schemes (ERDF)[39].

---

[32] http://www.eu-skladi.si/?set_language=en

[33] During the time of drawing on the EU SF, some relocations have been made, further enlarging the support to RDI measures, since some of the other ministries had more difficulties in identifying proper/timely projects.

[34] As an illustration: all of the measures supporting R&D in the business sector in 2004 amounted to €14m, while only one measure (the mobility of researchers from the public to the business sector R&D units & young researchers from industry), co-financed by ERDF received approximately €21m annually.

[35] These two measures were merged into a single instrument in 2009.

[36] Direct subsidies for joint development-investment projects (public tenders of the Public Agency for Technology of the Republic of Slovenia - TIA) of €50m in 2009 and again in 2010.

[37] Strategic research projects (public tender by the Public Agency for Technology - TIA; the value of the individual project approved between 1 to 3 million EUR, with a total funding of €26 m.

[38] Public tender of the Ministry of Economy in 2010; 17 Centres selected) with a total funding of €185m.

[39] SPIRIT (then JAPTI) was in charge of different voucher measures.

- Innovation voucher for the co-financing of R&D projects intended for the protection of intellectual property (budget €0.8m in 2010 and €1.5m in 2011)
- Business mentorship voucher (€0.6m in 2011 and 2012)
- Training voucher – the co-financing of training and skills upgrading costs for employees working at least 20 hours per week with a yearly budget of €0.2m

Practically all of the instruments were designed so as to stimulate cooperation between public research units and the business sector, with the majority focusing on business sector initiatives.

The instruments introduced in the OPs were addressing this challenge: centres of excellence were established to address the priority selection in combination with high quality basic research[40]. Competence centres[41] were to focus on more applied research and development centres, in combination with the support for development and investment projects, were to address the final stage of the transfer of new knowledge in the production. While in the centres of excellence the proposals were primarily drafted by the PROs in co-operation with the business sector, the competence centres were business-led but had to involve PROs. Development centres were dominated by the business sector, as were the development and investment projects. Therefore, in principle, the complete R&I process was to be covered. Yet in the implementation of the instruments this "chain" was no longer present, since the calls were implemented at different times, centres of excellence and competence centres were established in different fields and most of the resources for the development and investment projects were distributed even prior to the establishment of any of the proposed cooperation organisational forms in the country (Bučar 2015).

To really benefit from such a comprehensive policy mix, the instruments should be kept in NIS over a much longer period, with clear commitment to form alliances within topical areas. With the gap in financing between one and the other financial perspective, each of the instruments was an independent undertaking, significantly limiting synergy or any long-term effects. In addition, the drafting of the OP for the 2014-2020 period was happening during the time of frequent personnel and organisational change, so there is still a need to fine-tune the instruments and agree on the implementation. The institutional changes (the discontinuation of TIA, the shift of technology units from one to the other ministry) as well as several personnel changes hindered the learning process, so the experience (both positive and negative) obtained during the 2007-2013 period is to a significant extent, lost. Some of the centres of excellence / competence centres continue their work, others have kept their activity at a minimum due to the contractual obligation to stay operational till 2017, yet no monitoring mechanism is in place to follow their activity.

The evaluations of all three Ops were carried out, yet the links to the texts are provided only on the Slovene web page. The web page dedicated to the cohesion policy in English[42] provides description of the programmes and the application of various funds, but doesn't provide the evaluations.

4.2 Smart Specialisation Strategy (RIS3 is based on analysis of sectoral specialisation of both industry and R&D capacities)

- Process voucher – the co-financing of costs for engaging experts for the improvement of business operations and for co-funding of participation fees at training courses intended for the improvement of business practices (€0.3m per year, 2011-2012)

[40] Centres of excellence (public tender of MHEST in 2009; 8 R&D centres of excellence were selected, based on the evaluation by international and national experts: see http://www.arhiv.mvzt.gov.si/en/areas_of_work/science_and_technology/centres_of_excellence_and_competence_centres/) with a total funding of €84m. Among the positive characteristics of the centres of excellence, the following need to be mentioned:

- Inter-disciplinarity, since the centre of excellence joins together different scientific fields, relevant for a particular area. This by itself has been a novelty for Slovenia where the public financing of basic and applied research is usually divided according to the scientific fields and little cross- or interdisciplinary research finds sufficient financial support;
- Joining of the research teams at research institutes, at universities and in business firms on an equal footing;
- Joint sharing of the research equipment not only between the public research units but in particular with the business community. Most of the high tech equipment for research in the areas where centres of excellence have been established is for extremely expensive Slovenian initiatives and only the formation of a centre of excellence and the co-operation at such a scale makes it possible for the researchers to get access to this type of equipment;
- Benefit for the postgraduate students and young researchers who could use the sophisticated equipment for their research and participate in the on-going research activities of the centre (Bučar et al, 2010).

[41] Competence centres (public tender in 2010 by MHEST where 7 competence centres were selected) with a total funding of €45m. The main idea behind the establishment of competence centres was to provide an environment for the development of a specific product/service on the basis of applied research, where business-led partnerships with PROs identified the area of joint work.

[42] http://www.eu-skladi.si/kohezija-do-2013?set_language=en

Smart specialisation strategy was adopted in Slovenia on 20th September 2015 and approved by the European Commission in the first week of November 2015. Slovenia prepared several drafts of the Smart Specialisation Strategy in the period from 2012 to 2015 but the one adopted was prepared by the GODC, based on the previous three in Spring 2015. Since RIS3 is the key document within the 2014-2020 financial perspective and will have impact on most of the instruments to be financed in the next years, its impact on RDI policy is significant. Except for the funds channelled through the SRA, most of the other financial resources for RDI will be used as national co-funding commitments.

RIS3 or in Slovenian S4 (Slovenian Smart Specialisation Strategy)[43] presents three priorities of the Slovenian economy for the next financial period:

(1) Healthy living and working environment

1.1 Smart cities and communities with IT platforms and conversion, distribution and energy management.

1.2 Smart buildings and homes including wood-chains with smart building units, building management systems, smart appliances and advanced materials and elements.

(2) Natural and traditional sources for future

2.1 Networks for the transition to circular economy.

2.2 Sustainable food production.

2.3 Sustainable tourism.

(3) S (INDUSTRY) 4.0.

3.1 Factories for the future.

3.2 Health – medicine.

3.3 Mobility.

3.4 Development of materials as end products.

The intention of the RIS3 is to address, "in a comprehensive manner, a broad range of development policies related to innovation, in particular the policy of promoting research and innovation, industrial policy, entrepreneurship promotion as well as some parts of the education system, rural development policy, international relations, improved regulatory environment (procedures related to the issuing of permits), etc. The state will provide financial support to the identified priority areas as well as non-financial support providing services implemented in close cooperation with strategic partnerships".

According to the document, "RIS3 optimises the supportive business-innovation ecosystem, the nature of which should be horizontal with the performance thereof also depending on the competitiveness of priority areas" […] Due to Slovenia's limited critical mass in a given area and due to the strong regional complementarities between stakeholders in all areas, RIS3 is designed as a nationwide document.

In the period 2016–2018, Slovenia plans to invest €1.9 billion through the Operational Programme in accordance with RIS3 (€1 billion to RDI, €0.8 billion to entrepreneurship and €0.05 billion to human resources).

As soon as the RIS3 was approved by the Commission, the implementation of the OP began. The Ministry of Economic Development and Technology and the Ministry of Education, Science and Sports launched the first call in spring, to be co-financed by the European structural and investment funds (ESIF). The funds are allocated to the promotion of research in categories 3 to 9 of the technology readiness levels (TRL 3-9, starting from the experimental proof of concept) with a clear focus on the commercialisation of the research results.

[43] More available at: http://www.svrk.gov.si/fileadmin/svrk.gov.si/pageuploads/SPS_predstavitve/S4_dokument_2015_october_eng_clean_lekt.pdf

The Ministry of Education, Science and Sports funds €55m of R&D programmes in TRL 3-6, which are more research focused but also lead to important innovation. They require private-public partnership (business firms as well as PROs or/and HEIs). Their individual value could go up to €6m (plus co-financing of participating partners) and they are intended to last until June 2020. Nine projects were selected in total at a value of €53.95m.

The Ministry of Economic Development and Technology targeted TRL 7-9. Business firms submitted R&D projects individually or as a group and there is no requirement for cooperation with PROs. In fact, they can only be engaged as external experts. The thresholds for co-financing of the project are from €100,000 up to a maximum of €500,000. The total amount of resources is €15m for the period 2016-2020.

A special role for RIS3 is planned for the Strategic partnerships, which will facilitate a system-wide and long-term cooperation of stakeholders within an individual area, namely cooperation between stakeholders, cooperation of stakeholders with other entities and cooperation with the state (GODC, 2015). The call for the establishment of Strategic partnerships was published in October, inviting the business and research community to form partnerships according to the 9 priorities specified above. The GODC expects to select one partnership per priority, depending on the comprehensiveness of the proposal and provide co-financing to the selected strategic partnerships within the second call (expected in February 2017).

With the approval of RIS3, the ability to draw on ESIF has been made available to other agencies as well. In the light of this development, in June 2016, the Agency for Entrepreneurship, Internationalisation, Foreign Investments and Technology (SPIRIT) issued a call in the area of entrepreneurial support in order to apply for registration as a, "subject of support environment" (SPIRIT, 2016). If a specific organisation (technology park, incubator, development centre, etc.) fulfils the criteria, they can be registered in the MEDT/SPIRIT evidence of support institutions. Once registered, the institutions are able to apply for financial support. SPIRIT plans to allocate €2m for the support institutions, with €459,000 coming from the MEDT budget and the remaining from the EU structural and investment funds (ESIF) (SPIRIT, 2016, p. 24). The call for support institutions' (technology parks, business incubators and university incubators) co-financing was published at the end of October 2016[44], totalling €3.2m for 2017.

Several calls from SPIRIT are also expected in the area of entrepreneurship promotion, all supported by ESIF and based on a principle of co-financing (innovation process vouchers, internationalisation[45], strengthening the innovation potential of enterprises, a "seal of excellence" co-financing, pilot projects etc.). The call for a "Process voucher" was published on October 2nd, 2016. The enterprises can apply for the reimbursement of the consultancy costs, related to process reorganisation. Several openings are planned, so the enterprises can apply from November 2016 to February 2017, whenever they have incurred the costs of consultancy. €3m are allocated for this call, with 75% coming from ESIF.

[44] See more at http://www.mgrt.gov.si/si/kako_do_sredstev/objavljeni_razpisi/?tx_t3javnirazpis_pi1%5Bshow_single%5D=1094.

[45] Related to the internationalisation of SMEs business activities, not R&D.

5 SCIENCE-INDUSTRY COOPERATION

While the level of public-private cooperation is correlated with business R&I intensity, in countries such as Finland or Slovenia, the private and public sector collaborate less than expected (EC, 2016). This situation is also difficult to explain from the point of view of the R&D policy: from the very beginning of independent Slovenia's policy, the promotion of the collaboration between science and industry was one of the priorities. In the current strategic document RISS, the need to increase cooperation is again spelled out as one of the priorities, calling for new instruments, which would enable more active cooperation.

The cooperation between HEIs, PROs and business had started to develop more successfully during the previous financial perspective (2007-2014) through instruments like the centres of excellence, competence centres and joint research and investment projects[46]. This is reflected in an increase of joint publications, which grew during the 2007-2011 period by 14% annually (85 joint publications per capita in 2011). According to CIS 2012 data[47], more than 50% of innovation-active large enterprises cooperate with universities, while only slightly above 20% of innovative SMEs do so. The cooperation is surprisingly weaker with the PROs, where the figures for big business are above 35% for the large firms and less than 18% for SMEs.

Yet a delay in the preparation of the strategic documents for the on-going financial perspective, especially RIS3[48] as well as a decline of public resources for applied projects resulted in the decline of cooperation. One can see this also in a decline of the business sector's funding of public research by more than 9% in the period 2001 to 2014 (RISS Implementation Report, 2016).

5.1 Cooperation data[49]

Public-Private co-publications (per million population) (Slovenia & Benchmarks): For this indicator, data from the European Innovation Scoreboard was extracted.

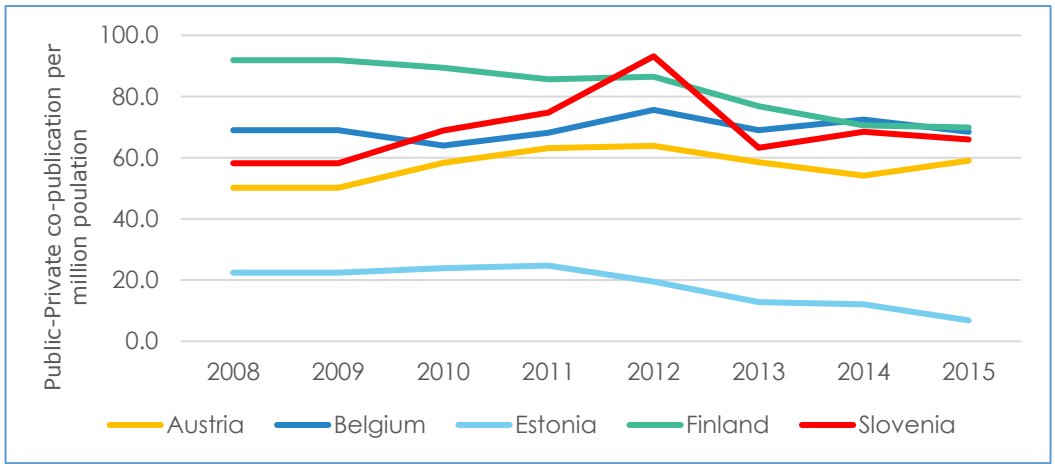
[46] Detailed explanation of these instruments can be found in the RIO Report 2014.
[47] This figure is not available in CIS 2012-2014.
[48] See details on the process of the preparation of RIS3 (or RIS4 as Slovenian authorities call it, Slovenian Smart Specialisation Strategy, in the RIO Country Report 2015).
[49] This section was contributed by Paresa Markianidou.

18 concerns public-private co-publications per million inhabitants (timeframe 2008-2015). Slovenia shows a positive average annual growth of 2% over this time period.

From 2008 until 2012, data for the amount of public-private co-publications increases sharply from 58.2 to 93.2. In 2013, this number sharply decreases to 63.2 but recovers in 2014 to 68.5. Slovenia, among the benchmarked countries, is the only one to undergo such a sharp increase in 2012. This is the highest value over the 8-year period in all countries, accounting for 93.2. However, all countries experience a substantial decrease in 2013, with Slovenia's being the worst. In 2015 Slovenia ranked third among benchmarked countries at 66 public-private co-publications per million inhabitants, after Finland and Belgium.

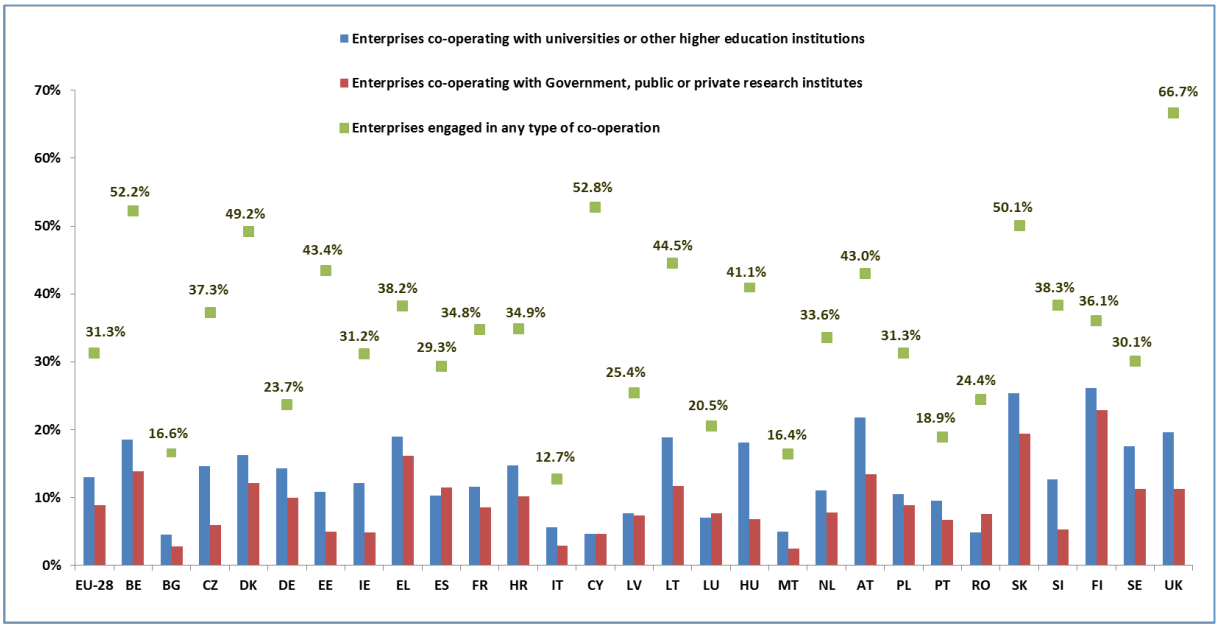
Over the time period 2008-2015, Austria and Slovenia are the only countries among benchmarks to experience a positive average annual growth. Indeed, Finland and Estonia both show negative trends. By far, Estonia's average annual growth is the lowest of the benchmarks at -16%, followed by Finland at -4%. In comparison, Belgium and the EU28's average annual growth has remained stable.

Figure 19: Public-Private co-publications per million inhabitants (2008-2015)



Source: IUS, 2016

Figure 20: Cooperation - Share of innovative companies cooperating with academia



Source: CIS, 2012

According to the CIS 2012, in Slovenia more than 38% of the innovative companies were engaged in any type of cooperation, more than the EU average of 31%. Yet, only one third of them (i.e. 12.7% of the total sample of innovative companies) cooperated with universities and higher education institutions. Even fewer (5.3%) cooperated with the government or public or private research institutes. A simple comparison with the EU average rate of cooperation (13% of innovative companies that work with higher education institutions and 8.9% with government or public or private research institutes), shows there is space for intensifying the cooperation between innovative Slovenian enterprises and public research.

5.2 Policy objectives and instruments encouraging cooperation

The degree of cooperation between the public science sector and business R&D has been identified as one of the weaker elements of the country's innovation system by OECD (2012), ERAC (2010) as well as national evaluations (RISS, 2011) and thus a focus of several policy actions. A number of early policy documents[50] addressed the issue of science–industry cooperation and proposed shifting resources towards more applied research. The implementation was less successful, which is also evident partly from the structure of R&D funding flows by funders and performers of R&D. The majority of the funding for public R&D institutions still comes from the government and business investments mostly in its own R&D capacities.

The policy makers tried to promote cooperation with the establishment of various intermediary organisations, which provided a point of contact, financing or advice to researchers from both sides. The evolvement of intermediary institutions is explained in detail in the next section. Other instruments, which were put in place to support the cooperation were focused on financing (co-financing) joint research projects, where the mix of partners was an important criteria. Especially during the financial perspective 2007-2013, there were several instruments directly or indirectly supporting the cooperation (COs, CCs, joint research and investment projects, etc.)[51]. The data from the CIS 2012-2014 is inconclusive with regard to the impact of these instruments on cooperation. One of the problems with these instruments is that they have only lasted a limited time, which only allowed for project-to-project cooperation and not a long-term relationship.

A set of instruments supporting mobility was also designed with the goal of partnership promotion. The first such instrument was the introduction of young researchers from industry, which proved a very good method of establishing links between the business sector and higher education institutions, as already explained. The support to mobility of researchers from the public sector to business entities was also relatively well received, improving the understanding of the different objectives of research in different environments. The merger of the two instruments and finally the decision to abandon them all together in the current financial perspective for other instruments is a novelty yet to prove itself.

Slovenia has no policy or instruments in place for developing knowledge markets for patents and licencing. That the area is important and needs to be supported has been recognised in RISS, yet it remains to be seen if in operationalising the programmes and measures under the financial perspective 2014–2020, some new instruments are going to be introduced in this area. The only activity worthwhile mentioning in relation to this is the annual Innovation Forum, where selected companies and individual inventors present their inventions with the intention of finding prospective investors (Udovič, Bučar, Hristov, 2016).

5.3 Intermediary organisations

Slovenia has developed a rather complex scheme of intermediary institutions with the objective of providing a comprehensive innovation system and supporting the cooperation of public research institutions with the business entities. It seems, however, that the main emphasis was more on the number of different instruments and institutions than on the quality of their work. Also, each change of government brought new ideas on how to promote cooperation. Broadly, we can group them in accordance with their main tasks:

a) **"Bridging" institutions** like technology centres, technology platforms, centres of excellence, competence centres and clusters.

b) **Technology/innovation/entrepreneurship support institutions** like technology parks, business and university incubators, technology transfer offices, VEM-points and regional development agencies.

c) **Financial intermediaries**: venture funds and business angels association, etc.

d) **Interest organisations**: Chamber of Commerce and Industry, Chamber of Craft and Small Business of Slovenia, etc.

a) Bridging institutions

[50] National Research and Development Programme (2006-2010), Slovenian Development Strategy (2005-2013), National Reform Programme for Achieving the Lisbon Strategy Goals (NRP) 2005-2010, National Strategic Reference Framework (NSRF) (2007-2013), etc. See details in Bučar et al., 2010.

[51] Explained in detail in section 4.1.

One of the early ideas of the bridging institutions was the formation of **technology centres** (from 1994 onwards). Technology centres are independent legal entities established by several companies for the purposes of R&D in a specific field or branch, as well as for the provision of R&D equipment subsequently made available to companies for their development projects. There were 28 active technology centres operating in fields ranging from textile processing, footwear, tool-making, electrical engineering, information and safety technologies. The innovation infrastructure support programme provided support to technology centres. The mode of co-financing has changed over the years, from the co-financing of the costs of operation to financing of the programmes to no specific support at all, which left their operation entirely to the founders. A good example of a well-functioning technology centre, which developed into an enterprise is Tecos- a technology centre for tools development[52]. Initially there was some involvement of the local communities and HEIs but since most of them developed more in the direction of what was requested by business founders, their role has changed.

Technology platforms were first introduced by the Ministry of Higher Education, Science and Technology in 2005 in cooperation with the Chamber of Commerce and Industry. MHEST offered a financial subsidy for the establishment of the platforms and their participation at the EU level. 12 technology platforms were formed in 2005. In 2008 and 2009 technology platforms were supported through two measures: one directed specifically to their functioning and the other, significantly larger, to joint research projects, initiated by the technology platforms. The platforms were supported by the Chamber of Industry and Commerce as well, since they were seen as an efficient way of voicing the R&D and innovation priorities of a particular branch of industry as well as mobilising the attention of the public R&D sphere to the R&D problems of the business sector.

The **cluster initiative** in Slovenia, beginning in 2000, was one of the top priority measures when introduced. The background of the cluster policy is interesting from the point of view of policy implementation and was set out as an example of good innovation governance. Prior to introducing the measure, several consultations and meetings with foreign experts took place. The extensive assessment of the potential clusters, involving 1700 companies, was carried out in 1999. On this basis, a pilot programme was planned for the period 2000-2003.

The cluster promotion started carefully: during the first year of the programme, only three pilot clusters were established. In the subsequent year, their number increased to five but a real breakthrough in clustering was achieved in 2003. The total 2003 budget for cluster policy was approximately €1.5 million. The ME accepted 14 projects and was able to grant on average only 21% of the requested funds. In 2004, 18 cluster offices were operational. All together 29 projects related to clustering were supported: 3 pilot cluster projects, 13 early stage clusters and an additional 13 cluster initiatives, bringing together 350 companies and 40 education/research institutes. The interest of the business sector far surpassed the ability of the government to support this initiative, in spite of the high priority assigned to clustering.

Clusters were primarily sector-based and linked together companies within the same industrial sector and research institutions in the particular field. The ME was not only supporting the clusters themselves, it was actively promoting the cluster concept as such. It co-funded several seminars, workshops and conferences and even study tours by the representatives of clusters abroad. Representatives of ME took part at international conferences, presenting the Slovenian experience in cluster support. The promotion of clusters in Slovenia was a reflection of a transfer of an example of good policy practice, observed abroad but modified to be more in line with the needs of Slovenian businesses.

The success of the cluster initiative was not convincing enough and after the change of government at the end of 2004, the cluster support programme was discontinued. The clusters which developed sufficiently by the time the programme stopped (like the automobile cluster) were able to apply for R&D project support but not for their own operational costs.

b) Support institutions

Technology parks – another early introduced measure (1994) - are supported by the Ministry of Economy through PAEFI. Here, too, the modes of financing have changed several times since their establishment - until 2005 the services the parks offered to SMEs located within the parks were subsidised but in 2005 and 2006, a special public call, also supported by the funds from the European Regional Development Fund provided substantially increased resources for the construction of new premises and new research infrastructure investments. Today, the support to technology parks is provided through SPIRIT via the programme on innovation infrastructure. Four parks are functional, the biggest being Ljubljana Technology park, where more than 250 enterprises are located.

[52] http://www.tecos.si/en/

University incubators were introduced in 2004 at the three main (public) universities, following the PHARE study recommendation. They are in part supported by SPIRIT through the innovation infrastructure support instrument. Yet sporadic funding in the past has led to relatively unimpressive activity, at least in the area of incubation. They have moved into the provision of different consultancy and training services, also to meet the criteria of the call to which they apply for co-financing. Especially successful in this regard has been the incubator at the University of Maribor, called the Factory of Ideas (Tovarna podjemov). The evidence of the innovation support environment lists three university incubators: the University of Maribor-Tovarna podjemom (Idea Factory- http://www.tovarnapodjemov.org/Default.aspx?id_menu=1 only in Slovenian); the University of Ljubljana- Ljubljanski univerzitetni incubator (http://lui.si/welcome-to-lui/) and the University of Primorska incubator[53].

New businesses can also turn for support to so called **"business incubators"**, which were set up either by local governments or private companies. Current (2016) evidence of the innovation support infrastructure lists 14 such incubators across Slovenia. In the long-term programme, included in the Operational Programme 2007-2013, the Ministry of Economy planned the establishment of a network of economic-developmental-logistical centres in all geographical areas of Slovenia, where sufficient critical mass of knowledge, economic development, business concentration and population is present. In 2008, PAEFI (predecessor of SPIRIT) published the first public call for the co-financing of the construction of technology parks and business incubators within "regional economic-logistic-technology centres", with approximately €50 million dedicated for the period 2009–2012 and with two locations selected. At the end of 2009, the change of OP was negotiated: some of the planned funds were transferred to the MHEST for the support of competence centres[54] and most of the remaining resources the Ministry of Economy allocated to "development centres" – similar to the previous idea of economic-business-logistical centres, just less ambitious.

Technology transfer offices have been established by some universities as an attempt to stimulate the cooperation of HEIs with the business sector but little systematic records on their impact exist. They are to be supported by the universities themselves and the business they generate. Yet with the current level of decentralised management, present especially at the larger universities, where much of the decision-making in relation to research is left at the level of the individual faculty, makes the position of these offices rather fluid.

Ljubljana University, for example, established the IRI (http://iri.uni-lj.si/en/about-us/), which currently employs 3 people and is engaged, according to the information on the web page, in various EU and Slovenian projects. No data is provided as to the transfer of technology deals or assisted spin-offs. The University of Maribor has a technology transfer office, called the TechnoCenter (http://tehnocenter.si/en) with 4 employees. In the autumn of 2016 they published a guidebook on technology transfer processes for the researchers at UM as well as Rules on IPM at UM.[55] The University of Nova Gorica on the other hand, is a co-founder of the Technology Park Primorska in its vicinity.

There are currently several **regional development agencies** but not policy-setting ones. They have a very differentiated legal status (from public agencies at the level of local community, to public-private partnership or full private ownership) and are primarily involved in providing consultancy services to local entities (SMEs) when applying for Structural Funds or other government subsidies. Some of the regional development agencies have registered with SPIRIT as business / innovation support providers and/or as VEM points[56] and thus receive some co-funding for their activities.

c) Financial intermediaries

The lack of **venture capital** has often been cited as one of the drawbacks for the promotion of entrepreneurship, especially in a high-tech area. Yet, the venture capital companies on the other hand say that there is a lack of sufficiently attractive projects.

Already in 2004, with the Law on the development of small and medium enterprises, the basis for the establishment of a venture capital fund within the Slovene Enterprise Fund was given. The Law also allowed for private sector co-financing of this activity. It took two more years for the

[53] Their web page is under construction.
[54] A call for the formation of Competence centres was issued in August 2010, for which the MHEST allocated 45 million EUR. (http://www.uradni-list.si/_pdf/2010/Ra/r2010064.pdf)
[55] English version available at: http://www.tehnocenter.si/en/management-of-intellectual-property
[56] VEM points are locations where one can establish a new business (a single point of registration).

Government to adopt a law on venture capital companies[57], while the Corporate Income Tax Act introduced tax relief for venture capital investments in fast-growing and innovative SMEs through venture capital companies.

In 2009, the Slovene Enterprise Fund formed a holding fund, which is offering **equity financing** to private venture capital companies of up to 49%. In the period 2011-2014, five venture companies received the support of €28.5 m and managed to invest in 25 projects. According to the data available at SEF, this instrument did not achieve its target and for 2017, they are developing a Central-European venture capital fund for Slovenia, Italy, Austria, Hungary, Slovakia and the Czech Republic.

The Chamber of Commerce and Industry has established RSG Capital as its spin-off and initially supported it by funds from the CCIS. It was set up as a non profit-making entity and therefore reinvested all excess income into the further development of its continuing operations. In 2008, RSG was transformed into a venture capital management company. The ownership of the company is now diversified and the company operates like a standard venture capital firm[58].

Since 2007, a **Business angels club** is also operating (http://www.poslovniangeli.si/) in Slovenia. According to their web page, it currently has around 200 members, who are well known entrepreneurs in the country and are prepared to invest between 100.000 to 400.000 EUR as equity in viable business propositions.

d) Interest associations

In addition to the government, several other institutions are also involved in promoting entrepreneurship and innovation. The Chamber of Commerce and Industry provides an information desk to new entrepreneurs and offers consultancy, as does the Chamber of Crafts and Small Business. Both associations are involved in the policy process as active participants in the discussion of new strategic orientation, voicing the views of their constituencies.

Local communities, especially larger ones, like the City of Ljubljana, have their own entrepreneurship promotion centres, where SMEs can find necessary information and support for their ideas.

5.4 Identified barriers to cooperation

Besides the standard barriers to cooperation, identified in innovation literature, like different objectives and time horizons for research in the public sector vis-à-vis research in business entity, the analyses undertaken in this area (Bučar and Rojec, 2014) have pointed out the following barriers which are more "Slovenian"- specific:

A. Lack of R&D and innovation activities in SMEs as well as lack of awareness of the need for R&D and of its potential contribution - in spite of increased investment by the business sector in R&D, the innovation data shows that especially among SMEs there is still a high percentage of non-active firms;

B. Focus on bibliometric results and heavy reliance on public funding with specific conditionality[59] puts a high emphasis on scientific excellence based on publications and citations and results in a "detachment" of researchers at universities and PROs from daily business challenges. In spite of several suggestions made by the different actors (the business sector, foreign and domestic evaluators of NIS) to adjust the promotion criteria in HEIs and public research institutes and put more emphasis on the practical experience of researchers, the changes introduced in recent years are moving in the opposite direction. The business community considers the public R&D units as too slow in responding to the changed economic environment and therefore does not consider them as well equipped with practical knowledge or able to respond within the timeframe required by firms.

C. Lack of sufficiently equipped R&D units in SMEs (low absorption capacity) seriously limits the opportunities for science-industry cooperation. The interest in most (small) firms lies with cost reduction applications and relatively routine improvements in the processes. Their

[57] Zakon o družbah tveganega kapitala http://www.uradni-list.si/1/content?id=82515; Official Gazette UL92/2007 from Oct.10, 2007.

[58] http://www.rsg-capital.si/en/

[59] The allocation of public funding (SRA) is based primarily on the publication and citation record of research groups.

"R&D" or development departments mostly perform routine procedures, like quality control and testing. Investing in knowledge is not seen as a factor of competitive strategy.

D. Systematic marketing of own knowledge is weakly present in PROs and the existing institutional framework at universities does not effectively support the cooperation with industry. The current system lacks incentives and infrastructure for establishing links with industry.

E. Promotion of science-industry cooperation is also not incorporated in research projects' evaluation. The evaluation of researchers, research programmes and/or projects and public research organisations is based primarily on the number of publications and citations. At least for the applied research co-financing, the positive experience of implementing R&D projects and translating them to innovation should be valued as equally important as the publishing activity for the public R&D units. Overall, the cooperation with industry should have a higher impact on the ranking of the researchers.

F. One of the key problems identified by both PROs and business entities is the irregularity in the government's announcements and the funding of support measures like the co-financing of joint R&D projects. For a firm which strategically depends on research inputs, the stability, transparency and regularity of available support measures is a key determinant of their effectiveness. This is why the programme of financing Young Researchers had also been assessed as one of the most beneficial from the science-industry cooperation point of view.

G. Productive cooperation does not develop quickly or easily. Good cooperation can only be found where the partnership has been developing over a longer period, where both sides have learned to understand each other. Much of the success in cooperation depends on good trustworthy personal relationships, which are even more important in the cases where there are few institutional guidelines for a more formalised agreement.

H. Strengthening of firms' absorption capacity through in-house R&D departments and R&D staff is necessary to intensify the cooperation. A relatively small number of such units in Slovenian firms undermines the potential for science-industry cooperation. To address this, various measures have been designed by the government (mobility schemes, interdisciplinary research teams and young researchers from industry) but these measures are not well known to the business sector or are assessed as too bureaucratic. This inappropriate support is of particular importance for the vast majority of small and medium-sized enterprises (SMEs), where one cannot expect them to have their own R&D departments. To increase innovation (cooperation), the absorption capacity in SMEs without their own R&D capacities, clustering around the more propulsive and R&D active firms may be promoted.

I. Low visibility of support measures, designed by the government. SMEs in particular have little or no awareness of the available measures for strengthening science-industry cooperation.

J. Heavy bureaucracy accompanying R&D and innovation related measures. A significant mistrust is felt in the documentation required by the government agencies, asking for data which is not easily obtainable or of a confidential nature. With the co-financing from the EU Structural Funds, the procedural details have worsened. Sometimes, the amount of paperwork turns away firms from application. Simplification, coordination and better visibility of the support measures is required.

K. More specificity in policy measures creation. The nature of the economic fabric is an important aspect to be taken into consideration by policy-makers when designing policy measures and framework conditions aiming at boosting science–business links. The science-industry relationship is determined significantly by the development level of a particular sector, by the size of the actors in a specific area (both the business and research capacities are highly heterogeneous in different areas) and by the very size of the country itself. Therefore, the design of policy measures needs to be done with Slovenian-specific conditions in mind and not copied and pasted from best practice in a more developed environment. One such example is the university technology transfer offices, which can be highly successful in the USA but have only limited applicability in Slovenia due to the different university system.

L. Policy stability and regularity of measures. Frequent changes in policies and support measures do not create a positive environment for cooperation. Stability in the innovation

policy, in the evaluation criteria as well as in the support instruments is what makes the framework supportive to the risky undertakings like science-industry cooperation.

In spite of all the criticism, it has to be recognised that there are several cases of good practice, where long-term cooperation has been successfully established between the business sector and the public sector researchers. In particular, the leading Slovenian companies and the top scientists / laboratories cooperate intensively in their areas of expertise and are able to exploit various support instruments provided by the government.

6 INTERNATIONALISATION OF SLOVENIAN SCIENCE BASE

Slovenian policy makers have recognised the fact that the international mobility of researchers yields positive impacts in terms of scientific quality, innovation and growth early. The increased participation of Slovenian researchers in international R&D cooperation is one of the objectives of several national research and development programmes, including RISS.

The cooperation is actively promoted through various measures. Co-financing, while modest, is regularly provided for the participation of Slovenian researchers at international conferences and their membership fees in international research associations. The preparations of project proposals for EU Framework Programmes / Horizon2020 is encouraged not only via providing technical and information assistance (NCPs) but also financially stimulated. More and more research programmes are open to foreign participation. Slovenia has signed numerous bilateral agreements on cooperation in the S&T field and is actively engaged in several multilateral programmes with the ambition of securing itself access to international knowledge.

Table 20: National public funding to transnationally coordinated R&D (Million euro)

	2011	2012	2013	2014
National public funding to transnationally coordinated R&D	7.506	6.486	6.685	3.749
National contributions to transnational public R&D performers	0.038	0.039	0.045	0
National contributions to Europe-wide transnational public R&D programmes	7.21	6.396	6.641	3.594
National contributions to bilateral or multilateral public R&D programmes	0.259	0.051	0	0.155

Source: Eurostat

6.1 Participation in EU R&D&I programmes

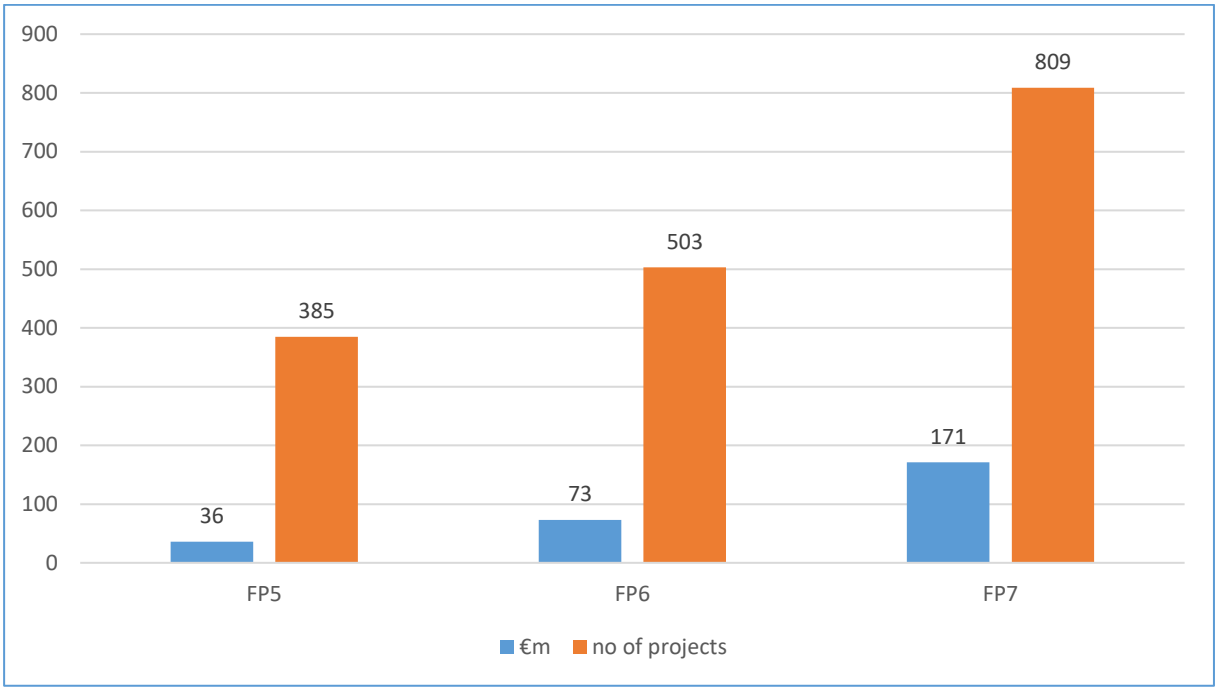
Since joining the EU, Slovenia has increased its participation in EU RDI programmes. During the period 2007–2014 Slovenia participated in 809 projects. The number reflects the relatively intensive international research collaboration of Slovenian RDI units, both PRO as well as SMEs. The most common funding instruments remain collaborative research projects (53.6%), followed by coordination and support actions (23.3%) and SME measures (8.4%).

The FP7 data reflects the increased quantity and quality of international cooperation by the Slovenian research community in comparison to EU28[60]. With €1.5 of expected income from each € invested in FP7, Slovenia is placed sixth among EU28.

According to the latest available data (September 2016), there are already 359 projects with Slovenian participation in H2020, of which 107 are SMEs. The EU's financial contribution is €94.48m, of which €28.21 is the SMEs share. In 62 cases, the Slovenian partner acts as coordinator.

[60] Peter Fisch, Think Piece, Monetary (re-)distribution effects of /FP, 2/2015, http://www.peter-fisch.eu/european-research-policy/think-pieces/

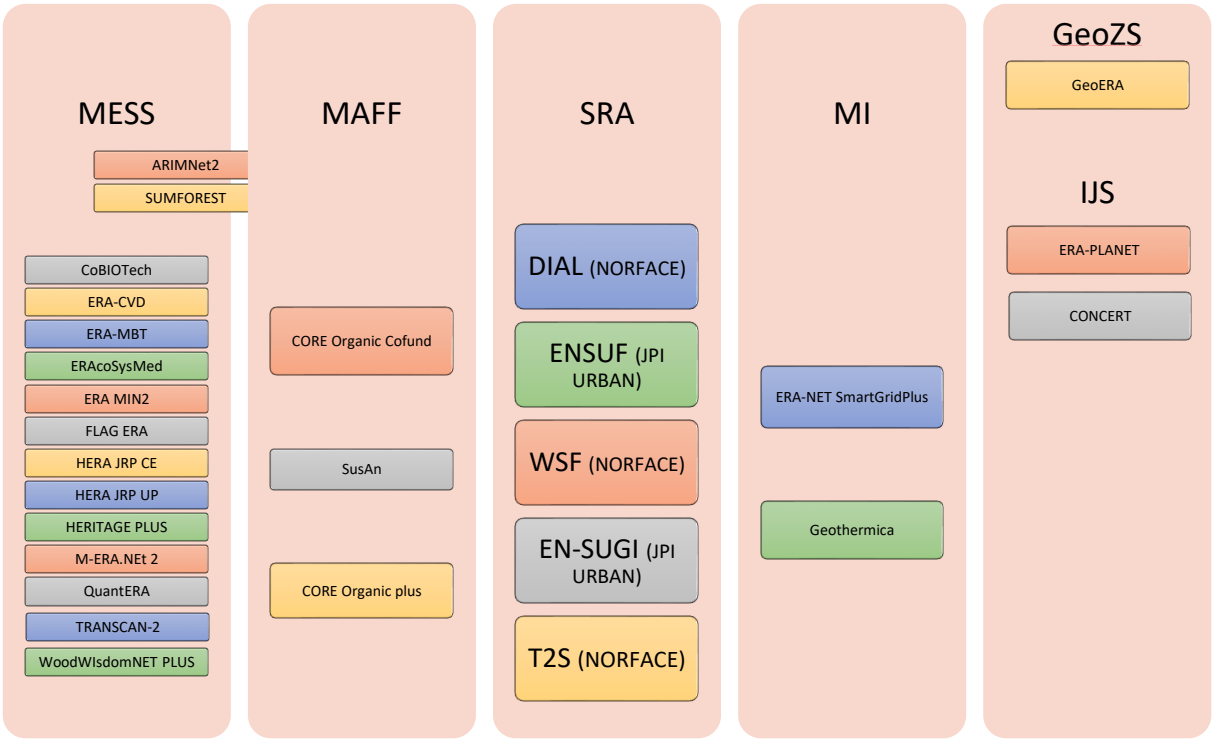
Figure 21: Participation in different Framework Programmes



Source: MESS data, 2016

Slovenia is actively involved in different ERA-NETs (see below) and in the following JTIs: JPND; CLIMATE; More Years, Better Lives; Urban Europe; Healthy Diet, Healthy Life; Oceans, FACCE, Water and AMR.

Figure 22: Participation of Slovenia in ERA-Nets, 2016 (data of MESS)



Slovenia is also a member of several EU and intergovernmental research institutions. In accordance with the priorities for international cooperation, specified in the national research infrastructure roadmap, so far Slovenia managed to participate in the following international R&D

infrastructures or ESFRI projects: CERN, FAIR, CERIC, SHARE, ESS, DARIAH, CESSDA, Belle 2, LifeWatch, EATRIS/ ELIXIR and CLARIN. In some of these infrastructures, Slovenia is already a full partner, in others it is a partner in the process of establishment and in some it is participating at the level of development of the full project proposal for a specific ESFRI project. Major barriers to even more active participation are the financial resources, especially in the cases of infrastructures in the field of natural sciences, where the memberships are very costly. On the other hand, Slovenia is involved in all ESFRI projects in the area of SSH.

In the analysis (Bučar, 2015) of the barriers to participation in FP/H2020, the administrative and teaching work overload for research staff, especially at HEIs was mentioned several times. The law on higher education (OG 119/ 2006) allows for the teaching staff to work on top of 100% teaching hours also an additional 20% of overtime, which is usually devoted to research. If an individual is engaged in research above 20%, he/she needs to lower proportionally his/her teaching commitment (up to 50%). This is in principle a viable option in the case of obtaining additional research money; the problem arises due to the question of security of both the job and the pay. While teaching is paid from the state budget and thus accounts for relatively stable funding, projects may end. Getting back the "old" teaching commitment may not always be simple to implement. The potential problem with losing a secure 100% teaching salary discourages individuals (especially more senior staff!) to get more actively involved in international research projects. Also, teaching employment is usually regarded as a permanent contract, while research contracts are usually limited to the duration of the research project. Much is expected from a new Law on higher education and the new Law on Research and Innovation, where the flexibility of combining teaching and research is expected to be regulated better as well as more job security being provided for the full-time researchers (STC, 2015). Both Laws are a priority for the Ministry of Education, Science and Sports and were expected in 2016, yet it is difficult to predict when they will happen.

As the "pull" factors, the existing international networks need to be mentioned as well as the ambition on behalf of research units to participate in EU research. The ability to gain additional research funds is also an important motivational factor, even though many research groups in the public sector find it easier (or with less strings attached) to apply for the national research funding (Bučar, 2015).

To stimulate researchers to participate in H2020, two measures exist. SRA introduced a measure, under which it disburses a small amount of money to every applicant who submits the application to the H2020 call and has been evaluated by the EC above the threshold[61]. To address a low success rate with the European Research Council (ERC) of only 3.1% and a very low submission of proposals by Slovenian scientists, a special measure was introduced by MESS and SRA in this regard: a project which was submitted to ERC and evaluated positively but had not received ERC funding is automatically picked up for financing by SRA at the level of maximum project financing available under SRA[62] (Bučar, 2015).

6.2 Other international cooperation programmes

In this field, Slovenia has not specific (extra RISS) national strategy but tries to participate in several EU-led initiatives, like Marie Skladowska Curie Programmes, which are actively promoted within the science community. MESS staff regularly participate at various coordination meetings at the EU level but a more pro-active approach towards third countries and international organisations is hindered due to the financial limitations. While the strategic documents call for increased international cooperation beyond the EU, the implementation is hindered both by financial and human resources[63].

The European programme COST (European Cooperation in Science and Technology) was one of the early programmes Slovenia could cooperate in right after it reached its independence. So far, researchers from Slovenia participated in 621 COST Actions and are currently (2016) active in 208 actions. Slovenia is also active in OECD, CERN, European Space Agency, as well as in several UN agencies.

From the viewpoint of the business sector, one of the most successful international programmes has been the participation in the EUREKA programme. A member of EUREKA since 1994, Slovenia has been involved in 349 EUREKA projects. Slovenia has chaired EUREKA for the period 2007–2008 and successfully participated in the launch of the new EUROSTARS programme, the first one to be

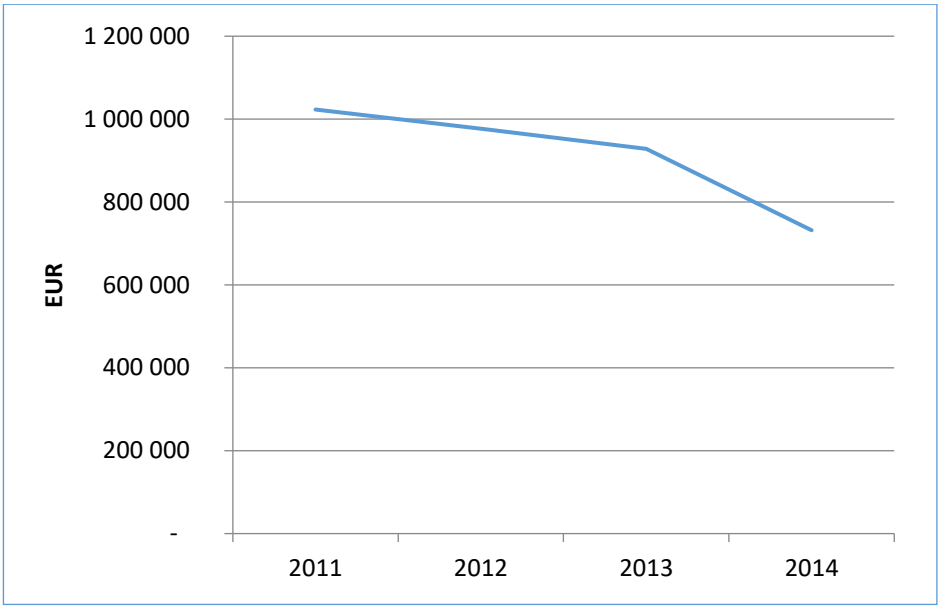
[61] €1500 is awarded to the participant and €5000 to the coordinator of a successful project.
[62] In 2016, this means €200,000 over the period of three years.
[63] The presence of Slovenia in Brussels on various EU-third country dialogues is often limited to a single representative of the Slovenian permanent delegation.

jointly financed and implemented by EUREKA and the European Commission. Slovenian companies, research institutes and universities are working on projects in a variety of areas from medicine, biotechnology and the environment to information technology and transport. During 2016, 9 EUREKA projects were running with Slovenian participation with a total value of €6.48 million. For 2016, €4.5 million public funds are planned for Slovenian participation in the programme, with 13 projects in the pipeline. Slovenia has cooperated in 28 EUROSTAR projects so far. In 2016, 6 projects are active in total with a value of €5.91 million, with two more in the pipeline.

6.3 Bilateral cooperation programmes

The SRA has concluded 48 bilateral agreements[64] with the EU and extra-EU countries. These bilateral agreements are the legal basis for the bilateral projects launched by the SRA every year. There are up to 15 such calls on a yearly basis for bilateral cooperation with different countries. The bilateral cooperation projects are not classical research projects, since the SRA covers only travel and housing costs for participants, meaning that researchers have to cover their other costs from different projects/programmes that are not part of the bilateral cooperation. The yearly amount of financial compensation varies from case to case, but it stops around €2,000 per year. These projects are for a maximum of two years.

Figure 23: Sources for bilateral research projects, in €000



Source: SRA Annual Report, 2014

There are some exceptions to this rule in the cases where the host countries provide financial assistance to Slovenian researchers. Countries like Japan and USA are two of such examples.

6.4 International inward and outward mobility of human resources in research

With the membership of Slovenia in the EU, one could witness the dynamic expansion of various exchange and mobility programmes in the area of higher education and research, so both the outward and inward mobility of students, professors and researchers is on the increase.

This area, however, is significantly understudied and documented in Slovenia. There is no centralised data gathering on either in-coming or outgoing PhD students or guest professors. The crisis caused an increase in the outward flow of researchers, yet there is no systematic gathering of data to provide exact figures. One of the few studies conducted in this area is the research by Bevc and Ogorevc (2014) where it was established that the younger generations are more and more in favour of emigration and thus outward flow is increasing every year.[65] There are also fragmented reports of different financing agencies (SRA and CMEPIUS–Centre of the Republic of Slovenia for Mobility and European Educational and Training Programmes). However, researchers can receive mobility funding from various other sources and neither institutes or HEIs are responsible for collecting and systematically reporting this data.

[64] https://www.arrs.gov.si/sl/medn/dvostr/sporazumi.asp

[65] This research was funded as TRP and its financing ceased in 2013, in spite of growing tendecies towards brain drain in the science community.

While there is little systematic analysis of an inward mobility, some of the R&D institutes report on complicated legal procedures for obtaining working / residence permits for non-EU researchers. Also, incoming researchers to the public research sector can only be awarded in accordance with the Public Sector Salary System Act and collective agreements for all public sector employees and specific collective agreements for RDI employees. While this level of salary may be attractive to researchers from ex-Yugoslav countries or other non-EU countries, they are well below the payments expected for researchers from more research-intensive countries. The income tax system is also unfriendly to out-going staff, since the payment or scholarships they receive abroad are included in their income tax, while actual costs occurred during their stay abroad are not eligible as deductible costs.

Table 21: Researchers in government sector by citizenship (Head count)

	2008	2009	2010	2011	2012	2013	2014	2015
European Union	33	28	39	:	45	47	n.d.	n.d.
European non-EU countries	13	38	55	:	74	65	n.d.	n.d.
Africa	0	0	0	:	:	2	n.d.	n.d.
Northern America	1	0	0	:	1	1	n.d.	n.d.
Central and South America	1	1	1	:	2	3	n.d.	n.d.

Source: Eurostat

Another of the barriers to inward mobility which still exists, especially in Slovenian higher education is the legal binding to provide teaching and teaching materials in the Slovenian language. The gradual introduction of joint PhD programmes at different universities with universities in other EU countries allows for greater flexibility in the use of language and opens doors to students from abroad. Yet the proposal of the MESS to introduce the possibility of teaching in the English language at tertiary level has triggered off a very emotional and nationalistic public debate on the necessity to protect the Slovenian language and culture. Eventually, MESS dropped the amendment to the Law on Higher Education.

The employment of a foreign researcher / professor is additionally complicated by the internal regulations at the HEIs. In such a case, the first step after the submission of an application is the process of verification of the habilitation standards. A special commission from the scientific field is appointed to decide whether the applicants qualify in accordance with the habilitation of the institution where they seek employment. After this decision has been adopted, the candidate(s) who qualify are evaluated.

Table 22: Researchers in higher education sector by citizenship (Head count)

	2008	2009	2010	2011	2012	2013	2014	2015
European Union	25	33	32	:	59	64	n.d.	n.d.
European non-EU countries	5	14	13	:	38	22	n.d.	n.d.
Africa	1	1	0	:	:	1	n.d.	n.d.
Northern America	0	2	1	:	4	4	n.d.	n.d.
Central and S. America	2	0	17	:	1	1	n.d.	n.d.

Source: Eurostat

6.5 Data on international cooperation in scientific outputs

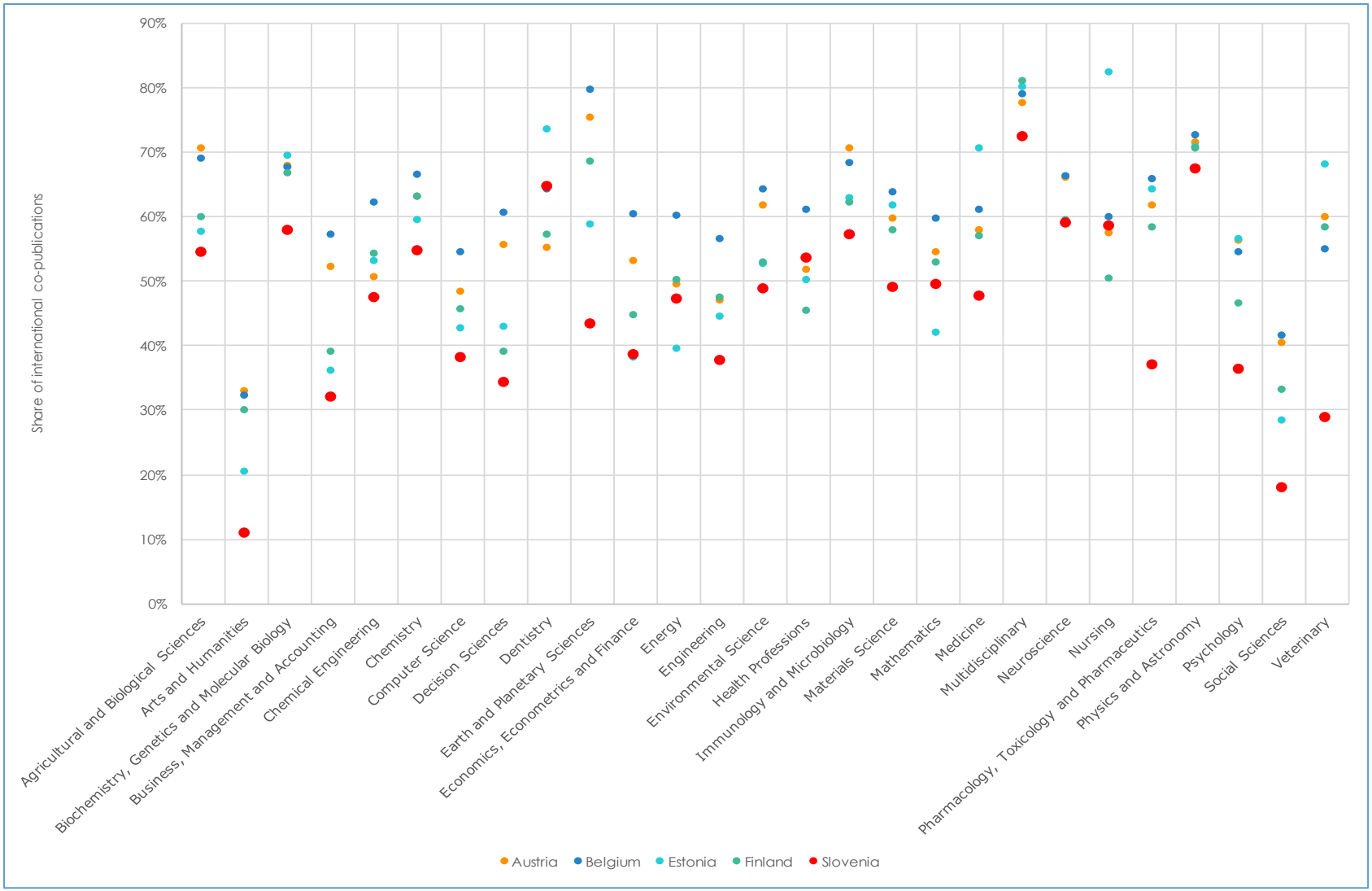
International co-publications (Slovenia & Benchmarks): Based on data extracted from Scopus, the amount of exclusively international co-publications was computed. This was made possible by subtracting the total amount of publications of a country by the amount of exclusively national publications. Data for the period of 2011-2015 was processed for Slovenia and its benchmark countries, Austria, Belgium, Estonia and Finland.

Error! Not a valid bookmark self-reference. shows the share of international co-publications among the total publications by subject area for Slovenia and benchmarks. Data shows that Slovenia has a comparatively low share compared to the benchmarked countries.

Its highest share of international co-publications is in the multidisciplinary subject area accounting for 72%. Nonetheless, this represents the lowest share compared to the benchmarked countries. Slovenia's second highest share is in the subject area of Physics and Astronomy, accounting for 67%. Yet this represents the lowest share of international co-publications compared to the benchmarked countries. Dentistry is the third highest subject area of Slovenia, amounting to 64%. Noticeably, Slovenia ranks second in this subject area after Estonia, followed by Belgium, Finland, and Austria respectively.

Slovenia's international co-publications are substantially lower compared to the benchmark countries in the subject areas of Arts and Humanities, Biochemistry, Genetics and Molecular Biology, Earth and Planetary Sciences, Engineering, Materials Science, Medicine, Pharmacology, Toxicology and Pharmaceuticals, Social Sciences and Veterinary Science. The largest gap occurs in the subject areas of Pharmacology, Toxicology and Pharmaceuticals and Veterinary Science with differences of 21% and 26% respectively compared to the second last.

Figure 24: International co-publications based on publication counts (2011-2015)

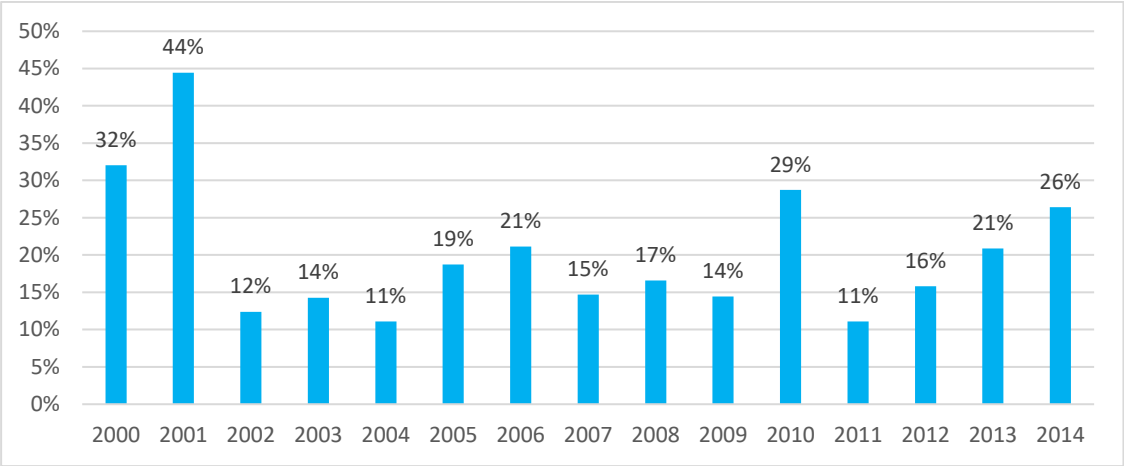


Source: Own extract based on Scopus

International co-patenting (as % share) (Slovenia only): The indicator for co-patenting is based on data extracted from Patstat (Worldwide Patent Statistical Database).

is based on the patents (applications and grants) with at least one Slovenian inventor. The data shows that Slovenia has recorded a positive average annual growth of 1.4% during the period 2000-2014. A peak of 44% of international co-patenting was reached in the year 2001 followed by a significantly lower percentage ranging from 11% to 29%.

Figure 25: International co-patenting (as % share) of Slovenia



Source: Source: Own extract based on PASTAT

Notes: To quality check the patent extract from Patstat the amount of yearly patents, grants and applications were computed using fractional counting (timeframe 2006-2015) and compared to Eurostat tables. Reference dates for all IP types as presented in this report are based on the priority date, which corresponds to the first filing worldwide, closest to the invention date.[66]

[66] Retrieved: http://ec.europa.eu/eurostat/cache/metadata/Annexes/pat_esms_an3.pdf, Criteria used to count the patents used in Eurostat's patent domain

ANNEX 1 - REFERENCES

Bevc, Milena and Marko Ogorevc (2014): Zaposlitvena emigracija nekdanjih Erasmosovih študento iz Slovenije. *IB revija*, XLVIII (3–4): 5 – 20. Available at: http://www.umar.gov.si/fileadmin/user_upload/publikacije/ib/2014/IB3-4-14splet.pdf

Bučar, Maja, Andreja Jaklič in Boštjan Udovič (2010): *National system of innovation in Slovenia*. Ljubljana: Faculty of Social Sciences. Available at: http://www.mednarodni-odnosi.si/cmo/publications.htm

Bučar, Maja, Matija Rojec (2014): Science-industry cooperation in Slovenia: determinants of success, *Economic and Business Review* 16 (3): 315–336, 371. Available at: http://www.ebrjournal.net/ojs/index.php/ebr/article/view/329/pdf_14.

BUČAR, Maja, STARE, Metka, UDOVIČ, Boštjan (2014): *Centri odličnosti in kompetenčni centri : evalvacija instrumentov*. (Centres of excellence and centres of competence) [Ljubljana]: Fakulteta za družbene vede, Center za mednarodne odnose. Available at: http://www.mizs.gov.si/fileadmin/mizs.gov.si/pageuploads/Znanost/doc/Strukturni_Skladi/Centri_odlicnosti/Centri_odlicnosti_in_kompetencni_centri.pdf

Bučar, Maja (2015): Stairway to Excellence Country Report: Slovenia; ISBN 978-92-79-51566-8 (PDF) Luxembourg: Publications Office of the European Union. Available at: http://s3platform.jrc.ec.europa.eu/documents/20182/117536/S2E_Report_SI.pdf/1e446b70-5efe-4cf7-8334-fa61a582cdcf

CIS (2012): Community Innovation Survey 2010-2012, Eurostat.

ECFIN (2016): EC Spring 2016 Economic Forecast – Slovenia. Available at: http://ec.europa.eu/economy_finance/eu/forecasts/2016_spring/si_en.pdf

EIS (2016): European Union Innovation Scoreboard – European Commission. Available at: http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en

ERAC (2010): ERAC expert group report on the design and implementation of national policy mixes. Policy Mix Peer Reviews: Country Report – Slovenia. http://www.arhiv.mvzt.gov.si/fileadmin/mvzt.gov.si/pageuploads/pdf/znanost/ang_verzija/Slovenia_OMC_Report-FINAL_dec.pdf

Eurostat (2007): Criteria used to count patents used in Eurostat's patent domain. Available at: http://ec.europa.eu/eurostat/cache/metadata/Annexes/pat_esms_an3.pdf
Hollanders, Hugo, Nordine Es-Sadki and Minna Kanerva (2016): European Innovation Scoreboard 2016. Belgium: European Union. Available at: http://ec.europa.eu/DocsRoom/documents/17822

Peter Fisch (2015): Think Piece, Monetary (re-)distribution effects of FP, 2/2015, https://www.peter-fisch.eu/european-research-policy/think-pieces/2-2015-distribution-effects/

IMAD (2016): *Development Report 2016.* Ljubljana: IMAD. Available at: http://www.umar.gov.si/fileadmin/user_upload/publikacije/pr/2016/APoR_2016.pdf

MEDT (2016): Podjetništvo in konkurenčnost. Available at: Podjetništvo in konkurenčnost – ukrepi http://www.mgrt.gov.si/fileadmin/mgrt.gov.si/pageuploads/SOJ/Razpisi/predstavitev_DPKT.pdf

MEDT (2016b): Informacija o KROP-ih 2011-2013, mimeo.

OECD (2012): Reviews of Innovation Policy: Slovenia 2012. Available at: http://www.oecd.org/publications/oecd-reviews-of-innovation-policy-slovenia-2012-9789264167407-en.htm

Official Gazette of the Republic of Slovenia 96/02 and 115/02

Official Gazette of the RS; no. 64. Javni razpis za razvoj kompetenčnih centrov v obodju 2010–2013. Available at: http://www.uradni-list.si/_pdf/2010/Ra/r2010064.pdf

Official Gazette of the RS; no. 92/2007. Law on Venture Capital Companies. Available at: http://www.uradni-list.si/1/content?id=82515

OPERATIONAL programme for the implementation of the EU cohesion policy 2014-2020 / Ljubljana: Governmental Office for Development and European Cohesion Policy, 2015
RISS (2011): Resolution on Research and Innovation Strategy of Slovenia 2011-2020; http://www.arhiv.mvzt.gov.si/fileadmin/mvzt.gov.si/pageuploads/pdf/odnosi_z_javnostmi/01.06.2011_dalje/01.06._RISSdz_ENG.pdf

RISS Implementation Report (2016): Poročilo o uresničevanju Resolucije o raziskovalni in inovacijski strategiji Slovenije 2011-2020. Ljubljana: Ministry of Education, Science and Sports and Ministry of Economic Development and Technology

Slovenia's Smart Specialisation Strategy (2015): *S4*. Available at: http://www.svrk.gov.si/fileadmin/svrk.gov.si/pageuploads/SPS_predstavitve/S4_dokument_2015_october_eng_clean_lekt.pdf (7 January 2017).

SORS (2015): Research and Development Activity, Slovenia, 2014. Available at: http://www.stat.si/StatWeb/prikazi-novico?id=5573&idp=25&headerbar=16

SORS (2016): Statistical data, various indicators. http://www.stat.si/StatWeb/en/home

SPIRIT (2016a): Javni poziv k vpisu in podaljšanju vpisa v evidenco subjektov inovativnega okolja za leto 2016 (Public call to enlisting and prolongation of enlisting in the evidence of subjects of innovative environment for 2016). Available at http://www.spiritslovenia.si/razpisi/2016-06-30-Javni-poziv-k-vpisu-in-podaljsanju-vpisa-v-evidenco-subjektov-inovativnega-okolja-za-leto-2016

SPIRIT (2016b): Program dela in finančni načrt za 2016 in 2017 (Programme of work and financial plan for 2016 and 2017). Available at: http://www.spiritslovenia.si/resources/files/2016/Razpisi/JR_Slo_poslovni_klubi_2016/Program_in_finani_nart_SPIRIT_Slovenija_2016_in_2017.pdf

SRA (2015): Annual report 2015. Available at: https://www.arrs.gov.si/en/gradivo/dokum/inc/ARRS-Annual-Report-2015.pdf

SRA (2017): International cooperation. Available at: http://www.arrs.gov.si/en/medn/dvostr/index.asp

SRA Annual Report 2014 https://www.arrs.gov.si/en/gradivo/dokum/inc/ARRS-Annual-Report-2014.pdf

SRA financial report for 2015 https://www.arrs.gov.si/Report/fin-por-2015.aspx
TechnoCentre (2017): Management of Intellectual Property Rights. Available at: http://www.tehnocenter.si/en/management-of-intellectual-property

Udovič, Boštjan and Maja Bučar (2014): ERAWATCH Country Report 2014: Slovenia. Available at: https://rio.jrc.ec.europa.eu/en/library/erawatch-country-report-slovenia-2014

Udovič, Boštjan, Maja Bučar, Hristo Hristov (2016): RIO 2015 Report. Brussels: EC.
World Bank (2015): *Doing Business: Going Beyond Efficiency.* Washington DC: World Bank. Available at: http://www.doingbusiness.org/~/media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf

ANNEX 2 – ABBREVIATIONS

BERD	Business Expenditure on R&D
CIS	Community Innovation Survey
CMEPIUS	Centre of the Republic of Slovenia for Mobility and European Educational and Training Programmes
COBISS	Kooperativni online bibliografski system in servis (Co-operative Online Bibliographic System and Services)
COST	European Cooperation in Science and Technology
CWTS	Centre for Science and Technology Studies
EC	European Commission
ECFIN	European Commission's Directorate General for Economic and Financial Affairs
ERA	European Research Area
ERAC	European Research Area and Innovation Committee
ERDF	European Regional Development Fund
ESF	European Social Fund
ESFRI	European Strategy Forum on Research Infrastructures
ESIF	European Structural and Investment Funds
EU	European Union
EU19	Euro area Member States
EU28	European Union's 28 Member States
EUREKA	Inter-government Programme for SME R&D Support
EUROSTARS	EU Programme for SME projects
FDI	Foreign Direct Investment
FTE	Full Time Equivalent
GBOARD	Government Budget Appropriations or Outlays for R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GODC	Government Office for Development and European Cohesion Policy
HEI	Higher Education Institutions
HES	Higher Education Sector
IER	Institute for Economic Research
ILO	International Labour Organisation
IMAD	Institute for Macroeconomic Analyses and Development (Slovenia)
IMF	International Monetary Fund
IOI	Innovation Output indicator
KORSIS	The Coordination of Directors of Research Institutes
KROP	Strengthening the Research Capabilities of Business Enterprises
MAFF	Ministry of Agriculture, Forestry and Food
ME	Ministry of Economy
MEDT	Ministry of Economic Development and Technology
MESS	Ministry of Education, Science and Sports
MHEST	Ministry of Higher Education, Science and Technology
MI	Ministry of Infrastructure
NIS	National Innovation System
NRDP	National R&D Programme
OECD	Organisation for Economic Co-operation and Development
OPETIP	Operational Programme of Environmental and Transport Infrastructure Development
OPHRD	Operational Programme for Human Resources Development
OPSRDP	Operational Programme for Strengthening Regional Development Potential
PAEFI	Public Agency for Entrepreneurship and Foreign Investment
PPS	Purchasing Power Standard

PRO	Public Research Organisation
R&D	Research and Development
R&I	Research and Innovation
RDI	Research, Development and Innovation
RIS3	Smart specialisation strategy of Slovenia
RISS	Research and Innovation Strategy of Slovenia
SASA	Slovenian Academy of Science and Arts
SCI	Science Citation Index
SEF	Slovenian Entrepreneurship Fund
SICRIS	Informacijski system o raziskovalni dejavnosti v Sloveniji (Information System Research Activity in Slovenia)
SID	Slovenska izvozna družba (Slovenian Export and Development Bank)
SME	Small and Medium-sized Enterprise
SORS	Statistical Office of the Republic of Slovenia
SPIRIT	Slovenia's Public Agency for Entrepreneurship, Internationalisation, Foreign Investments and Technology
SRA	Slovenian Research Agency
SSCI	Social Sciences Citation Index
STI	Science, Technology and Innovation
SZT	Svet za znanost in tehnologijo- Science and Technology Council
TIA	Technology Agency
TRL	Technology Readiness Levels

ANNEX 3 – ADDITIONAL FIGURES AND TABLES

Source: Eurostat

Table 23: GERD - all sectors (Million euro)

Table	2008	2009	2010	2011	2012	2013	2014	2015
European Union (28 countries)	239,942.255	237,421.283	246,994.747	259,892.222	270,321.521	274,499.98	286,121.331	298,810.649
Euro area (19 countries)	182,072.332	184,433.032	190,347.02	200,082.319	206,744.563	209,381.963	217,042.054	221,628.957
Belgium	6,812.699	6,924.591	7,487.5	8,171	9,153.5	9,545.663	9,874.579	10,072.4
Estonia	208.039	197.393	232.76	384.447	380.695	326.045	286.736	302.766
Austria	7,548.06	7,479.745	8,066.44	8,276.335	9,287.84	9,571.282	10,099.78	10,444.16
Slovenia	616.949	656.882	745.942	894.213	928.306	935.006	890.232	853.067
Finland	6,871.092	6,786.472	6,971.301	7,163.692	6,831.888	6,684.1	6,512.1	6,070.9

Figure 26: GERD - all sectors (Million euro)

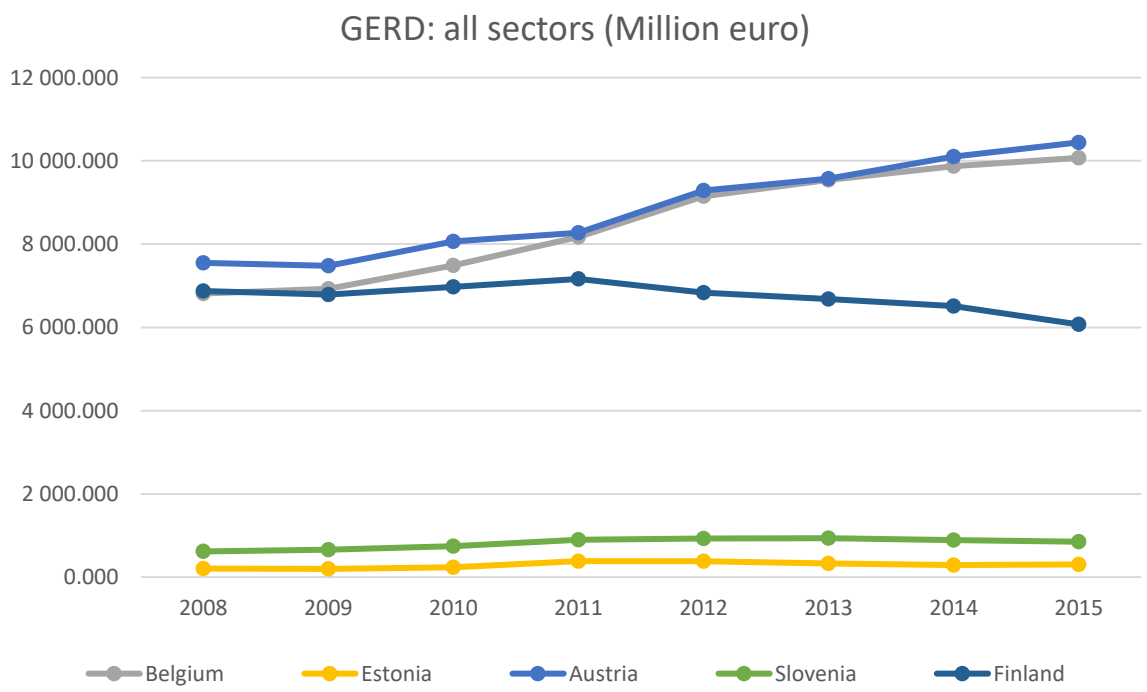


Table 24: GERD - all sectors (Euro per inhabitant)

Table	2008	2009	2010	2011	2012	2013	2014	2015
European Union (28 countries)	479.6	472.9	490.9	516.7	536.3	543.4	564.4	587.7
Euro area (19 countries)	546.6	551.4	567.7	598	616.6	623.1	643.1	654.8
Belgium	638.7	644	690.7	742.8	825	855.2	881.3	894.7
Estonia	155.4	147.8	174.6	289.1	287.3	247	217.9	230.5
Austria	908.5	897.4	965.9	988.2	1,104.6	1,132.4	1,187.2	1,217.8
Slovenia	306.9	323.2	364.4	436.2	451.6	454.1	431.9	413.5
Finland	1,296.3	1,274.1	1,302.7	1,332.7	1,264.9	1,231.7	1,194.6	1,109.5

Figure 27: GERD - all sectors (Euro per inhabitant)

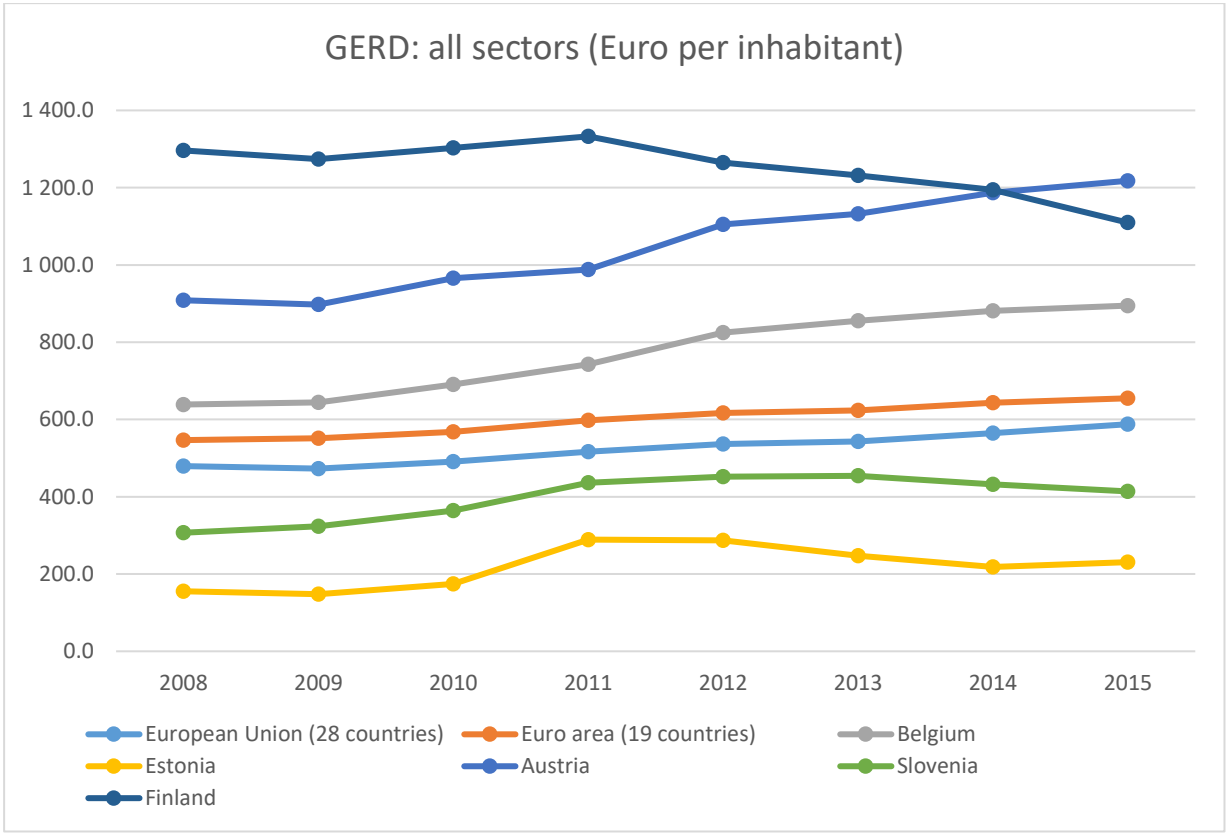


Table 25: GERD - all sectors (Million purchasing power standard (PPS))

Table	2008	2009	2010	2011	2012	2013	2014	2015
European Union (28 countries)	229,807.915	225,783.136	235,641.355	247,978.762	257,832.205	261,268.552	273,275.465	286,631.583
Euro area (19 countries)	173,563.598	171,223.698	180,461.27	190,260.031	197,691.815	199,081.566	208,002.443	215,565.056
Belgium	6,092.559	6,068.347	6,750.361	7,360.598	8,337.28	8,638.609	8,946.796	9,308.197
Estonia	296.099	283.082	339.003	553.32	548.236	453.154	395.389	415.658
Austria	6,916.577	6,664.064	7,315.172	7,472.989	8,564.958	8,796.326	9,299.982	9,718.21
Slovenia	759.696	766.669	887.498	1,070.144	1,143.093	1,151.91	1,113.207	1,083.397
Finland	5,849.231	5,651.626	5,840.078	5,953.372	5,662.099	5,403.476	5,246.616	4,969.223

Figure 28: GERD - all sectors (Million purchasing power standard (PPS))

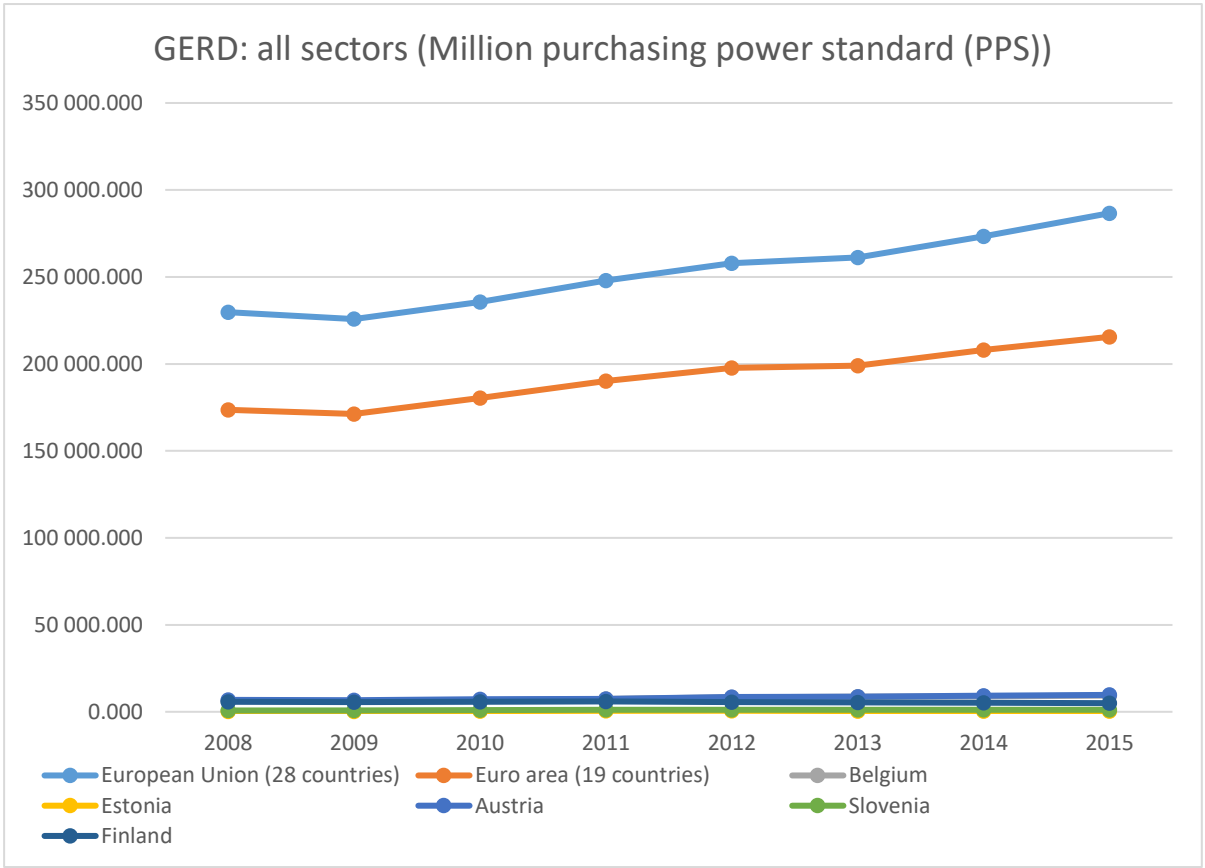


Table 26: GERD - all sectors (Purchasing power standard (PPS) per inhabitant at constant 2005 prices)

Table	2008	2009	2010	2011	2012	2013	2014	2015
European Union (28 countries)	440.5	438.6	446.8	464.6	471.4	473.7	485.8	494.5
Euro area (19 countries)	497	495.7	506.9	528.2	536.8	534.5	546.1	549.7
Belgium	558	558.1	587.3	619.1	674	689.3	705.7	710.2
Estonia	198.5	187.9	218.6	344	332.8	275.2	238	248.3
Austria	808.4	783.5	834.9	838.4	918.9	927.4	955.2	961.6
Slovenia	377.4	384.6	437.9	518.3	535.3	533.7	503.5	477.4
Finland	1,038.5	1,001.9	1,020.8	1,018	938.4	891.1	849.7	776.5

Table 27: GERD - Higher education sector (Euro per inhabitant)

Table	2008	2009	2010	2011	2012	2013	2014	2015
European Union (28 countries)	109.9	113.2	118.9	121.2	125.1	127.6	132	136.4
Euro area (19 countries)	121	127	132.3	134.2	135.9	139	142.5	144.3
Belgium	139.4	152.8	162.4	165.9	169.3	178.4	178.2	178.4
Estonia	66.7	62.3	66.4	80.5	92.3	104.5	96.5	95.3
Austria	226.8	234.2	249.6	252.8	271.4	275.4	288.7	296.2
Slovenia	41.2	47.1	50.7	51.4	50.2	47.3	45.2	42.1
Finland	222.7	240.8	266.3	266.4	273	265	273.2	270.6

Table 28: GERD - Private non-profit sector (Million euro)

Table	2008	2009	2010	2011	2012	2013	2014	2015
European Union (28 countries)	2,338.887	2,368.241	2,566.966	2,339.104	2,390.043	2,231.29	2,407.025	2,506.024
Euro area (19 countries)	1,520.508	1,594.592	1,745.175	1,673.476	1,648.659	1,532.499	1,626.01	1,605.731
Belgium	66.864	69.154	68.5	73.6	35.2	34.164	34.339	34.47
Estonia	4.333	4.282	2.903	3.498	4.012	3.444	3.424	5.436
Austria	27.67	35.905	39.204	40.719	40.61	40.223	42.444	43.89
Slovenia	0.618	0.463	0.433	0.469	0.442	0.374	0.364	0.337
Finland	36.42	39.205	47.39	50.711	46.385	47.2	50	46.9

Figure 29: GERD - Private non-profit sector (Million euro)

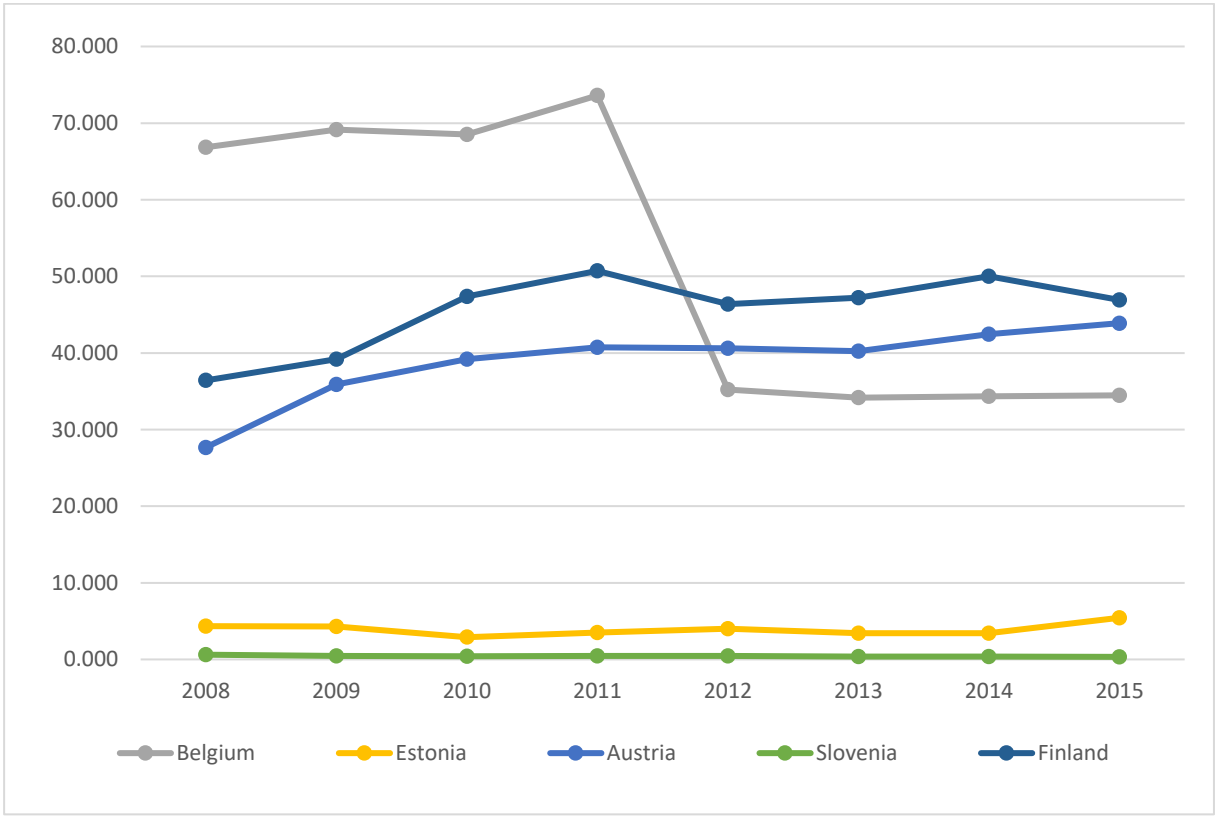


Table 29: GERD - Private non-profit sector (Purchasing power standard (PPS) per inhabitant at constant 2005 prices)

Table	2008	2009	2010	2011	2012	2013	2014	2015
European Union (28 countries)	4.4	4.5	4.8	4.3	4.2	3.8	4	4
Euro area (19 countries)	4.2	4.3	4.7	4.4	4.3	3.8	4	3.9
Belgium	5.5	5.6	5.4	5.6	2.6	2.5	2.5	2.4
Estonia	4.1	4.1	2.7	3.1	3.5	2.9	2.8	4.5
Austria	3	3.8	4.1	4.1	4	3.9	4	4
Slovenia	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2
Finland	5.5	5.8	6.9	7.2	6.4	6.3	6.5	6

Table 30: Total intramural R&D expenditure (GERD) by socio-economic objectives according to NABS 2007 (Million euro)

Table	2008	2009	2010	2011	2012	2013	2014
Exploration and exploitation of the earth	11.474	8.029	9.85	14.515	14.81	8.485	9.259
Environment	13.759	17.507	18.867	22.987	21.442	23.23	23.52
Exploration and exploitation of space	0.032	0.064	0.903	0.572	3.454	4.609	1.013
Transport, telecommunication and other infrastructures	51.451	45.598	48.309	32.121	47.428	51.181	43.465
Energy	18.597	27.587	33.994	63.566	41.448	45.497	44.924
Industrial production and technology	262.877	273.402	314.019	339.648	395.134	429.268	406.689
Health	84.337	82.375	104.468	108.609	97.863	96.911	100.43
Agriculture	11.173	12.652	12.79	15.465	17.986	16.357	16.358
Education	12.445	14.468	13.356	10.418	10.711	18.876	10.648
Culture, recreation, religion and mass media	2.175	3.205	2.653	5.394	3.467	3.95	3.012
Political and social systems, structures and processes	6.396	6.379	5.709	5.307	4.32	5.794	4.645
General advancement of knowledge: R&D financed from other sources than GUF	141.743	165.022	180.283	275.316	270.2	230.718	226.269
Defence	0.488	0.596	0.742	0.295	0.02	0.131	0
Total R&D appropriations	**616.949**	**656.882**	**745.942**	**894.213**	**928.306**	**935.006**	**890.232**

Figure 30: Total intramural R&D expenditure (GERD) by socio-economic objectives according to NABS 2007 (Million euro)

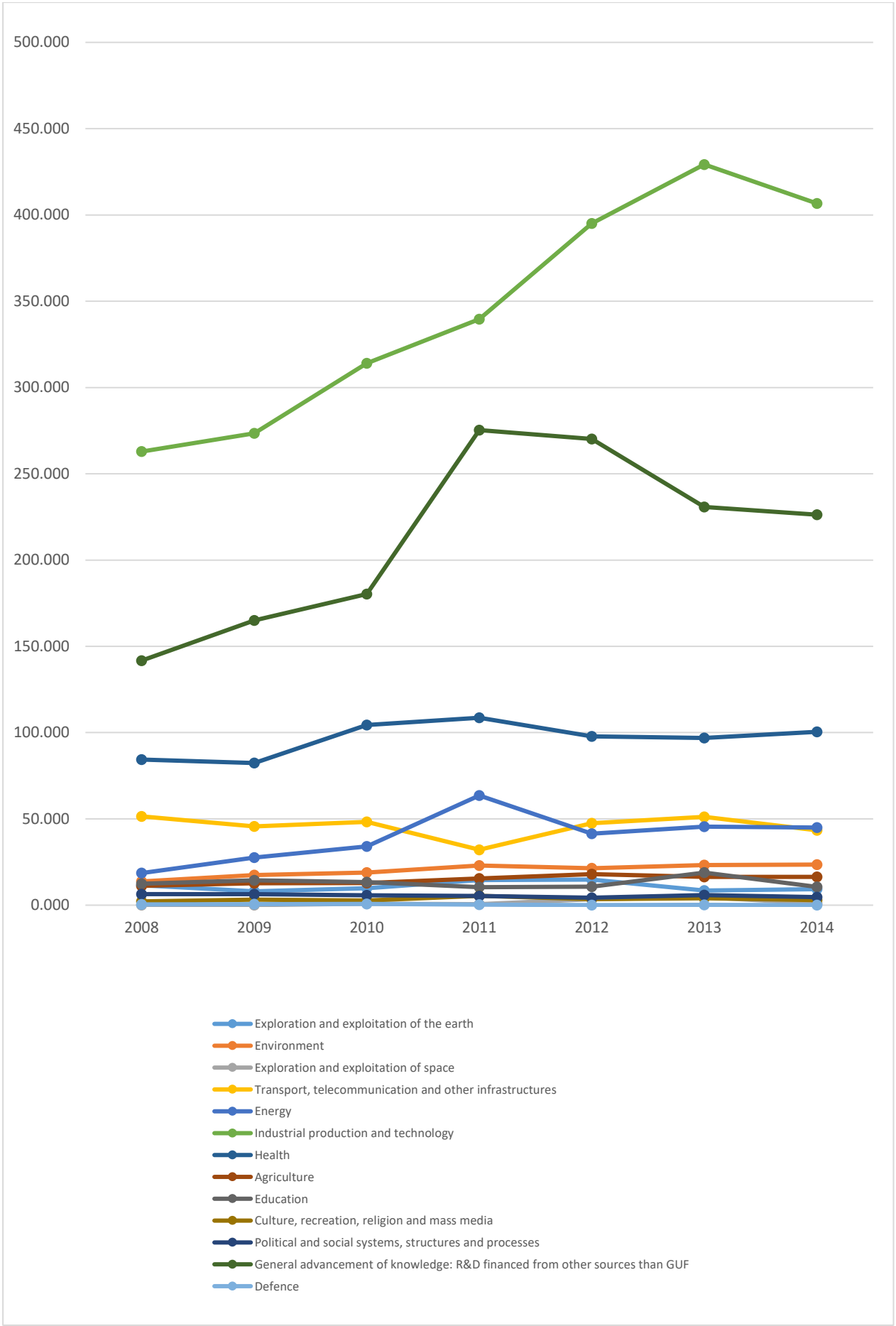


Figure 31: Business enterprise R&D expenditure (Million euro)

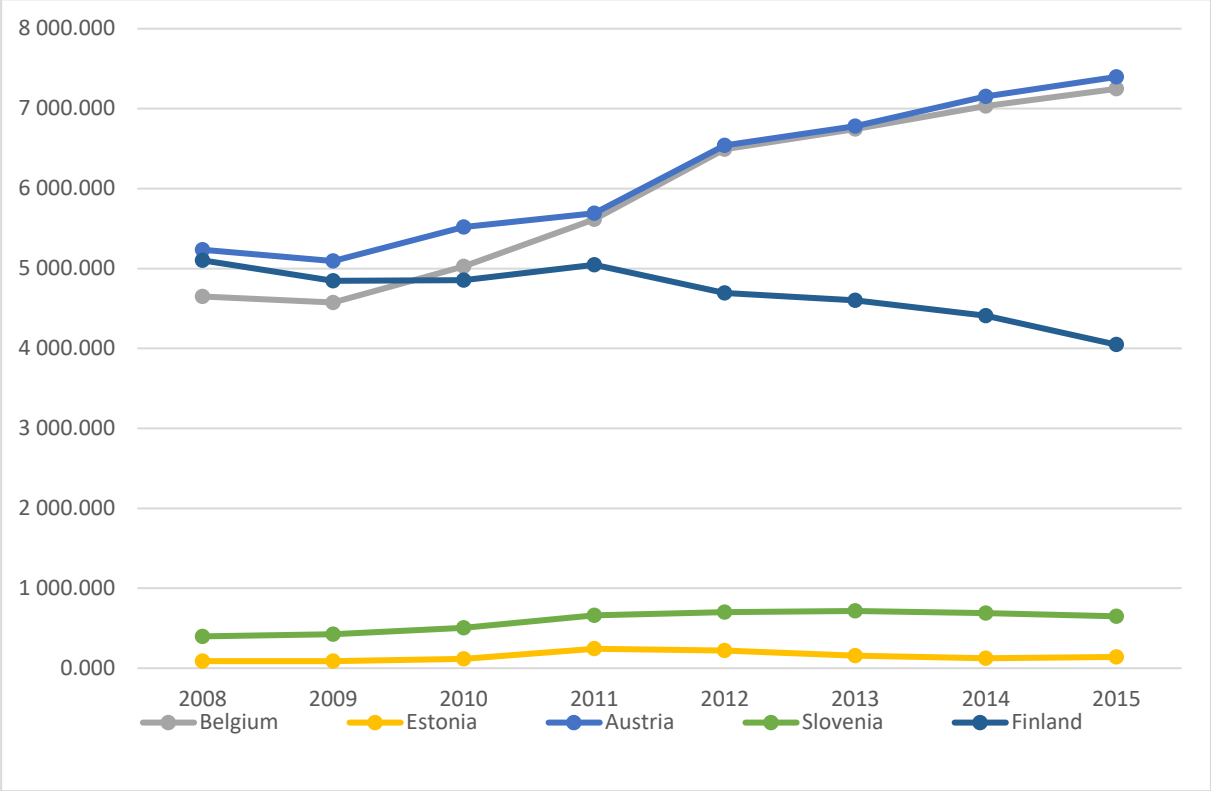


Figure 32: Business enterprise R&D expenditure (BERD) by economic activity (NACE Rev. 2) (Million euro)

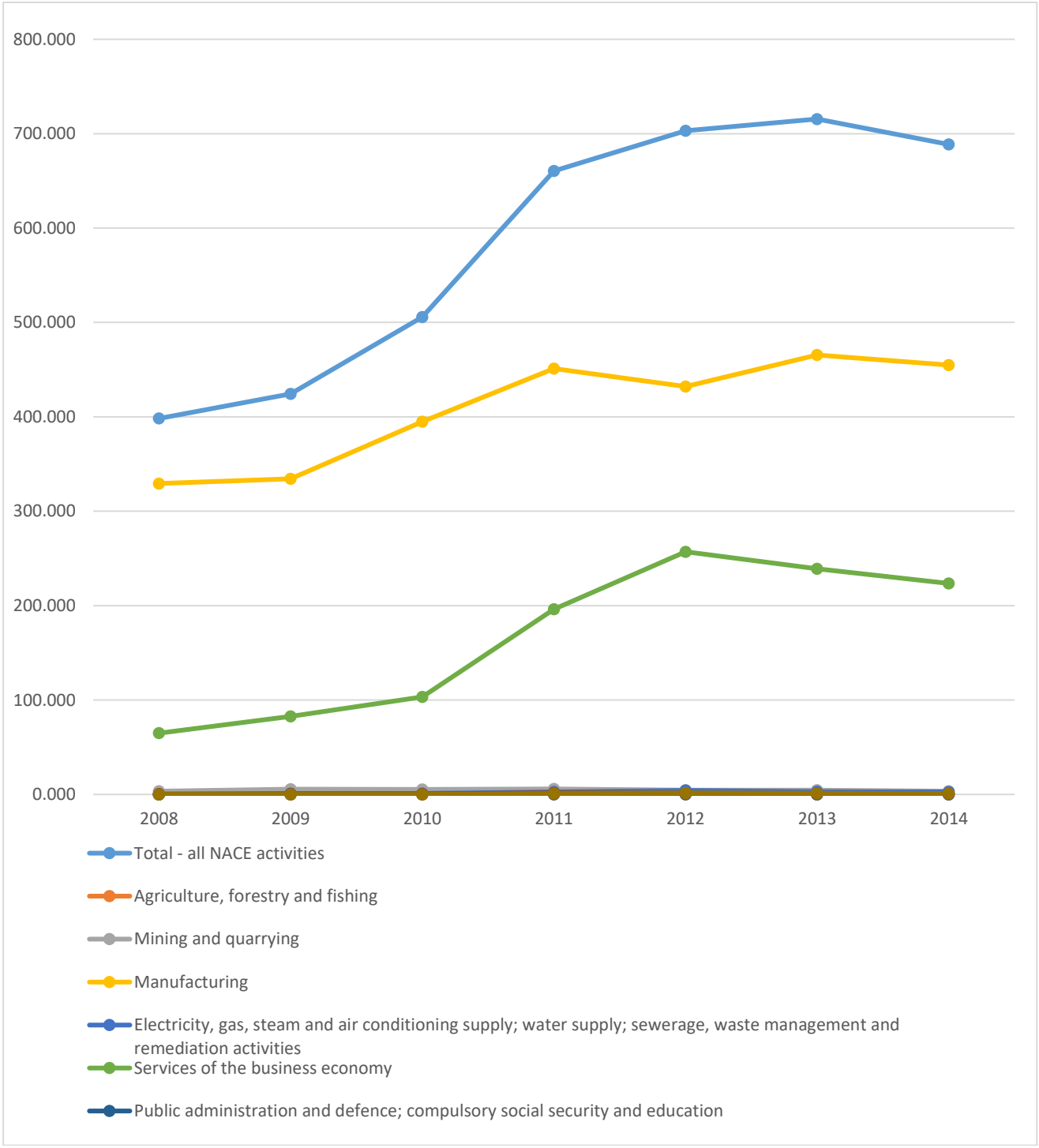


Table 31: Total intramural R&D expenditure (GERD) by Business enterprise sector of performance and fields of science (Million euro)

Table	2008	2009	2010	2011	2012	2013	2014
Natural sciences	159.678	167.721	196.545	236.952	233.042	233.463	232.691
Engineering and technology	229.444	245.457	296.148	400.932	437.833	463.335	428.22
Medical and health sciences	2.676	2.553	1.874	5.15	6.746	6.408	7.196
Agricultural sciences	0.907	1.406	1.544	3.012	3.637	2.945	3.937
Social sciences and Humanities	5.568	7.262	9.706	14.437	21.841	9.388	16.474
Social sciences	4.462	6.173	8.796	13.55	20.704	8.615	15.609
Humanities	1.106	1.089	0.91	0.887	1.138	0.773	0.866

Figure 33: EU Member States' innovation performance

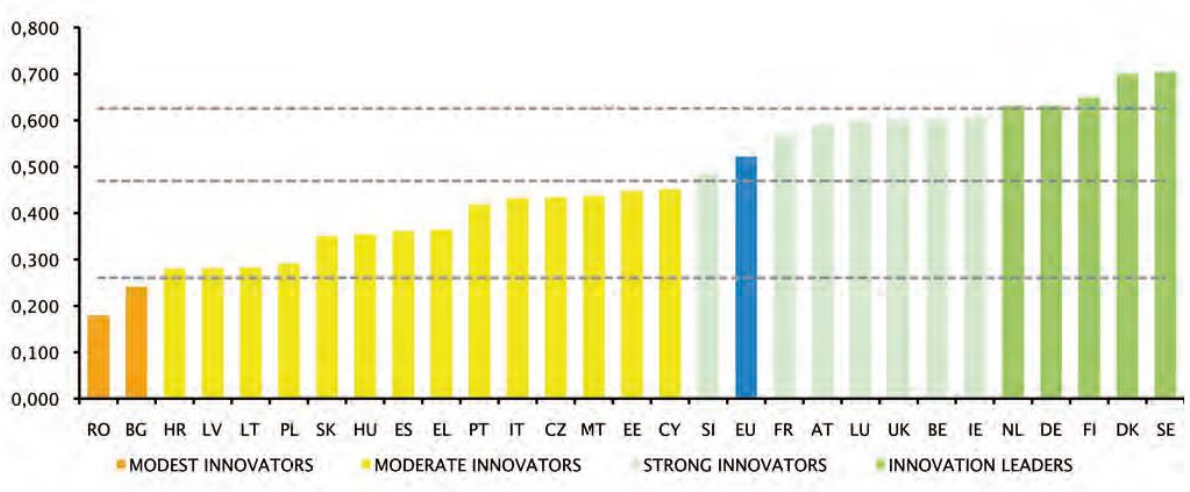


Table 32: Total GBAORD by NABS 2007 socio-economic objectives (Million euro)

Table	2008	2009	2010	2011	2012	2013	2014	2015
Exploration and exploitation of the earth	2.154	3.618	4.054	2.386	2.111	2.061	2.509	3.218
Environment	6.655	5.558	7.121	7.364	5.663	5.415	5.317	6.361
Exploration and exploitation of space	0.497	0.847	1.345	0.679	0.61	0.862	0.563	0.346
Transport, telecommunication and other infrastructures	5.588	5.581	8.021	4.302	5.938	5.799	5.361	5.213
Energy	2.107	3.876	4.341	7.884	5.301	5.062	4.966	4.815
Industrial production and technology	34.184	54.161	35.499	38.345	35.79	26.476	22.708	21.269
Health	7.856	11.544	11.806	14.389	13.112	12.775	12.094	15.351
Agriculture	7.679	8.068	8.174	9.159	7.497	6.968	6.759	8.254
Education	0.81	0.011	0.628	1.915	1.876	2.111	2.818	2.758
Culture, recreation, religion and mass media	8.623	0.206	13.855	3.504	3.565	3.132	2.674	3.382
Political and social systems, structures and processes	6.987	15.711	1.292	4.384	4.037	3.851	4.085	5.156
General advancement of knowledge: R&D financed from General University Funds (GUF)	2.006	1.737	1.949	1.474	0.816	0.439	1.025	1.02
Defence	9.975	4.255	1.482	1.155	1.405	1.175	0.333	0.635
Total civil R&D appropriations	179.639	240.703	216.373	218.252	188.571	173.333	161.004	157.257
Total R&D appropriations	189.614	244.958	217.855	219.407	189.976	174.507	161.337	157.892

Table 33: Total intramural R&D expenditure (GERD) by Government sector of performance and fields of science (Million euro)

Table	2008	2009	2010	2011	2012	2013	2014
Natural sciences	71.956	70.313	73.752	80.019	76.533	75.604	68.841
Engineering and technology	18.056	17.181	15.765	5.369	4.974	4.811	2.871
Medical and health sciences	5.975	6.139	6.997	4.3	3.464	5.338	5.447
Agricultural sciences	4.754	5.09	4.887	3.843	4.633	3.494	6.312
Social sciences and Humanities	34.483	37.629	34.519	34.301	31.88	32.415	24.819
Social sciences	19.176	20.331	16.738	16.515	14.755	15.628	9.199
Humanities	15.307	17.298	17.781	17.786	17.125	16.787	15.621

Table 34: Total intramural R&D expenditure (GERD) by Higher Education sector of performance and fields of science (Million euro)

Table	2008	2009	2010	2011	2012	2013	2014
Natural sciences	17.715	11.487	13.147	14.616	15.268	16.862	16.018
Engineering and technology	34.249	44.538	48.729	37.727	37.381	33.439	33.369
Medical and health sciences	11.838	13.177	14.196	13.534	14.264	14.138	14.409
Agricultural sciences	2.553	0.939	2.662	14.331	14.279	12.828	8.901
Social sciences and Humanities	16.479	25.528	25.038	25.22	22.09	20.164	20.364
Social sciences	12.567	15.305	15.374	14.491	12.35	12.254	12.379
Humanities	3.912	10.223	9.663	10.729	9.74	7.91	7.985

The background report provides an overview of the Slovenian R&I system with a focus on the elements which are most relevant with regards to the science base and its cooperation with the business sector as well as to internationalisation. It includes a brief introduction of the macro-economic framework, especially the recent events, relevant for the research field, as well as a description of the R&D system, with elements of the legal system, strategies and policy processes. This is followed by a presentation of the basic data on R&D and innovation and provides for the overview of the main actors in the Slovenian NIS: from business sector R&D and innovation activity to public R&D at the higher education institutions (HEIs) and public research institutes. With the application of bibliometrics, the main parameters of the R&D system outputs are presented.