Supporting the transformation of the Slovak economy by increasing its innovation performance

TO-BE Report

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MINISTRY
OF INVESTMENTS, REGIONAL DEVELOPMENT AND INFORMATIZATION OF THE SLOVAK REPUBLIC

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1 Introduction

This TO-BE report constitutes the draft recommendations for improving the Slovak Research Technology Development and Innovation (RTDI) system. It has been produced as part of the study "Supporting the transformation of the Slovak economy by increasing its innovation performance".

This report accompanies the AS-IS report, which provides an analysis of drivers and bottlenecks of the Slovak RTDI system. Both reports should be read together because they complement each other.

The recommendations drafted in this TO-BE report cover:

- RTDI funding
- Collaboration between RTDI research performers, policymakers and industry
- Skills and human resources
- Monitoring and evaluation
- RTDI Infrastructure
- The legislative framework governing RTDI in Slovakia

The evidence supporting the findings of this report (presented in the AS-IS report) has been gathered through a thorough literature review and face-to-face and telephone interviews with stakeholders. The bibliography and list of stakeholders interviewed can be found appended to the AS-IS report. Moreover, online validation workshops to discuss this report (and forthcoming recommendations) were carried out on 23 April and 22 June 2020.

2 Recommendations

Chapter 2 outlines the draft recommendations developed based on the findings and conclusions of the preceding AS-IS report.

As stipulated in the terms of references for this assignment, the focus of the recommendations is to propose measures specifically to:

- Reduce the fragmentation of the Slovak research and innovation ecosystem at the level of teams, projects, institutions and governance;
- Increase the efficiency of its funding, including optimisation of the ratio between institutional and project funding;
- Optimise the organisation and operation of public grant agencies;
- Improve coordination of public investment in research and development infrastructure;
- Improve the quality and availability of human resources for research, development and innovation;
- Improve methods to evaluate the performance of the system and the performance of individual public institutions, mainly with regards to their institutional funding;
- Increase the intensity and efficiency of intellectual property protection and transfer;
- Improve the functioning of the ecosystem also in other areas where the need for improvement has been identified in the AS-IS report;
- Remove identified obstacles to diffusion of innovation in the public and private sector; and
- Manage Slovak industrial transition (measures to be implemented at the latest by 2027).

The recommendations also include good practices from RTDI systems across Europe, which could be relevant and serve as inspiration for the improvement of the Slovak RTDI system.

The recommendations in this report are aimed at all RTDI actors in Slovakia, but predominantly at the new Slovak government that was elected in the Spring of 2020. Its planned reforms with regards to the RTDI system, in particular boosting R&D and innovation, are currently dependent on the situation of the COVID-19 pandemic and the long-term consequences of the crisis on the Slovak economy.

Given the challenging circumstance of the COVID-19 crisis, the Slovak government will need to make a strong case for prioritising RTDI investments, although these can be justified both in the short and long term.

Innovation today is more closely linked to societal challenges than industrial policy – innovation policy is invoked not only in relation to economic objectives related to growth and technological change, but also to cope with modern societal challenges, such as food security, environment, energy transitions and health. Therefore, it can be argued that setting aside public funding for RTDI is a public good and a justifiable investment of taxpayers' money.[1] Moreover, prioritising RTDI is the policy of Innovation Leaders in the EU (Sweden, Finland, Denmark and the Netherlands) and is associated with a higher quality of life.

[1] WIPO (2019) THE GLOBAL INNOVATION INDEX 2019. Chapter 1.

Although the COVID-19 crisis is not conducive to long-term investments, forced short-term measures to tackle unemployment brought on by the pandemic can also aim to help both immediate challenges (job losses, firm closures) as well as tackle structural ones (skills shortages). For example, in Sweden in May, the coalition government proposed setting aside additional funding for higher education and lifelong learning to encourage those left unemployed by the crisis to reskill and seek student support rather than (extended) job seekers support.[2]

The subsequent sections of Chapter 2 present the detailed recommendations, encompassing measures across a range of areas. The recommendations are presented in order of priority, based on the analysis carried out in the AS-IS report and the feedback from stakeholders who ranked the recommendations from highest to lowest priority during the validation webinars.

2.1 RTDI funding

As outlined in the AS IS report, Slovakia's investment is RTDI is modest compared to the EU-27 average and the Visegrad countries. As a result, international funding is an important aspect of Slovak RTDI funding overall and Slovakia is one of the most dependent countries in the EU-27 on European funding. This has resulted in an inconsistent funding landscape for research performers. In order to smooth over the cyclical dips in overall levels of RTDI funding in Slovakia, which are greater than with other countries in the region, it is vital to increase national funding.

Recommendation 1: Strengthen the case for increasing national funding by building a strong and robust evidence base for arguing for higher prioritisation of RTDI

Responsible: SGCSTI, MIRRI

Timeframe: Indicative data within six months; developed return on investment methodology in 12 months

Following models such as those in the UK, Europe and elsewhere, a **sound economic analysis** should be used as a roadmap for obtaining increased national funding. Information should be gathered for Slovak research and development investments and benchmarked against other country or regional studies to show how increasing spending in the Slovak system would produce a net gain for the Slovak economy as a whole.

A senior ministry official should be responsible for making the case for research and innovation funding alone. This could be the newly formed ministry of investment, regional development and informatisation of the Slovak Republic, or another ministry. They should work with stakeholders through the GCSTI to oversee the building of a portfolio of analysis with which to argue for increasing the priority of research and development within the national policy landscape. This analysis should be used consistently and adeptly by policymakers, research performers and others in a joint effort to **raise the priority of research funding** as an efficient system of wealth creation and social capital enhancement.

Key information that is often used to influence policy includes:

- **Return on investment.** A 2014 LERU report noted how for each €1 in GVA directly generated by the LERU universities, there was a total contribution of almost €6 to the European economy, and every job directly created by the LERU universities supported almost six jobs in the European economy.[3] Similar figures should be generated specifically for Slovakia.

[2] https://www.regeringen.se/pressmeddelanden/2020/05/satsningar-ska-underlatta-for-fler-att-kunna-studera/

[3] https://www.leru.org/publications/the-economic-contribution-of-leru-universities

- **Direct economic contribution of the research sector**. Getting figures on the private sector is more challenging, so for the purposes of this analysis the focus should be on the public research performers. Figures that can be included are the generation of GVA, job creation and employment, procurement expenditure and supply chain value, as well as even the money spent by staff in the local economies.
- **Indirect economic and social contribution through knowledge creation.** Knowledge transfer, enterprise, and innovation activity can include items such as technology licensing, consultancy, contract and collaborative research, spinoffs and start-ups, science parks, training and staff volunteering.
- These figures should be supported by **case studies** of research projects with high socio-economic value or international importance.

Recommendation 2: Re-orientate the national funding system to include excellence of research as a clear criterion for funding

Responsible: MESRS

Timeframe: Initial stakeholder consultation on metrics could take one to two years

As outlined in the AS-IS report, block funding of research and researchers career progression lacks a quality-linked element. This has the effect of demotivating talented researchers who feel their dedication is not sufficiently recognised. Funding for universities is still largely linked to the number of publications, with no link to the **number of citations, no consideration of supporting text to highlight significance, impact case studies or other valuable indicators of quality.** Exercises such as the Research Excellence Framework in the UK, although from a vastly different higher education system, can offer some inspiration on how to conceptualise public value of research more reliably.[4]

MESRS should therefore **restructure the funding model** by bringing 25% of block research funding under new quality metrics, gathered every three years. This 25% figure can then be scaled up as the system shows signed of re-orientating itself towards quality over quantity. These metrics should be proposed by MESRS and agreed in conjunction with stakeholders two years in advance of the cycle.

Recommendation 3: Address fragmentation of RTDI implementation through better coordination

Responsible: SGCSTI, MIRRI, MESRS, MoE

Timeframe: Start immediately; achieve mid-term of the next funding period 2021-2027

The number of agencies implementing RTDI grants in Slovakia is very high. Two ministries, the Ministry of Education (MESRS) and the Ministry of Economy (MoE), are mainly responsible for RTDI funding and are each acting through their own strand of agencies. At present, there are five agencies under the responsibility of the MESRS (Scientific Grant Agency (VEGA), Slovak R&D Agency (SRDA), Research Agency, Cultural and Educational Grant Agency (KEGA), Department for Science and Technology) and three agencies under the responsibility of the MoE (Slovak Business Agency (SBA), Slovak Investment & Trade Development Agency (SITDA), Slovak Innovation & Energy Agency (SIEA)). Recently, the Ministry of Transport has also taken a greater role in the implementation of RTDI support by becoming the Managing Authority of the Operational Programme Integrated Infrastructure after the Operational Programme Research and Innovations was included under the

[4] https://www.ref.ac.uk/

former in December 2019.[5] This fragmented system of responsibilities causes a lack of clarity and consequently inefficiencies and inefficacies in the implementation of RTDI support.

Already in the RIS3 strategy 2013-2020 and the implementation plan, it was planned to pool the responsibility in two newly created agencies, the Research Agency and the Technology Agency. While these two agencies are now operating independently, they were based on existing agencies, and other existing agencies were also maintained, thereby not effectively reducing the number of active agencies. This restructuring process should thus be continued, starting with a large-scale assessment of the RTDI-related roles and responsibilities of the different agencies.

It is crucial that the research funding activities of the different specialised agencies are well coordinated to make sure that they complement each other. This coordinating role could be taken by the SGCSTI, which represents all the relevant ministries and thus has the necessary expertise at hand to coordinate the different implementing agencies. To this end, the competencies of the SGCSTI need to be strengthened to give it more decision-making powers (see also the respective recommendation in the section on collaboration below). The coordination body should be responsible for developing a common strategic approach for the different agencies and should be in a position to issue common guidelines and standards for the implementation of research funding.

As part of this coordination process, the agencies should also exchange best practices of implementing funding in a structured and regular manner. Ultimately, the implementation procedures of the different agencies should thereby be harmonised and aligned as much as possible (taking into account the specific needs of the different funding schemes) while reducing unnecessary administrative steps and making the procedures for applicants as simple as possible (see also the next recommendation). This alignment should be one of the main objectives of the coordination between the agencies.

This measure has a high priority, as it impacts the whole implementation of RTDI support in Slovakia. The process should therefore start immediately and should be achieved by mid-term of the next funding period 2021-2027.

Recommendation 4: Halve the number of approval and discussion layers for agreeing ESIF calls, give more autonomy to the Research Agencies

Responsible: MESRS, SGCSTI, Research Agencies

Timeframe: six months to one year

Currently the system for drafting, approving, and publishing calls is far too long, inefficient, opaque and does not produce as many high-quality calls as are needed to disperse the ESIF funds. Many layers – for example, research agency councils, the standing committee and permanent committee – also share members and could be merged or streamlined. Each layer of approval that a call passes through needs to have a **clear, rationalised and defined role**. Each layer or approval must also have a Terms of Reference document that outlines the following:

- The **added value** of the group, committee, or council in the process of developing calls (authority, organisational input etc.)
- Some **Key Performance Indicators** for the group, committee or council which should be SMART (Specific, Measurable, Achievable, Relevant, Time-bound)

[5] The Ministry as a Managing Authority for priority axes 8-11 (former Operational Programme Research and Innovation) certified from January (first report after taking over the responsibility for the Programme) until June 2020 EUR 46m, which represents an increase from 15.48% to 19.31% of the sum allocated for the axes. Source: Ministry of Transport and Construction of the Slovak Republic, available at: https://www.opii.gov.sk/monitorovanie-a-hodnotenie/vyvoj-cerpania-v-ramci-opii, accessed on 04/08/2020.

- A systematic **agenda-setting** procedure, frequency of meetings (including a resourced secretariat)
- A process for appointing a group chair who decides when invitations for meetings are sent and publicises meetings well in advance (**six months' notice would be acceptable**)
- If a group has more than a 20% overlap in terms of membership with another ESIF scrutiny group or body, **merging them should be considered**.

Furthermore, more autonomy should be given to research agencies (or consolidated research agency) in the process of call development. At present, calls are published by the ministries themselves, and the role of the research agencies is limited to administration. The research agencies should be given a more strategic role in the process, as they are the ones closest to the research performers. A good starting point would be to have the research agencies publish the ESIF calls themselves.

Recommendation 5: Scale up the innovation voucher scheme to provide more direct support to Industry

Responsible: Ministry of Economy and Slovak Innovation and Energy Agency

Timeframe: Next ESIF programming period

As evidenced in the AS-IS report, the innovation voucher schemes in Slovakia are, at present, only minor supporting mechanisms and are much smaller than in comparable countries, mainly in terms of the overall envelope size for the programmes. However, they are regarded as one of the more successful funding schemes in the Slovak Republic and should therefore be expanded to capitalise on this success and ensure funding meets demand. This report proposes to increase the size of the innovation vouchers substantially to **EUR 5 million across the next ESIF programming period**, in line with comparable countries (Czech Republic, Hungary, Poland), and increase the maximum for each voucher to EUR 20,000.

The purpose of the vouchers should also be refined. According to the research, Slovakia's schemes are both dedicated to supporting cooperation between businesses and research institutes. This recommendation proposes to have **more nuanced focuses for each voucher**. One voucher should remain to support cooperation in R&D; however another should be focused more on the provision and procurement of training, advice and expert support from the university or research institute by SMEs.

By expanding the voucher programme to match comparable countries and expanding its remit, Slovakia can reach a **more diverse set of SMEs and increase their capacity** to collaborate in research projects both immediately and in the longer term.

Recommendation 6: Prioritise Disbursal of Technical Assistance (TA) Funding under ERDF

Responsible: Initial factfinding mission by MIRRI for RTDI, cross-ministry solutions to be sought as it is not a specific RTDI issue

Timeframe: 12 months

As outlined in the AS-IS report, the Technical Assistance budget of ERDF funds (EUR 19 billion 2014-2020) is intended to establish or improve organisational structures, the use of systems and tools, and human resource development. This can involve:

- Subcontracting or outsourcing of programme management
- Procurement of tools for situation analysis, forecasting, environmental impact analysis, cost-benefit analysis, energy-efficiency assessment and evaluation models

- Top-ups and bonuses to improve staff retention rates and staff training and related professional development actions.

By June 2018 Slovakia had only used 4% of its total budget for this programme under ERDF, among the lowest level in all Member States.[6] The areas that TA can fund relate to almost all those where Slovakia has the biggest challenges in terms of its RTDI system, and therefore use of these funds should become a far higher priority.

To prioritise the use of these funds, **a senior team at the Ministry of Investment, Regional Development and Informatisation** should be provided with an explicit mandate to understand how they can be used **and why the uptake has been so low** across this programming period. Problems relating to lack of uptake are detailed in the AS-IS report. It should then become a priority across relevant ministries to use these funds once sufficient capacity and awareness has been raised. This exercise should be completed **within 12 months**.

Recommendation 7: Ensure grant proposal requirements do not discriminate against 'new or emerging' RTDI applicants

Responsible: Research agencies

Timeframe: Next programming period – 2021

All public authorities responsible for allocating RTDI funding should ensure that Calls for Proposals requirements are fair from **different stakeholders' point of view** and consider that SMEs or individual entrepreneurs cannot be expected to provide the same evidence as large HEIs.

The focus on administrative requirements in response to calls for proposals should also **shift to a focus on results and outcomes.**

2.2 Collaboration

A key conclusion of the AS-IS report is that Slovak RTDI has potential to improve its competitiveness internationally in several fields. However, it faces a number of financial and behavioural barriers. Although the private sector is increasing its expenditure on RTDI, there is still some room for improvement. Moreover, along with the dominance of the public sector, both the public and private sectors in Slovakia adapt their RTDI to the cyclical nature of structural funds.

Although ESIF projects are predominantly collaborative in nature, the majority of national public sector research in Slovakia does not lend itself to, or require, cooperation between public and private research performers. The AS-IS's report's generalised conclusion was that a culture of cooperation is lacking, which means that a lack of trust, networks and cooperative behaviour is also an issue. This collaboration should entail cooperation at policy level and at research performing level and between the various elements of the RTDI system.

Slovakia's challenges are not unique. Many innovation systems struggle to meet the demands of the constantly changing global competitive environment and to develop a common response to challenges among national or local RTDI actors required. A collaborative response to challenges, through, for example, Entrepreneurial Discovery Process activities is particularly crucial since innovation systems need to undergo structural changes as the global economy has shifted from manufacturing to services and as new socio-technical developments shape innovation trends.

Oksanen and Hautamäki suggest that in order to manage the structural change and to support innovations as efficiently as possible, local innovation environments need to be developed and

[6] https://www.europarl.europa.eu/RegData/etudes/STUD/2018/621785/IPOL_STU(2018)621785_EN.pdf p65

strengthened. Their research presents interesting and relevant findings using Central Finland as a case study. Although the Slovak Republic and Finland do not share many socio-economic characteristics – Finland's competitiveness has been based on innovation to a larger extent than Slovakia – this particular case study may still provide some interesting lessons for Slovakia to consider.

Firstly, Central Finland is a manufacturing region, traditionally focusing on pulp, paper, and metal industries. Secondly, some of the acute challenges faced by the region bear some resemblance to what is currently happening elsewhere. In 2009–2010, the Central Finland region and its 260,000 inhabitants experienced a broad structural crisis.

In the early 2000s, the region's development strategy focused heavily on ICT expertise and as a result Jyväskylä, the largest city of the region with 80,000 inhabitants, became one of the most important ICT centres in Finland. The region was branded as a Human Technology Centre. During this period, the traditional paper and machinery industries were also relatively strong.

However, in spring 2009, the Jyväskylä region faced a new kind of structural change. Two major employers, Nokia and Metso Paper, began to reduce their research activities. Nokia shut down its R&D unit in Jyväskylä, leaving more than 300 highly skilled professionals and researchers unemployed. Altogether, the region lost about 1,000 knowledge-intensive jobs in a short period.

The questions that arose from this situation were: 1) How can regions and cities be systematically transformed into innovation ecosystems? and 2) How can local industrial structures be renewed?

Box 1: Central Finland – collaboration between actors in response to structural change

Oksanen and Hautamäki firstly argue that innovations require a special ecosystem that includes top-level universities and research institutions, sufficient financing and a local market, a skilled labour force, specialisation as well as cooperation among companies, and global networking. Such a hub can be built through deep cooperation among local, regional and national actors.

However, in reality not many regions have this kind of renewal capability. Instead, innovation tends to cluster in certain sectors or areas which grow faster and imply structural changes – Bratislava and Košice in the case of Slovakia. Similarly, regional development policy is not geared towards supporting large clusters, cities and metropolitan areas, while most of the value creation, R&D activities, and patenting happens in international, innovation hubs. For smaller countries, regions and urban areas, it is essential to identify and support the full innovation potential of the area.

To make the ecosystem alive and renewable, a risk-taking entrepreneurial culture is essential. Another special feature is recycling, the continuous movement of ideas and people.

Individuals can easily move between businesses and from research institutions to the private sector and vice versa. Interactive, dynamic companies are at the core of the ecosystem. The most famous example of this characteristic is Silicon Valley. Supporting services are equally important. These include intermediary organisations, which are often local organisations such as technology centres, enterprise incubators, and development companies whose primary tasks are to facilitate knowledge and technology transfer, and the development of innovation networks. In short, innovation activity is linked to a certain environment and its networks. It concerns businesses, research institutions, financiers, policymakers, company personnel, consumers and other interest groups. The ecosystem approach emphasises the position and roles of local and public actors in developing the innovation activity.[7]

Source: Oksanen and Hautamäki (2014)

[7] Oksanen and Hautamäki (2014) Agora Center University of Jyväskylä Finland. The Innovation Journal: The Public Sector Innovation Journal, 19(2), 2014, article 5.

2.2.1 Collaboration at policy level

As indicated in the introduction to this section, the conclusion of the AS-IS report is that the political system governing Slovak RTDI is not effective. This is in line with previous studies on the topic which indicates that RTDI governance is a longstanding challenge.

Although this study, as well as previous assignments[8], has struggled to clearly articulate what the factors behind these barriers are, it is sufficiently clear that they are predominantly political in nature. A lack of coordination at the political level is clearly hampering efforts in Slovakia.

To address these challenges it will be necessary to plan for and implement both immediate measures (6-12 months) to enable reform as well as to design longer term activities (over the next four-year parliamentary term).

The recommendations for collaboration at policy level should be read in tandem with recommendations on monitoring and evaluation and with the recommendations for legislative measures since these are closely interlinked.

The draft recommendations developed with regards to collaboration among policymakers are as follows.

Recommendation 8: Address fragmentation of RTDI policymaking

Responsible: SGCSTI, Ministries

Timeframe: Immediate start, estimated implementation time 6-12 months

Slovakia has taken many steps towards developing an innovation strategy. Its current strategy is embodied in the RIS3 strategy. This is focused on implementation of activities in the very near future. In this regard, it is focused on solving today's problems. The flip side to this is that longer-term challenges and opportunities are not addressed. What is **still lacking is a long-term vision of Slovakia's RTDI** – and what the country wants to and needs to achieve over the next 20 years.

Establishing a common long-term goal will help to foster a common purpose and set a defined framework for fostering collaboration among public and private stakeholders. A long-term vision for RTDI needs ministerial leadership, through the new Ministry for Investment, to develop, but it equally needs stakeholders from the entire RTDI system, through the EDP, to be involved from start to finish.

Our recommendation is for the Slovak Government Council for Science, Technology and Innovation to initiate this process as part of a wider inventory of RTDI in Slovakia. Based on the findings of the AS-IS report, we also **recommend that the ministries are involved in innovation and that the Council is granted further competencies in the decision-making process**. The Council is currently a "expert, advisory, initiative and coordination body of the Slovak Government",[9] but it is generally a trusted institution among a wide range of RTDI stakeholders that wish to see the Council more directly involved in implementation and the follow-up of agreed decisions. With strengthened competencies, the Council could also take over the coordination of the RTDI agencies, as proposed in the section on RTDI funding.

[8] For example, the Interim Evaluation of Operational programme Research and Innovation (2014-2020), which states that "*It is not easy to name the exact causes of the current state of the program. Thorough analyses show that this state is primarily caused by a combination of systemic and administrative flaws throughout all degrees of management and implementation system of ESIF and OPs; starting with delays in defining basic rules for a functioning system of ESIF management, delay in functionalities for primary system of programs' operations, delay in meeting ex ante conditionality criteria on program level, as well as not abiding of defined methods for selection of operations on different levels of management of the program.*"

[9] https://rio.jrc.ec.europa.eu/country-analysis/organisations/slovak-government-council-science-technology-and-innovation

A third recommendation is for the ministries responsible (MESRS, OVPMII) **to implement the planned international audit of science and research envisaged in the RIS3 Implementation plan** and to use this study to address issues of fragmentation and effectiveness.

Recommendation 9: Carry out an immediate review of the current coordination RIS3 procedures with the view to identifying and agreeing common principles for implementation

Responsible: SGCSTI

Timeframe: Immediate start; estimated implementation time 6-12 months

The serious shortcomings of the current ESIF programme period strongly indicate that the quality of procedures and the quality of management need to improve in order for the Slovak ministries and agencies to more effectively and efficiently fund research and innovation activities through ESIF. Although the AS-IS report can point to examples of high-quality civil servant skills in Slovakia, there is a need to improve skills and capabilities overall and the varying quality of management needs to be addressed as a matter of priority:

As a result, our recommendation is that **all ministries and agencies involved in coordination should provide common innovation management training to civil servants involved in RIS3 and in national RTDI implementation**. A training course could be arranged in cooperation with Slovak universities and/or research institutes (see recommendation 3 in section 2.6).

Support and advice can also be drawn from international experts in particular with regards to reforming the current calls for proposals evaluation process, which needs to improve both in terms of becoming more effective and efficient, and also in terms of transparency. We therefore recommend that, as a first step, the Council for Science, Technology and Innovation appoints a **task force taking responsibility for a rapid review of the current evaluation and peer review system(s) in use in Slovakia and benchmarks this with international standards**, for example guidelines available through the European Science Foundation's European Peer Review Guide Integrating Policies and Practices into Coherent Procedures.[10]

Recommendation 10: Carry out a forward-looking review to ensure the enabling conditions set for the next programming period of European Funds are adhered to

Responsible: RIS3 Committee

Timeframe: Immediate start; estimated implementation time 6-12 months

The upcoming programme period of European Funds, 2021-2027 will be governed by the Common Provisions Regulation, which are detailed in Regulation COM (2018) 375 final.

As described in the AS-IS report, the aim of Regulation COM (2018) 375 is to reduce fragmentation and to deliver a common set of basic rules for EU funds. The adoption of the Regulation means that "Ex ante conditionalities" in the 2014-2020 period will be replaced by "enabling conditions".[11] These will be fewer but more focused in nature, and – in contrast to the 2014-2020 period – monitored and applied throughout the period. One important practical consequence is that Member States will not be able to declare expenditure related to specific objectives until the enabling conditions are fulfilled. This condition is in place to ensure that all co-financed operations are in line with the EU policy framework.

In order to avoid delays in implementation of the next programme period, it will be crucial that **Slovak ministries and agencies involved in RIS3 prioritise a review of current practices and what lessons can be applied for the next period**. The review should directly focus on meeting the

[10] http://archives.esf.org/fileadmin/Public_documents/Publications/European_Peer_Review_Guide_01.pdf

[11] Regulation COM (2018) 375 final.

enabling conditions outlined in the regulation to safeguard against future problems, and the output of the review should assign responsibility and a timeline for adhering to these.

2.2.2 Collaboration between RTDI performers

The recommendations laid down in this section outline several facets of collaboration that should be improved in Slovakia through a mixture of initiatives requiring commitment from all RTDI stakeholders. Each recommendation is focused on a specific aspect or type of RTDI collaboration, from informal collaboration, to university industry partnerships and policies addressing research culture. Since funding is looked at elsewhere in the document, this section will focus on policy changes or changes to the way RTDI performers work together, as separate from direct resource allocation. However, some of the recommendations may require changes to the funding landscape to varying degrees.

Recommendation 11: Improve the Collaborative Culture in RTDI actors

Responsible: Academic community, MESRS

Timeframe: 12 months to develop the Code

This analysis has shown that siloed thinking is common among Slovakia's research community and that a lack of a collaborative culture is impeding excellent research both within the public sector and in collaborations with the private sector. Matters relating to culture are, by their nature, long term and so it is vital for Slovakia to **maintain policy measures over time and provide stability for the research community.** Shrum, Genuth and Chompalov[12] carried out an extensive study on scientific collaboration, which identified inter-personal context (relations among scientists) as a key element of successful collaboration. The Slovak Government should try to implement policies to stimulate a **greater degree of self-awareness for individuals within the research community**. This process must be done in collaboration with all stakeholders and could be initiated by drafting a country-wide **set of best practices** for the management of teams, responsibilities, relationships between individuals, initiatives for building trust and crucial soft skills.

This 'Code of Practice' could be inspired by the format of the newly created **'Concordat to Support the Career Development of Researchers'** drafted in September 2019 for the UK research community.[13] The Concordat builds upon previous versions, drafted in 1996 and 2008, and contains pillars on environment and culture, employment and professional career development. It emphasises the shared responsibility of the funders, institutions, researchers, and managers to provide a positive culture. This process should be led by the academic community, **with input from international experts** and MESRS, who would then be responsible for dissemination of the code and its promotion at nationwide workshops at both senior management and researcher level, to promote and institutionalise the practices.

Evaluation of the code should be done through a set of pre-**agreed Key Performance Indicators,** comprising a mix of results and impact indicators, not least the number of scientific publications written collaboratively. Further measurable KPIs should then be developed, along with reporting requirements. An institution could then be given an overall 'collaboration score', which in the longer term may be linked to research funding allocation.

Recommendation 12: Support the creation of a single, country-wide Research Network

Responsible: Led by MESRS, with broad input from research base

Timeframe: 12 months

[12] Shrum W, Genuth J, et al. Structures of Scientific Collaboration. Boston: The MIT Press; 2007

[13] https://www.vitae.ac.uk/policy/concordat

Slovakia lacks a single large research network which can **facilitate formal partnerships between industry and academia.** Evidence collected during this study has shown that universities and faculties are making individual, ad hoc approaches to companies and lack the critical mass to attract sufficient attention, **develop a strong brand for Slovak science**, and a broad enough scientific offer for companies to see the added value.

By employing **models such as the newly created Łukasiewicz Research Network in Poland**[14], (itself modelled on Germany's Fraunhofer and Finland's VTT) which brings together 11 cities and 37 research institutes and was itself modelled on other successful networks of institutions, such as the Fraunhofer society in Germany, public RTDI actors can create a single point of contact for the Slovak research base. While an association of research universities was mentioned by stakeholders during the course of this study, it lacks formality and sufficient visible and strategic direction, which makes its effect on practical collaboration outcomes difficult to measure.

A research network should also actively work towards supporting emerging and existing research organisations and teams through, for example, support to internationalisation and support to participation in European research programmes.

Recommendation 13: Support the development of cluster management as a specific skillset, part of an overall cluster strategy for Slovakia

Responsible: MIRRI, Ministry of Economy

Timeframe: 6-12 months to draft strategy; implementation over next ERDF programming period

The current smart specialisation strategy mentions clusters, but the implementation plan lacked reference to any clear policies for supporting them in a systematic way. Clusters in Slovakia are performing well when benchmarked against the EU-13 and should be supported further. They need to have a recognised terminology among policymakers, specific support for the skills needed to manage clusters and positive national policy environment to create opportunities for internationalisation and best practice exchange.

A **national cluster and network strategy** should therefore be drafted by the Ministry of Investment, Regional Development and Informatisation, through extensive consultation with the clusters themselves and other relevant ministries (Ministry of Economy etc.). The ministry should also be responsible for cluster policy. Case studies such as the Danish Cluster Strategy (2016-2018) could also prove useful,[15] not least in developing an understanding of cluster's importance and how they may be used by policymakers – for example, the **creation of a Cluster Forum**, composed of national, regional, and local policymakers as well as industry representatives, which could be responsible for monitoring the implementation of the cluster and network strategy for the Slovak Republic.

This strategy should include a provision for education and capacity-building for cluster managers, through **specific accredited training courses** such as those offered by Cluster Education and others.[16] It should also include a **national cluster exchange programme** for those working in clusters, with the longer-term aim of increasing participation in EU-level initiatives such as the recent ClusterXChange Pilot Call in 2019. Policymakers should also seek to develop their understanding of how clusters can be used by attending EU-level groups, such as the European Cluster Policy Forum, in a more consistent way.

[14] https://lukasiewicz.gov.pl/en/

[15] https://s3platform.jrc.ec.europa.eu/documents/20182/232200/DK_Cluster_Strategy_Final.pdf/cec1103a-b6bf-4895-8fe5-892ce3a0b00c

[16] https://www.clustereducation.com/

Recommendation 14: Support collaboration in education, as a long-term investment and aspect of the research pipeline

Responsible: Higher education institutions, industry, with clear mandate and support from MESRS and MoE

Timeframe: First courses should aim to start in academic year 2021

In Slovakia there is a mismatch between how higher education institutions conceptualise the role of research and innovation and the needs of industry. This mismatch is influenced by aspects such as the typical academic pathway for researchers, where it is the norm in Slovakia for researchers to have studied bachelor's, master's and doctorate at the university, and to then be employed by that institution as an academic for the majority of their careers. The **link between tertiary education, career pathways for academics, and research culture is clear**. This mismatch has therefore created several accessibility barriers and resulted in a dearth of collaboration between the public and private sectors, with little comprehension of who is responsible for what in the innovation pipeline. This recommendation is long term and aims to **increase levels of exposure,** without putting immediate pressure on public or private stakeholders to push for research collaboration or technology transfer outputs.

In order to facilitate an increase in understanding, several options are available reflecting various degrees of development and advancement in collaboration for individual regions and institutions.

Universities in Slovakia should seek to **co-create more courses and curriculum** with local businesses. This means better integration of industry in the educational process or the creation of new courses, including short courses, sponsored by, and with the collaboration of, Slovak businesses or industry organisations. Models such as the INENTER project, which 13 organisations from across Europe took part in, could serve as good practice here.[17]

Further options include supporting the development of 'sandwich courses', **bachelor's degrees which typically involve a placement year or internship in industry**. For institutions which already have more developed academia/industry collaborations, **industrial fellowships** should be considered. These kinds of initiatives should be coordinated with recommendations relating to skills and human resources (section 2.4).

Recommendation 15: Provide a wider variety of opportunities for academia and industry to interact

Responsible: MESRS, MoE

Timeframe: Development and Implementation over next programming period

Slovakia needs to provide more accessible opportunities for interaction between the university sector and private sector, aside from just call-based opportunities. These fora must be supported **for at least five years** and be adequately funded, while ensuring they target different stages of the innovation pipeline. For example, the Czech Republic has the ALFA, Delta, Epsilon, Zeta and Trio initiatives, which each **target different aspects of knowledge transfer** by facilitating links between academia and industry.[18]

Another activity with great potential is to establish a jointly run placement scheme that promotes collaboration between business and academia funded by a fellowship grant. The scheme could draw inspiration from Science Foundation Ireland, which is known for its successful placement schemes that allows academics to work in industry or industry researchers to collaborate with academia. The

[17] http://www.unica-network.eu/project/improving-student-placements-inenter

[18] Rio Report: Czech Republic 2017, p12

SFI scheme also offers collaborative funding opportunities to researchers and business representatives. One approach is to offer financial and technical assistance, which could be combined with mentorship, business plan development and proposal writing.

2.3 Skills and human resources

The AS-IS report identified the main factors behind skills shortages as a combination of i) educational attainment and labour market needs, ii) low educational performance, iii) lack of interest in STEM occupations and iv) demographic changes.

Overall, Slovak tertiary education places too little emphasis on practical experience and this contributes to a significant educational mismatch with the labour market. The main task is to halt the continuous degradation of the education system at all levels and the adoption of appropriate measures.

Systemic changes required short-term and long-term action. Immediate action could include the following:

Recommendation 16: Strengthen the supply-demand link between higher education and the labour market by incentivising students to take up courses linked to labour market demand (e.g. ICT, STEM)

Responsible: MESRS

Timeframe: 18 months

As the AS-IS report outlines, Slovakia – along with many other countries - is lacking STEM and ICT professionals and uptake of these subjects. Indeed, this is not an uncommon problem among OECD countries, and demand and supply in higher education, i.e. attracting students to disciplines with strong skills needs can be supported through scholarship incentives. For example, in Slovenia, STEM studies have been promoted through more favourable scholarship policies and as a result there has been a small increase in the share of students enrolled. The gender balance of students choosing STEM studies has also improved over time. In 2004 only 7% of women were enrolled in STEM tertiary education; in 2010 the number had increased to 11%, and in 2016/17 14.3% of women chose STEM. [19]

Similar policies, i.e. **establishing scholarships to encourage STEM and ICT uptake among Slovak students, can also be championed by the Ministry of Education**.

The Ministry of Education could also liaise with universities and key employers in the fields of ICT and STEM to explore possibilities of supporting an Industrial Master's and PhD programme. This would entail offering students currently enrolled in a STEM degree the opportunity to complete a compulsory industry placement component of up to 12 months as part of their degree.

Recommendation 17: Implement a package of measures aimed at combating brain drain

Responsible: MESRS

Timeframe: 18 months

As outlined in the AS-IS report, brain drain is a common challenge among EU countries with smaller RTDI systems. The AS-IS report describes a number of initiatives developed by other EU-13 countries

[19] Bučar M, Jaklič A and Gonzalez Verdesoto, E, *RIO Country Report 2017: Slovenia*, Publications Office of the European Union, 2018.

in seeking to reverse brain drain trends. These have been a mixture of financial and reform-based incentives.

Box 2: SOMOPRO

For example, the SOMOPRO initiative, which was funded by a mixture of ESIF, Marie Sklodowska-Curie and FP7/H2020 funds, is a grant scheme aimed at attracting skilled researchers from the Czech Republic to the region.20 Elsewhere, Romania has a one-month grant for scientific diaspora to return to Romania and see how the country has changed since they left, in terms of opportunities and facilities for the research community.[21]

These are examples of existing initiatives which **should be considered by the Ministry of Education for adaption in the Slovak Republic**. The Ministry of Education should also **consider offering stipends or cash grants to encourage highly educated individuals to return from abroad**. Another option is for the Ministry of Education to **consider awarding additional points on grant applications** to project plans that promise to work with, or 'bring home', Slovak researchers currently working abroad.

Recommendation 18: Operationalise OECD recommendations using EU funding

Responsible: Ministry of Labour, Social Affairs and Family

Timeframe: Immediately

The AS-IS report describes the outputs of the recent OECD National Skills Strategy project[22] which was a collaborative initiative that also included Slovak government stakeholders (represented by the former Slovak government). The project produced a comprehensive list of recommendations to be implemented in Slovakia to improve skills.

These cover four main areas:

- Strengthening the skills of youth
- Reducing skills imbalances
- Fostering greater participation in adult learning
- Strengthening the use of skills in the workplace

Our recommendation is that the new government continues to build on the work of its predecessors and **operationalise the OECD recommendations**. The Ministry of Labour, Social Affairs and Family should take the lead in cooperation with its agencies. The recommendations articulated could be **made priorities to be included in the upcoming programme periods for Erasmus+ and the European Social Fund**.

Moreover, the ministry could consider stimulating demand by **offering simply designed tax incentives to firms engaging in reskilling and adult learning.**

Recommendation 19: Improve understanding of intellectual property protection

Responsible: Ministry of Economy, Ministry of Education, ÚPV

Timeframe: Mid to long-term; should run over several years

[20] Cavallini et al, *Addressing brain drain: The local and regional dimension*, European Committee of the Regions, 2018, https://cor.europa.eu/en/engage/studies/Documents/addressing-brain-drain/addressing-brain-drain.pdf p44.

[21] Anita Tregner Mlinaric, *We need directed policies to transform brain drain into brain circulation,* ScienceBusiness, 30 Jan 2020, https://sciencebusiness.net/viewpoint/viewpoint-we-need-directed-policies-transform-brain-drain-brain-circulation

[22] OECD, OECD Skills Strategy Slovak Republic: Assessment and Recommendations, 2020, OECD Skills Studies, OECD Publishing, Paris, https://doi.org/10.1787/bb688e68-en

The use of intellectual property protection mechanisms is not very strong in Slovakia. In terms of the number of patent registrations, the country ranks very low among the EU-27, with fewer than 200 patent registration per year (national and EPO patents combined).[23] While some financial or administrative burdens exist for companies trying to obtain intellectual property protection, these are generally manageable and are not perceived as a major issue (although registration fees can pose a problem for academic institutions). Instead, the main issue concerns using intellectual property rights in an effective and cost-efficient way. Many companies and research organisations, although being aware of the possibility to get patent protection, seem to not consider patents a useful option to pursue. This is linked to inexperience with enforcement of intellectual property rights and obtaining royalties from licensing.

The Ministry of Economy, in cooperation with the Ministry of Education and the Industrial Property Office (ÚPV), should therefore implement a large-scale skills initiative to improve overall patent literacy, in particular the understanding of effectively using intellectual property protection in Slovakia (notably regarding enforcement and effective commercialisation). This should include offering support services and advice for commercialisation by actively approaching the beneficiaries, for example through strengthening the IPR desks in large universities. The initiative should not only target companies and research organisations (i.e. the research performers that would register patents) but also be implemented in the education system to raise awareness on a general level. As such, intellectual property protection should be covered in the modules of technical and business study programmes. The Czech Republic, for example, has adopted a similar strategic target in its innovation strategy 2019-30.[24]

Both the World Intellectual Property Organization (WIPO)[25] and the European Patent Office (EPO) provide examples and material to support initiatives to improve knowledge about intellectual property protection. In order for this measure to have a long-term impact, it should be implemented over a period of several years. In the long term, the effectiveness of this measure should be reflected in the number of patent registrations.

2.4 Monitoring and evaluation (M&E)

The AS-IS report made a number of observations on monitoring and evaluation. These findings fall into two categories:

Shortcomings in the current system. This point relates to monitoring during the whole project cycle, in particular with regards to ESIF OPs. There was an overall agreement that the calls for proposals process (which in turn also produces monitoring data) and the administrative requirements for applicants seeking funding were too cumbersome and not conducive to the innovation support sought by *inter alia* entrepreneurs and small business. This process is the responsibility of the ministries.26 Although some processes are in place, there is a general lack of trust in the monitoring and evaluation system; faster and more transparent processes would help considerably to rebuild trust.

[23] Industrial Property Office of the Slovak Republic, Annual Report 2019, https://www.indprop.gov.sk/swift_data/source/dokumenty_na_stiahnutie/vyrocne_spravy/Annual%20report%202019.pdf; EPO, European Patent Applications per Country of Origin, https://www.epo.org/about-us/annual-reports-statistics/statistics/2019/statistics/patent-applications.html#tab2

[24] Research, Development and Innovation Council (RVVI), 2019, Czech Republic Innovation Strategy 2019-2030, https://www.countryforfuture.com/wp-content/uploads/2019/09/Inovacni-strategie-CR_Country-for-Future.pdf

[25] WIPO, IP Outreach Campaigns, https://www.wipo.int/ip-outreach/en/tools/

[26] The bodies responsible are outlined on p.44 of the Operational Programme Research and Innovation, *Implementation plan: Research and Innovation Strategy for Smart Specialisation of the Slovak Republic, 2015.*

The Slovak RIS3 implementation plan outlines a detailed coordination plan for monitoring, which appears in writing as relevant and effective. However, stakeholders find the process opaque. The Ministry of Investment, Regional Development and Informatisation of the Slovak Republic is tasked with undertaking regular evaluation of ESIF projects.

Lack of strategic oversight. Although monitoring data (e.g. the number of proposals received per call on selected projects) is collected by the Slovak Research Agency, there appears to be a lack of strategic use of this data. There is also limited use of a results-based approached to monitoring and evaluation among Slovak public authorities, which would be more suited to innovation support. One option is for the Ministry of Investment, Regional Development and Informatisation of the Slovak Republic to take responsibility for monitoring.

Given that the next programme period of ESIF will see an increase in reliance on national management and control systems and procedures as oppose to EU-level ones, this is an opportune moment for making improvements. The stakeholder consultations carried out as part of this study showed that there are existing concrete ideas for how to improve M&E of RTDI in Slovakia, and these should to be capitalised on.

For example, a group of research performers and Slovak entrepreneurs presented a proposal to modify the current Slovak monitoring and evaluation process, taking ideas from the current Dutch system for M&E of ESIF, with the aim of adapting practices in the Netherlands to produce a fairer and more efficient system in the Slovak Republic.

The Slovak Ministry of Economy has also produced a set of proposals for simplifying the current system in order to eliminate current bottlenecks and improve transparency. This proposal identifies an extensive number of processes (e.g. verifying documentation, procedures relating to calls for proposals, auditing, indicators and the verification of SMEs, which appears to be a particular challenge).

As for capitalising on existing good practice, the World Bank has produced detailed guidelines for improving monitoring and evaluation of RIS3 in Poland.27 This is a comprehensive set of guidelines, and although the Slovak and Polish systems are not directly comparable, the guidelines nevertheless tackle some common challenges relating to conflict of interests, scarce human resources, and diversified skills and methodological capacities.

The TO-BE report makes the following recommendations for monitoring and evaluation:

Recommendation 20: Set up an M&E Task Force

Responsible: SGCSTI

Timeframe: 12 months

As a first step, the SGCSTI could appoint a task force with the explicit responsibility of revising the current system in line with the identified problems affecting the whole project cycle and based on good practice from other countries (as identified by the AS-IS report and by Slovak stakeholders). A special focus should be placed on building on the work already carried out by the Ministry of Economy's methodological unit for ESIF.

The task force would need to consult widely among the RTDI community, by launching a public consultation or by consulting other members of the Council as intermediaries for example, to ensure buy-in, and in order to prioritise the areas in need of immediate improvement. Existing evaluative studies would also need to be taken into account. The task force could publish the terms of

[27] World Bank (2014) Guideline Note for a monitoring and evaluation system for innovation strategies (RIS3) in Poland. See https://s3platform.jrc.ec.europa.eu/documents/20182/111599/Guideline+note+for+a+M%26E+system+for+innovation+strategies+%28RIS3%29+in+Poland.pdf/6d88c42c-5629-4ccc-b899-dbd4af2ecc7f

references of its mission and timeline to allow time for stakeholders to feed into the process according to due process. The output of the task force would be a concrete proposal for improving the current system. It could be supported by input from an international peer review panel.

Recommendation 21: Make M&E a public priority

Responsible: RIS3 Committee, SGCSTI

Timeframe: 12 months

Within the next few months, the ministries co-responsible for RIS3 implementation could make M&E an explicit priority and to provide a detailed update on the work envisaged to be carried out in the RIS3 implementation plan, including a published mitigation plan for areas which have not been successfully implemented. This work should be led by the Ministry of Investment, Regional Development and Informatisation.

Recommendation 22: Collaborate with HEIs to develop trainings on M&E

Responsible: SGCSTI, HEIs

Timeframe: 12 months

The SGCSTI could consult with Slovak universities to develop a week-long training course on innovation management and on results-based M&E to encourage better interaction between research performers and policymakers and to provide a concrete opportunity for policymakers at ministerial and agency level to benefit from regular training and academic expertise on M&E and on innovation management in particular. In addition, master students in innovation management could be encouraged to take up a placement in the Slovak public administration to allow for new ideas and exchanges with policymakers.

2.5 Infrastructure

Research Infrastructures are key investments in research across all areas. They are important for meeting both the demands of the scientific community for state-of-the-art resources for supporting excellent science and the demands of knowledge transfer for innovation at social and economic level. Significant investments in research infrastructures continued in Slovakia from the 2007-2013 period in the current programme period. In 2019 Slovakia saw the largest ever such infrastructure investment, with the two largest Slovak universities – the Slovak University of Technology and Comenius University – investing a total of EUR 111m on the modernisation and renovation of R&I and scientific capacity. The use, maintenance and staffing of these infrastructures is an area that requires significant attention from policymakers and forms a crucial part of 'making the case' for further investment in RTDI as a system when looked at in the context of competing policy priorities at the national level. With this in mind, the following recommendations have been tailored to Slovakia to fulfil several requirements, including the need for monitoring, evaluation, investment, communication and the need to develop a stronger political profile for RTDI in the national policy context.

Recommendation 23: Create a Council for Research Infrastructures to oversee and advise the below reforms relating to infrastructure

Responsible: SGCSTI

Timeframe: six months to recruit council members

The use of research infrastructures is crucial considering the significant investment in them through structural funds. Proper maintenance and use of the infrastructures will ensure a broad base of

innovation and provide an incentive for businesses to innovate and collaborate with public sector research performers. The Council would act as a champion for Research Infrastructures at the national level, overseeing implementation of reforms by state government agencies.

For example, Sweden has a Council for Research Infrastructures that is a subgroup of their National Science Council, while the Czech Republic has the Large Research Infrastructures Council.28 The Council should not just be advisory but also have a mandate to fund research infrastructures. The Czech model, for example, uses both its state budget and European Structural and Investment Funds to fund specific infrastructure configurations and projects following evaluation by an international panel of experts.29 The Council should be drawn from senior academics, government research organisations and industry. Applications should be submitted to a joint committee formed of the research agencies; appointments should have a tenure of two to four years. The Council should report to the GCSTI and submit an annual update of progress.

Recommendation 24: Complete an ESFRI Roadmap

Responsible: MESRS, Council for Research Infrastructures

Timeframe: six months

The drafting and completion of an ESFRI Roadmap including special Slovak Roadmap is a high priority for the Slovak Republic. These roadmaps are vital blueprints which enable countries to set national priorities and to earmark funds for both national and pan-European research infrastructures. In addition, the national roadmaps should be linked to the regional smart specialisation strategies, if existing. Within this there is the task of refining these regional strategies, which are generic and lack precise actions. This could be done through the national roadmap, as R&D is a national and not a regional competence. Having a roadmap would therefore facilitate smoother disbursal of ESIF funding further down the line. Cohesion guidance furthermore states that, where appropriate, ESFRI forms an ex ante conditionality.[30]

With this in mind, the MESRS should, as a matter of priority, appoint a team to draft the ESFRI roadmap in collaboration with stakeholders. This team should have an individual who acts as a clear point of contact for ESFRI and should utilise the significant advice, training and methodologies developed by ESFRI. The measurable outcome for this recommendation is the drafting of an ESFRI Roadmap by the end of 2020.

Recommendation 25: Develop a national funding model to maintain Research Infrastructures

Responsible: MESRS, MoE, Higher Education Institutions, Council for Research Infrastructures

Timeframe: 24 months.

Science parks and research centres perform sub-optimally due to a lack of ability to generate revenue and an absence of complimentary funding for maintenance.[31] A governmental consensus should be sought, with internationally benchmarked economic analysis supporting the return on investment, that research infrastructures require national funding to sustain them. Bearing in mind that public research institutions should bear some of the costs for their maintenance, which is seen as an issue of grant categorisation and discussed in the AS-IS report, the aim over the longer term

[28] https://www.vyzkumne-infrastruktury.cz/wp-content/uploads/2020/01/Rada-pro-velk%C3%A9-v%C3%BDzkumn%C3%A9-infrastruktury_en-2.pdf

[29] http://www.jaspersnetwork.org/download/attachments/24150062/8.%20National%20Authorities%20-%20Czech%20Republic.pdf?version=1&modificationDate=1513516270000&api=v2

[30] https://ec.europa.eu/regional_policy/sources/docgener/informat/2014/eac_guidance_esif_part2_en.pdf p14

[31] Miroslav Balog, EFFECTS OF THE SLOVAK SCIENCE PARKS AND RESEARCH CENTERS, 2019. Available at http://www.prog.sav.sk/sites/default/files/2020-02/Miroslav%20Balog_EFFECTS%20OF%20THE%20SLOVAK%20SCIENCE%20PARKS%20AND%20RESEARCH%20CENTERS.pdf

should be to reduce the costs to the state budget. However, at present, there must be national funding to support the use of these infrastructures. as there is across other countries, such as the Czech Republic, to maintain equipment, for example the ELI Beamlines large infrastructures funding.[32] This project is supported by the Czech national funding to the amount of EUR 18,798,000 and is integrated into the Czech Republic's Large Research Infrastructures Roadmap, Smart Specialisation Strategy and National Research and Innovation Policy. As well as providing access to user-orientated research infrastructure, it brings together a consortium of 14 leading universities and research institutes of the Czech Academy of Sciences and coordinates the preparation of research, education and training programmes for students.

Recommendation 26: Develop a set of Key Performance Indicators for Research Infrastructures

Responsible: Council for Research Infrastructures

Timeframe:12 months

The AS-IS report demonstrated that the prevailing opinion in Slovakia is that the research infrastructures are poorly maintained and underutilised.[33] However, in order to build the case for further funding, analysis and stock-taking must be undertaken to provide an up-to-date map of the current situation and the perceptions from those who use these facilities and from those who do not, but may benefit from their use. In order to do this, policymakers must understand how these infrastructures are currently performing and place this in the international context. These key performance indicators should evaluate the socio-economic value of RIs and provide comparisons between different types of RIs.

In 2019, the Organisation for Economic Cooperation and Development (OECD) published a Reference Framework for Assessing the Scientific and Socio-Economic Impact of Research Infrastructures, which would provide a strong baseline for developing indicators.[34] In the longer term, these indicators can be used to calculate return on investment, when national funding for maintenance is secured. In the Czech Republic, a comprehensive evaluation of 58 large research infrastructures was undertaken in 2017 by the Ministry for Education, Youth and Sport, using international peer review and conforming to the evaluation standards of ESFRI.[35] The results form part of the evidence base for future funding of the infrastructures – both from the national budget and ESIF – over 2020-2022.

In Slovakia such an evaluation is sorely needed. During the previous period (2003-2013) the OECD noted that "the increase in resources between 2007 and 2013 resulted in more publications but a decline in their citation rate compared to the other Visegrad countries".[36] It is crucial to know precisely what value these infrastructures are bringing in the current programming period and how they could be improved in the next one. Evaluation and the creation of KPIs for research infrastructures is therefore essential for putting forward the case for resource allocation.

[32] http://www.jaspersnetwork.org/download/attachments/24150062/8.%20National%20Authorities%20-%20Czech%20Republic.pdf?version=1&modificationDate=1513516270000&api=v2

[33] This has also been supported through other studies, such as: Miroslav Balog, EFFECTS OF THE SLOVAK SCIENCE PARKS AND RESEARCH CENTERS, 2019. Available at http://www.prog.sav.sk/sites/default/files/2020-02/Miroslav%20Balog_EFFECTS%20OF%20THE%20SLOVAK%20SCIENCE%20PARKS%20AND%20RESEARCH%20CENTERS.pdf

[34] https://www.oecd-ilibrary.org/docserver/3ffee43b-en.pdf?expires=1591294205&id=id&accname=guest&checksum=24D1DC2B776C0595E5171C2E347DE0BB

[35] Czech Rio Report p6

[36] Claude Giorno, INCREASING THE BENEFITS OF SLOVAKIA'S INTEGRATION IN GLOBAL VALUE CHAINS, OECD, 21 May 2019, P32.

Recommendation 27: Clarify and raise awareness of state aid rules surrounding private firms' use of research infrastructures

Responsible: Ministry of Finance, MESRS, European Commission, Ministry of Economy

Timeframe: 18 months.

During the course of the evidence gathering, it emerged that there were concerns among research performers and policymakers alike with regards to state aid and the use of research infrastructures. These concerns were not just over the rules, but also the effects those rules have had on the development of capacity calculation methodologies and the nature of contracts. On numerous occasions the study team was told that it was not possible for private firms to use research infrastructures as they would be deriving profit, which would run contrary to state aid rules on the use of such equipment. This in turn has reduced the access of companies to research infrastructures that could be used for research and innovation, either directly via contracts or through a lack of a perceived 'open environment'. In fact, economic activities are permitted under EU state aid rules for uses of research infrastructures, provided they comply with accounting rules or other special circumstances, for example the rule of *ancillary economic activities*. This rule means that state aid does not apply when activities consume the same inputs as non-economic activities or are limited in scope and the capacity allocated is not over 20% of the entity's overall annual capacity. Implicit in this recommendation is the need to develop a clear set of methodologies for calculating capacity, in order to ensure this 20% limit is not passed.

To promote a more nuanced understanding of state aid for research infrastructures, an awareness-raising campaign should be organised by the Ministry of Finance Antimonopoly (responsible for state aid enforcement) and delivered to research performers via coordination from MESRS and input from the European Commission. Workshops should take place in all regions of Slovakia and involve regional bodies, including clusters, as well as public research performers. Subsequent development of an open access policy, as implemented by many, including the Joint Research Council of the European Commission, should be a priority to support greater utilisation of these facilities and market-driven access.[37] This recommendation will also require some existing contracts to be amended, for example by adapting the 'non-commercial use' element of the contracts to permit use of the infrastructures under the state aid rules. This policy should be in line with the European Charter for Access to Research Infrastructures and ESFRI Roadmap.[38] The measurable outcome is a greater number of companies accessing the research infrastructures for research and/or innovation purposes.

2.6 Legislative framework

The main legal acts forming the framework for RTDI and higher education in Slovakia were adopted in the early 2000s. While there have been regular amendments to the individual acts, no major revision of the legislative framework as a whole has since taken place. One of the biggest changes was the reform of the university accreditation system in 2018, and its subsequent implementation from early 2020. Another more recent development was the introduction of tax reliefs for R&D expenses, which began in 2015 and has gradually increased.

Recommendation 28: Carry out a full evaluation of the regulatory framework

Responsible: SGCSTI

[37] https://ec.europa.eu/jrc/en/research-facility/open-access

[38] https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf

Timeframe: 18 months

Addressing the fragmentation of responsibilities should be embedded in a larger and comprehensive assessment of the current legal and regulatory framework for RTDI funding in Slovakia. While changes and amendments to the framework have regularly been made, no full revision has been undertaken. Therefore, an evaluation of the framework as a whole, taking into account how the different acts interact and coincide with each other, should be conducted under the political leadership of the SGCSTI. The evaluation should be conducted by a consortium of RTDI experts and innovation lawyers.

The relevant framework is outlined in the AS-IS report and notably includes Act 172/2005 on the organisation of state support for research and development, Act 523/2002 on budgetary rules of the public administration, Act 185/2009 on the incentives for research and development and Act 292/2014 on the contribution provided by the European Structural and Investment Funds. Regarding the regulatory framework for higher education, such an assessment is currently already being carried out.

The goal is to determine how well the individual pieces of legislation go together and how well the legal framework facilitates RTDI in Slovakia. A focal point would be to identify unnecessary legislation and legal barriers to RTDI. The evaluation should cover legislation on national and EU funding, relevant tax legislation, and legislation on higher education institutions and the Slovak Academy of Sciences.

Recommendation 29: Complete the reform of the Slovak Academy of Sciences

Responsible: National Government

Timeframe: Short-term, about six months

Plans to transform the legal form of the Slovak Academy of Sciences (SAS) into a public research institution have existed for several years. However, changes in the applicable law are needed to enable the SAS to complete the transformation. There is no evidence that the proposed transformation of the SAS is problematic in terms of its content, so the issue to address is in essence a legal and administrative one. The necessary legislative changes should be proposed by the government as soon as possible in order to finalise the effective transformation of the SAS. If similar obstacles exist for other state-owned research institutions, these should be removed at the same time.

Recommendation 30: Assess effects of tax incentives for R&D

Responsible: Ministry of Finance

Timeframe: Start in 2021 so that the tax year 2020 can be taken into account

The income tax incentives introduced in 2015 allow companies to deduct investments into R&D from their taxable income. The uptake of this measure has initially been low but has constantly increased since 2015 and is expected to increase further with the increase of the deduction rate to 200% for 2020. While the majority of beneficiaries are SMEs, the largest share of the total tax deductions was claimed by large enterprises, indicating that the benefits generated for SMEs and start-ups are low.

It is not per se an issue that large enterprises also benefit from this measure, as there are generally few large international companies that conduct research in Slovakia. However, it needs to be made sure that this has a positive effect on the Slovak RTDI system – for example, if large enterprises use the tax deduction to actually increase their research activities in Slovakia which consequently creates RTDI opportunities for suppliers and innovative local SMEs. To verify this point, the Ministry of Finance should start an impact assessment of the tax incentives for R&D. This assessment should investigate whether there are barriers that keep companies from using the tax deductions, and

whether the recent increase of the deduction rate to 200% has improved the uptake of the measure also by SMEs. Indirect effects on SMEs need to be taken into account.

If the assessment shows that the positive effect of the measure on SMEs is not sufficient, the Ministry of Finance should adjust the tax incentive accordingly. It is also important to simplify and shorten the procedure for claiming these tax incentives to make them accessible and cost efficient for SMEs. Other countries (such as Belgium, France and the UK) where similar tax incentives exist have implemented special conditions for SMEs that are more favourable than the conditions for large enterprises.[39] The assessment should be started in 2021 so that the tax year 2020 can be taken into account.

[39] OECD, Review of National R&D Tax Incentives and Estimates of R&D Tax Subsidy Rates, 2018, https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5c1e91ecb&appId=PPGMS

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