ROADMAP OF RESEARCH INFRASTRUCTURES

SK VI ROADMAP 2020 – 2030

MINISTERSTVO
ŠKOLSTVA, VEDY,
VÝSKUMU A ŠPORTU
SLOVENSKEJ REPUBLIKY

ROADMAP
OF RESEARCH INFRASTRUCTURES

SK VI ROADMAP 2020 – 2030

UPDATED VERSION
MARCH 2021

CONTENTS

1 INTRODUCTION

Roadmap of Research Infrastructures - SK VI Roadmap 2020 - 2030 is a key document of the Slovak Republic in the field of research infrastructures, which not only monitors the current development and current state of major public and private research infrastructure in the Slovak Republic, but also its links to the economy, domains of smart specialization , international cooperation in the context of ESFRI and the forthcoming framework program of the European Union in the field of research and innovation for the years 2021 - 2027 Horizon Europe.

This material was prepared by the Ministry of Education, Science, Research and Sports of the Slovak Republic in cooperation with World Bank experts and representatives of the Research Agency and was discussed by commissions for coordination of Slovak activities in ESFRI research infrastructures at the national level. These commissions act as advisory bodies to the Minister of Education and sports of the Slovak Republic.

The material aims to point out the importance and potential of the existing research infrastructure and its role in the development and innovation tendencies of the Slovak Republic on the path towards the knowledge society. The Roadmap of Research Infrastructures - SK VI Roadmap 2020 - 2030 mainly monitors the existing R&D infrastructure built from public sources, while the construction of other necessary technical R&D infrastructure focused on industrial research and experimental development with the active participation of the private sector is one of the key steps in the process of introducing results and outputs of the basic research into practice.

The material briefly informs about the environment of research infrastructures at the national and international level, identifies established international research infrastructures in which the Slovak Republic is an observer or member and also indicates forthcoming ESFRI projects in which the Slovak Republic is significantly involved.

Moreover, the material frameworks the system of assessment, monitoring, management and financing of research infrastructures in the context of the Slovak Republic and establishes a vision and specific measures for the development of research infrastructures of the Slovak Republic in the next period. It also specifies the conditions and processes for identifying, monitoring and supporting the development and gradual internationalization of the research infrastructure of the Slovak Republic.

An important part of this material is the part which describes the structure of coordination of activities in the field of research infrastructures at the national level, defines the evaluation and selection criteria of research infrastructures and also describes in detail individual ESFRI infrastructures and ESFRI projects with current or future participation of the Slovak Republic.

The Roadmap of Research Infrastructures (SK VI Roadmap 2020 - 2030) is a key national document in relation to the ESFRI Roadmap 2021 update within the EU. By approving the material "Roadmap of Research Infrastructures (SK VI Roadmap 2020 - 2030)", the Slovak Republic will redefine the system framework of policies and activities in the field of research infrastructures at the national and international level. Based on the approved material, the Slovak Republic will prepare I. and II. Action plan for the implementation of the Roadmap of Research Infrastructures in order to make the material in question a relevant tool in the field of research infrastructures based on the practice and the results of the monitoring process. Action plans will be prepared in accordance with the Resolution of the Government of the Slovak Republic no. 197/2017 Methodology and institutional framework for the creation of public strategies. This procedure will ensure a high degree of participation, transparency and relevance of the materials in question. The action plans will include tasks to ensure the fulfillment of the objectives of SK VI Roadmap 2020 - 2030, aimed, inter alia, at ensuring cooperation between the public and private sectors in the field of research infrastructures. ■

2 BASIC CONCEPTS

and strategies in the field of research infrastructures

Research infrastructures are made up of research facilities, research instruments and equipment, experts and service staff, materials, resources and related services of a unique nature. These enable research and development at different stages of innovation, while enabling organized research, training and education of researchers involved. At the same time, they support and develop research and innovation capacities and create an incentive environment for the creation of start-ups and spin-offs.

At the same time, research infrastructures consist of technical equipment, knowledge networks, databases, research stations, collections, libraries, computing capacities and related user services that are essential for research.

In general, research infrastructures are international and open to cooperation, providing opportunities for cooperation between Slovak and foreign scientists and other entities.

Research infrastructures can be centralized, i. e. located in one place, but also distributed or virtual and can form complementary units and networks. In addition to traditional natural sciences, the importance of research infrastructures has become prominent in other areas as well. At the same time, the number of distributed and virtual international research infrastructures has increased over the past decade. Traditionally, the research infrastructure has been perceived as a research centre with a specific geographical location, such as the European Organization for Nuclear Research (CERN) and the European Molecular Biology Laboratory (EMBL).

Digitization, scientific progress and ever closer international cooperation have created the conditions for research networking based on the processing of large amounts of data, such as the research infrastructure for biobanking and biomolecular resources and the European Environmental Scientific Infrastructure for Biological Information.

The important research infrastructures of the Slovak Republic also include university science parks and research centres, specified in more detail in Chapter 4.4 and Significant national research infrastructures - university science parks and research centres. These types of research infrastructures are an integral part of the national research infrastructure, however, these should be kept separate from the participation of the Slovak Republic in pan-European ERIC-type infrastructures within the ESFRI.

The National Platform is a grouping of key research and development institutions of the Slovak Republic in the relevant professional field and its complementary branches, which creates an association with contractually defined goals, competencies and obligations of association members to jointly coordinate approach and address specific research and development issues. In this regard, national platform for the FNH-RI project - Food, Nutrition and Health Research Infrastructure should be highlighted as it groups together the most important Slovak institutions in this area, namely the Slovak University of Agriculture in Nitra, the National Agricultural and Food Centre and the Bioeconomy Cluster.

At the same time, the national platforms are also based on the domains of intelligent specialization defined in RIS3 SK and its implementation plan IP RIS3 SR. ■

BENEFITS OF SIGNIFICANT RESEARCH INFRASTRUCTURE IN THE SLOVAK REPUBLIC

The importance of continuous development of significant research infrastructure in the Slovak Republic was reflected in its impact on the economy and labor productivity in priority areas of intelligent specialization RIS3 SK. The high added value and cooperation of university science parks and research centers with the Slovak Academy of Sciences and business sector should be highlighted in this regard. The research infrastructure demonstrates its irreplaceable position in society, especially in crisis situations against which the society as a whole must stand.

3 EUROPEAN STRATEGY

Forum on Research Infrastructures

In order to strengthen European competitiveness, improve the coordination of R&D activities at European and national levels in the Member States of the European Union, develop human resources in R&D and increase the attractiveness of European research for the best researchers from around the world, the European Research Area concept has been developed (ERA).

This area allows for the free movement of researchers, scientific knowledge and technology, thus jointly strengthening the scientific and technological potential of the European Union and its individual Member States.

Building common European research infrastructures and research centres plays a key role in this process. Research infrastructures play an important role in creating innovation, addressing societal challenges and promoting excellence, collaboration and openness in research and development.

The European Strategy Forum for Research Infrastructures (ESFRI; http://www.esfri.eu) is a tool created in 2002 by the EU Member States and the European Commission to develop scientific integration in Europe and strengthen its international cooperation. The main tasks of ESFRI are: to promote a coherent and strategically led approach to policy-making for research infrastructures in Europe, to facilitate multilateral initiatives leading to better use and development of research infrastructures, to establish a European Roadmap for research infrastructures (new and major upgrades, pan-European interests) for the next 10 to 20 years, to stimulate the implementation of these facilities and, if necessary, to update the roadmap, to assess the implementation of ongoing ESFRI projects after a comprehensive assessment and to prioritize the infrastructure projects listed in the ESFRI Roadmap.

In December 2012, the Council of the European Union extended the mandate of ESFRI. In its conclusions on a "strengthened partnership for the European Research Area for Excellence and Growth", the Council supported the need to strengthen the partnership on research infrastructures and "renew and adapt the ESFRI mandate to address existing challenges. The Council also focused on monitoring comprehensive assessment as well as the prioritization of the infrastructure projects listed in the ESFRI Roadmap.

THE FUNCTIONING OF ESFRI AT EUROPEAN LEVEL

ESFRI is a self-regulatory body that operates openly and on the basis of consensus. ESFRI follows a set of procedural guidelines which are revised every two years and amended if necessary. ESFRI delegates are the leading science figures who represent the ministers responsible for research in the country. The head of science policy also represents the European Commission. ESFRI delegates should, by virtue of their position, be able to influence research infrastructure policy-making in their own country. The forum usually meets four times a year.

The President of ESFRI is appointed from among the delegates for a two-year term, without the possibility of continuing the term for the next two years. The ESFRI Executive Board assists the Chair in planning activities.

This Board consists of the President of ESFRI, a representative of the European Commission and ESFRI delegates selected by consensus. ESFRI has working groups

and can set up ad hoc working groups as needed to analyse and report on current issues. The European Commission provides the ESFRI Secretariat to support the Forum's activities.

ESFRI plays a key role in policy-making on research infrastructures in Europe. In particular, ESFRI contributes to the development of a strategic plan (ESFRI Roadmap), which identifies important new European research infrastructures for the next 10-20 years.

The ESFRI Roadmap is a roadmap for creating European research infrastructures. It is an ongoing process. The last update took place in 2018. ESFRI Roadmap 2018 has three parts, the first of which characterizes the main features of Roadmap 2018 with an emphasis on the strategic role of ESFRI infrastructures and new ESFRI projects, providing an analysis of the evolving role of research infrastructures reflected by specific mandates ESFRI in the field of FAIR data principle (Findable, Accessible, Interoperable, Reusable), e-Infrastructure and long-term sustainability of research infrastructures. An overview of the ESFRI methodology, the background of the ESFRI and its history is given. The second part provides an overview of the state of research ("landscape analysis") and provides the current context for the most important research infrastructures available to European scientists and technology developers. It analyses the unique contribution of ESFRI research infrastructures in all scientific fields, as well as the links and cross-cutting aspects of the whole field of European research infrastructures. The third part provides a description of individual ESFRI projects and infrastructures.

Compared to the previous Roadmap of 2016, the ESFRI Roadmap 2018 identified 8 infrastructure projects that had reached the operational phase and were reclassified to ESFRI infrastructures (Landmarks). It also identified 6 new projects that were selected for their strategic potential and impact on strengthening European research. Following these changes, ESFRI contains Roadmap 2018:

a) 18 infrastructure projects; of which 6 are new
b) 37 existing ESFRI infrastructures (ESFRI Landmarks) already in place and providing their services for the development of Europe. ■

ESFRI Roadmap 2018 covers all scientific disciplines that require a research infrastructure with a joint effort at European or international level. The infrastructures are structured into the following research areas:

a) Energy	2 ESFRI infrastructures,	4 ESFRI projects
b) Environment	7 ESFRI infrastructures,	4 ESFRI projects
c) Health and Food	10 ESFRI infrastructures,	6 ESFRI projects
c) Physical Sciences and Engineering	12 ESFRI infrastructures,	2 ESFRI projects
d) Social and Cultural Innovation	5 ESFRI infrastructures,	2 ESFRI projects
e) E- infrastructure	1 ESFRI infrastructure	

4 OVERVIEW OF
research infrastructures in the Slovak Republic

Research infrastructures in the Slovak Republic consist mainly of university science parks, research centres and institutions associated in national research and development platforms. The research infrastructure also includes technologies, equipment and highly qualified staff in the private sector. Several research infrastructures are of international importance and individual research institutions are closely linked to international research infrastructures under the ESFRI. They are financed from the state budget, via resources obtained on the basis of own project activities as well as European Structural and Investment Funds (major part). The membership fees of the Slovak Republic in international research and development organizations are financed from the budget of the Ministry of Education, Science, Research and Sports of the Slovak Republic on the basis of prior membership approval given by the Government of the Slovak Republic which allocates funds for this purpose.

The need to expand the scientific base, develop the potential of research and development at the international level, introduce innovative elements into enterprises and the efforts to interlink basic and applied research were translated into Operational Programs: Research and Development and Competitiveness and Economic Growth, through which Slovakia implemented research support and development at all levels of research infrastructure from public resources and the contribution of the SF. The announcement of calls aimed at supporting research and development in the Slovak Republic within the Structural Funds in the programming period 2007-2013 stemmed from the requirement of the state and European structures to increase the competitiveness of individual EU countries in the field of research and development in order to boost the EU's research and development and knowledge economy.

In line with this goal, the goals of university science parks (UVP), research centres (VC) and Slovak infrastructure for high-performance computing SIVVP have been defined. The goal is to develop science and research in Slovakia and connect the academic sector with businesses in order to implement the results of scientific research.

TERRITORIAL DISTRIBUTION OF SCIENTIFIC RESEARCH CAPACITIES

Scientific research capacities are historically concentrated in the western part of the Slovak Republic, creating spatial groupings along the axis Bratislava - Trnava - Piešťany - Trenčín - Ilava - Prievidza - Žilina and along the axis Bratislava - Nitra - Banská Bystrica while the group including Košice – Prešov is a separate territory. Most universities and colleges are concentrated in the Bratislava region, which creates a precondition for the development of research and development clusters. The regions of southern Slovakia and eastern Slovakia are known for the absence of scientific research infrastructure in the business sphere as well as by the lack of availability of public research centres (SAS, universities).

Western Slovakia

- Comenius University in Bratislava
- University of Economics in Bratislava
- Slovak University of Technology in Bratislava
- University of Health and Social Work St. Elizabeth in Bratislava
- Academy of Performing Arts in Bratislava
- Academy of Fine Arts in Bratislava
- Academy of the Police Force in Bratislava
- Slovak Medical University in Bratislava
- Bratislava International School of Liberal Studies
- Pan-European University
- Danubius College
- University of Economics and Public Administration Management in Bratislava
- Central European University in Skalica
- Slovak University of Agriculture in Nitra
- University of Constantine the Philosopher in Nitra
- Alexander Dubček University of Trenčín in Trenčín
- College of Management
- Trnava University in Trnava
- University of St. Cyril and Methodius in Trnava
- J. Selye University in Komárno
- Dubnica Institute of Technology in Dubnica nad Váhom

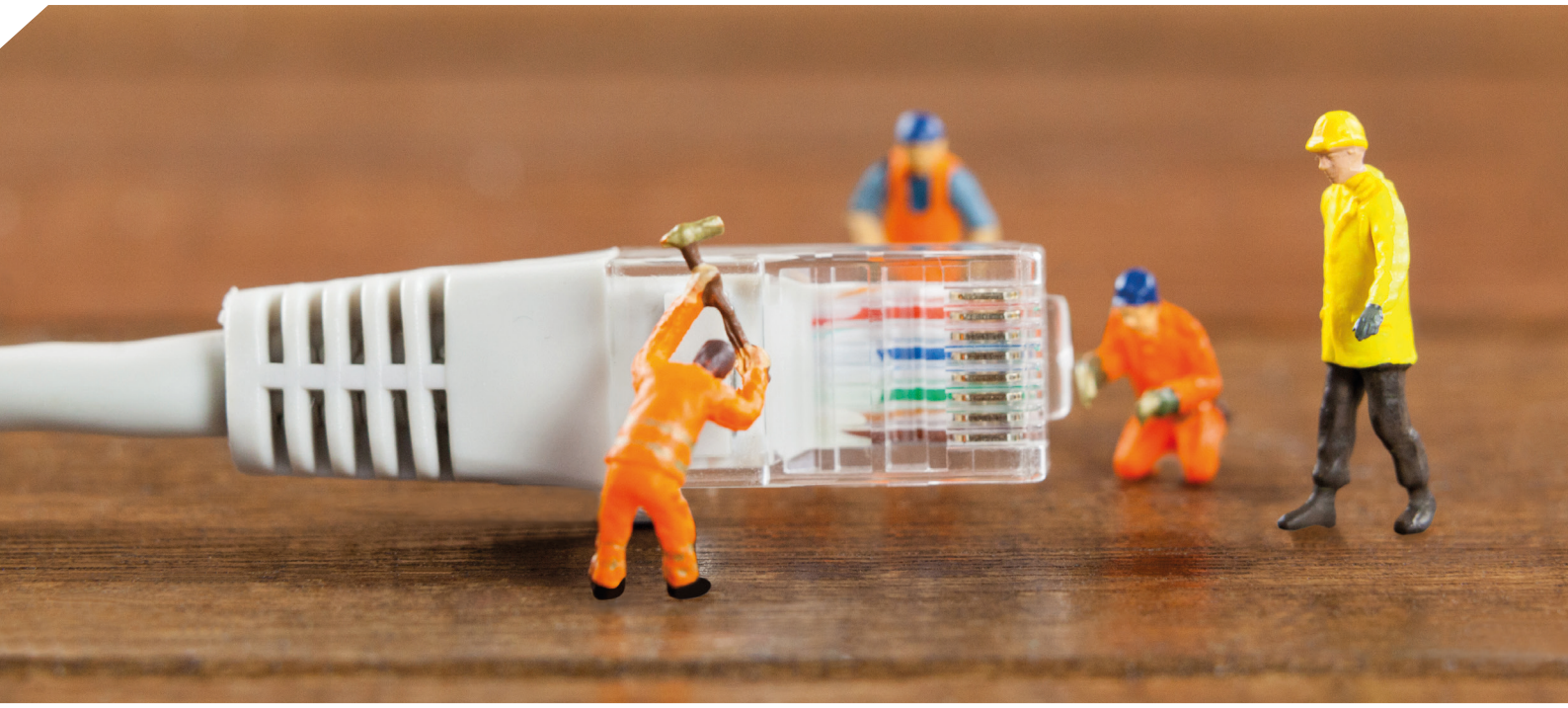
Central Slovakia

- Matej Bel University in Banská Bystrica
- Academy of Arts in Banská Bystrica
- Technical University in Zvolen
- University of Žilina in Žilina
- Catholic University in Ružomberok
- General Milan Rastislav Štefánik Armed Forces Academy in Liptovský Mikuláš
- Ján Albrecht Academy of Music and Arts - Banská Štiavnica, s.r.o, vocational university

Eastern Slovakia

- Pavel Jozef Šafárik University in Košice
- Technical University in Košice
- University of Veterinary Medicine and Pharmacy in Košice
- University of Security Management in Košice
- University of Prešov in Prešov
- University of International Business ISM Slovakia in Prešov

Source: Statistical data of the Ministry of Education, Youth and Sports of the Slovak Republic; author's own work



The Ministry of Education, Science, Research and Sports of the Slovak Republic has granted authorization to use the designation "research university" pursuant to Section 113ah, par. 5 of Act No. 131/2002 Coll., on Higher Education Institutions and on Amendments to Certain Acts, as amended.

Western Slovakia boasts not only by the number of colleges and universities, but also the high number of students studying in I. (undergraduate), II. (graduate) and III. (postgraduate) level of study, either full-time or part-time study. Comenius University in Bratislava, Slovak University of Technology, Technical University in Košice,

Pavel Jozef Šafárik University in Košice and the University of Žilina dominate the number of university students at public universities. Together, they provide university studies to almost half of all university students in Slovakia.

After joining the EU, several small and medium-sized enterprises were established in the Slovak Republic which could be described as "innovative" or "high-tech" and which were able to cooperate with research institutes of the Slovak Academy of Sciences, universities and other institutions implementing research and development activities. The slow onset of the "innovation" culture among small and medium-sized enterprises was manifested on the one hand by insufficient performance in the field of knowledge transfer of research and development organizations (SAS, universities ...) and at the same time by absence of parties interested in the outputs.

Despite the increase in investments in the industry and the recorded economic growth, businesses lowered the R&D expenditures after Slovakia joined the EU, which is a consequence of the fact that many investments (especially the automotive industry) were directed primarily at the purchase of new technologies and starting production as soon as possible and thus lacked the research dimension. In an effort to renew the research infrastructure, the idea of building university science parks and research centres was introduced. The aim of university science parks and research centres is to:

- use the existing potential of the largest Slovak universities, colleges and the Slovak Academy of Sciences in the establishment and operation of university science parks and research centres,
- focus on a specific area defined in the strategic documents of the Slovak Republic so that the same technical units and laboratories for the same area (focus) are not built in parallel,
- integrate various R&D organizations (universities, colleges, SAS and business entities),
- show potential for international cooperation in working on international projects,
- ensure science and research are aligned the needs of the manufacturing sector in cooperation with the business sector,
- commercialize and use in practice the acquired scientific knowledge,
- employ top scientists according to internationally recognized criteria.

The period 2007-2013, i.e. the programming period during which the national priorities were defined in the National Strategic Reference Framework 2007-2013 (NSRF), the Operational Program Research and Development, is decisive for the establishment of USP, RS and SIV-VP. The strategic goal for 2007-2013 was formulated in the NSRF as "Significantly increase the competitiveness and performance of the regions and the Slovak economy and employment by 2013 while respecting sustainable development." More detailed information on major national research infrastructures and development trends is provided in section 4.4 National Research Infrastructures.

Technologies, equipment and highly qualified staff in the private sector, who work closely with the academic sector, are also important research infrastructures. It is the cooperation of the private and academic sector that is a major driving force of the economy as these bring added value.

4.1 PARTICIPATION OF THE SLOVAK REPUBLIC IN EUROPEAN RESEARCH INFRASTRUCTURES ESFRI

This chapter presents an overview of the participation of the Slovak Republic in European research infrastructures, included in the ESFRI Roadmap 2018. The chapter provides an overview of the current situation, which is important for the development of Slovakia's participation in ESFRI infrastructures in the future. In accordance with the European Roadmap 2018, a distinction is made between ESFRI projects (ESFRI projects) and ESFRI infrastructures (ESFRI Landmarks).

ESFRI research infrastructures are facilities, resources and services of a unique nature that European research communities have identified to carry out cutting-edge research activities in a given field of science. ESFRI selects research infrastructure proposals in strategic research areas with a suitable level of maturity to become ESFRI projects and identifies successfully implemented research infrastructures that become ESFRI infrastructures (Landmarks).

Under ESFRI projects and ESFRI infrastructures, members / observers are represented by the relevant ministry responsible for science and research. In the case of the Slovak Republic, it is the Ministry of Education, Science, Research and Sports of the Slovak Republic (hereinafter "MESRS SR"). In terms of ESFRI project or infrastructure, the Ministry of Education, Science, Research and Sports of the Slovak Republic entrusts the relevant national platform with the performance of activities related to participation in the given ESFRI project or infrastructure. At the same time, the Ministry retains decision-making and control powers.

ESFRI projects are research infrastructures in the preparatory phase that have been selected for their scientific excellence and for their maturity (such projects are expected to be implemented within ten years). They are included in the Roadmap due to their strategic importance for the European Research Area as their timely completion entails significant improvements to existing research infrastructures. Projects can be at different stages of their development - this usually depends on the year of their inclusion in the Roadmap. The decisive criterion for inclusion of a project in the ESFRI Roadmap are the long-term needs of the European research communities. The second criterion is the condition that the project be fully feasible only with the joint efforts of several Member States (both scientifically and financially). At the same time, this material allows European countries to build their own infrastructure that is compatible with the ESFRI Roadmap. The research infrastructure which wishes to become a part of the Roadmap must meet several other criteria, but one of the basic ones is its openness to all EU scientists. At least 30% of its capacity must be used by scientists from a country other than that in which the infrastructure is located.

Slovakia is currently a promising member in three ESFRI projects, and an observer in one project. In addition, Slovakia participates in the activities of one ESFRI project as an informal observer. More information on the individual ESFRI projects can be found below.

ESFRI projects	Status of Slovakia's participation
Energy	
-	SK is not represented
Environment	
■ DiSSCo - Distributed System of Scientific Collections	Perspective member
■ eLTER - Long-Term Ecosystem Research in Europe	Perspective member
Health and Food	
■ MIRRI - Microbial Resource Research Infrastructure	Unofficial observer
Physical Sciences and Engineering	
■ EST - European Solar Telescope	Unofficial observer
Social and Cultural Innovation	
■ EHRI - European Holocaust Research Infrastructure	Perspective member
E-infrastructure	
-	SK is not represented

ESFRI infrastructures (landmarks) - are research infrastructures that have been built or have reached an advanced implementation phase within the Roadmap and which are key elements of the competitiveness of the European Research Area (ERA). ESFRI infrastructures may already provide scientific services and user access or may be at an advanced stage of construction with a clear timetable for the start of the operational phase. ESFRI infrastructures need continuous support and advice for successful completion, operation and, if necessary, improvements to achieve optimal management and maximum return on investment.

Slovakia is currently a member in eight ESFRI infrastructures and a promising member in one ESFRI infrastructure. In addition, Slovakia participates in the activities of the four ESFRI infrastructures as an informal observer. More information on the individual ESFRI infrastructures can be found below.

ESFRI infrastructures	Status of Slovakia's participation
Energy	
-	SK is not represented
Environment	
■ EPOS - European Plate Observing System	Unofficial observer
■ LifeWatch ERIC - LifeWatch ERIC	Unofficial observer
Food and Health	
■ ECRIN ERIC – European Clinical Research Infrastructure Network	Member
■ Euro-BioImaging - European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences	Perspective member
■ INSTRUCT ERIC - Integrated Structural Biology Infrastructure	Member
Physical Sciences and Engineering	
■ European XFEL - European X-Ray Free-Electron Laser Facility	Member
■ HL-LHC - High-Luminosity Large Hadron Collider	Member
■ ILL - Institut Max von Laue - Paul Langevin	Member
Social and Cultural Innovation	
■ CESSDA ERIC - Consortium of European Social Science Data Archives	Member
■ CLARIN ERIC - Common Language Resources and Technology Infrastructure	Unofficial observer
■ DARIAH ERIC - Digital Research Infrastructure for the Arts and Humanities	Unofficial observer
■ ESS ERIC - European Social Survey	Member
E-infrastructure	
■ PRACE - Partnership for Advanced Computing in Europe	Member

LINKING RIS3 SK PRIORITIES TO THE EUROPEAN ESFRI ROADMAP THEMATIC AREAS

Priorities of RIS3 SK*	RIS3 implementation domains	Thematic areas ESFRI Roadmap 2018	SK Roadmap management areas	SK Infrastructure Roadmap and Projects
Agriculture and environment	Healthy food and environment	Environment	Commission for Health, Food and the Environment	**I:** EPOS, LifeWatch ERIC **P:** DiSSCo, eLTER
Biomedicine and biotechnology	Healthy food and environment / Public health and medical technology	Health & Food	Commission for Health, Food and the Environment	**I:** Euro-BioImaging, INSTRUCT ERIC, ECRIN ERIC **P:** MIRRI
Sustainable energy and power engineering	Industry for 21st century / Means of transport for 21st century	Energy, Physical sciences	Commission for Physical and Materials Sciences and Energy Facilities	**I:** European XFEL, HL-LHC, ILL **P:** EST
Materials research and nanotechnology	Industry for 21st century / Means of transport for 21st century	Engineering	Commission for Technical Sciences and Industry	-
Industrial technologies	Industry for 21st century / Means of transport for 21st century	Engineering	Commission for Technical Sciences and Industry	-
Information and communication	Digital Slovakia and creative industry	Digit e-Infrastructures	Commission for Technical Sciences and Industry	**I:** PRACE
Social priorities	-	Social & Cultural Innovation	Commission for Culture, Social Sciences and Humanities	**I:** CESSDA ERIC, CLARIN ERIC, DARIAH ERIC, ESS ERIC **P:** EHRI

*Note: The link between RIS3 SK priorities and the Thematic Areas of the European ESFRI Roadmap will be updated in view of the approval of the updated Strategy of Intelligent Specialization of the Slovak Republic for the period 2021-2027 (RIS3 2021+).

www.epos-ip.org

EPOS-ERIC

European Plate Observing System
Infrastructure for the study of the geodynamics of the Earth's surface

EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

The European Geodesy of Earth Geodynamics (EPOS) coordinates and integrates research infrastructures in the European Mediterranean region to support innovative approaches to better understand the physical processes responsible for earthquakes, volcanic eruptions, tsunamis, as well as processes that drive tectonics and earth dynamics of the Earth's surface.

The EPOS 30-year plan aims to integrate the currently scattered but highly developed European facilities into one decentralized, coherent multidisciplinary research infrastructure that will enable development of sustainable long-term geoscience research strategies and an effectively coordinated European earth dynamics monitoring facility, taking full advantage of new opportunities provided by e-science.

ACTIVITIES

The EPOS infrastructure will provide access not only to data provided by various Earth science disciplines, but also to data products, services and facilities. The EPOS project includes 3 main strategic activities:

- implementation of data provision services within an effective legal and financial framework,
- harmonization of EPOS implementation with national priorities and strategies,
- management guaranteeing the effective functioning of works from a technical, administrative and financial perspective.

The European Commission has approved the Statute of the European Research Infrastructure Consortium (ERIC), which marked the beginning of the Pilot Operational Phase of the EPOS-ERIC project. This phase has 2 strategic objectives:

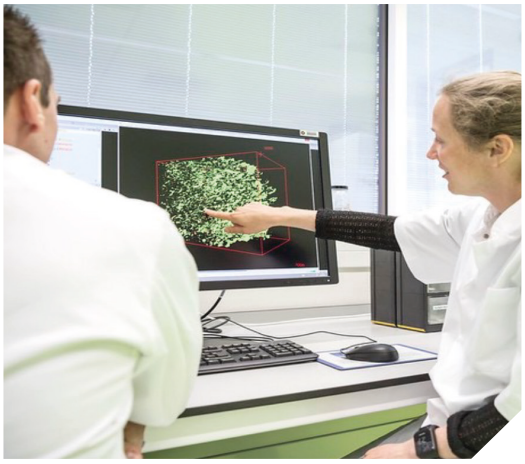
- building a framework for the delivery of geophysical data,
- ensuring its stability and sustainability.

SOCIO-ECONOMIC IMPACT

A fundamental change in the understanding of the processes causing geohazards in Europe and a fundamental refinement of the maps of geohazards on the European territory. Better analyses, synthesis and prediction of geohazards will help mitigate their consequences.

PARTICIPATING COUNTRIES

Leading country: IT. **Members:** BE, DK, FR, GR, IS, NL, NO, PL, PT, SI, UK. **Observers:** CH. **Potential members / observers:** AT, CZ, DE, ES, FI, HU, IE, RO, SE, SK, TR.



PARTICIPATION OF SLOVAKIA

Slovakia's position: unofficial observer

CURRENT AND PLANNED ACTIVITIES

The Institute of Earth Sciences of the Slovak Academy of Sciences monitors seismic activity in the territory of the Slovak Republic using the National Network of Seismic Stations, deformation of the earth's crust at the Vyhne tidal station; spatio-temporal changes of the geomagnetic field at the Hurbanov geomagnetic observatory and radon emanation at the Modra-Piesok radon emanation station. It plans measurements of aftershakes after stronger earthquakes with macroseismic effects, seismic noise, gravity measurements, magnetotelluric and paleomagnetic measurements of samples at selected localities. The Department of Astronomy, Earth Physics and Meteorology at FMFI UK monitors seismic activity in eastern Slovakia using the Local Seismic Network of Eastern Slovakia.

It plans seismic noise measurements at selected localities and is a pioneering institution in numerical earthquake modelling. Progseis s.r.o. monitors seismic activities in the vicinity of the nuclear power plants Jaslovské Bohunice and Mochovce using the local seismic networks the Little Carpathians / Central Slovakia. Department of Geodetic Foundations at the Faculty of Civil Engineering STU monitors recent physical activity using the Network of Permanent Stations of the Global Navigation Satellite Systems with a geodynamic character. Currently, it is building an integrated monitoring station Hurbanovo in cooperation with the Institute of Earth Sciences of the Slovak Academy of Sciences. It also plans measurements with absolute and relative gravimeters and epoch measurements using local GNSS networks Tatry, Mochovce, Tribeč, Sihla and Kozie chrbty. The Dionýz Štúr State Geological Institute monitors active tectonic structures through a network of mechanical-optical dilatometers TM-71 and by measuring radon activity in soil air. Department of Applied and Environmental Geophysics at Comenius University plans gravity, geomagnetic, geoelectric and radiometric measurements at selected localities.

BENEFITS FOR SLOVAKIA

The territory of the Slovak Republic is seismically active. Whether or not it is possible to predict the location, time and magnitude of a future earthquake, it is very important to predict what will happen during future earthquakes and to design, build and increase the resilience of existing structures accordingly (evacuation and measures ensuring critical energy and industrial facilities continue to operate after the earthquake). Continuous monitoring and analysis of all earthquakes is a prerequisite for any seismic hazard and risk analysis. Such an analysis cannot be done without a national earthquake database. Earthquakes are related to the fundamental physical processes in the Earth's crust and mantle. Therefore, it is necessary to apply geodetic, geomagnetic, gravimetric and geothermal measurements to analyse geohazards at the national and European level.

For Slovakia, monitoring and analysis of recent physical activity (in the horizontal and vertical directions) using satellite technologies are very important. Physical activities are monitored using the

Global Navigation Satellite Systems and methods of satellite radar interferometry. These enable researchers to monitor seismically and geologically active areas, geohazards, strategically important infrastructure at the global, regional and local levels, and thus help in the comprehensive protection of the population and the infrastructure.

The time series of observations of the geomagnetic field from the Hurbanovo Observatory are necessary for the creation of a new generation of global geomagnetic models IGRF and WMM, and for monitoring geomagnetic activity (as part of space weather). The resulting global geomagnetic models are necessary for the Slovak Republic to measure the characteristics of compensating rings in order to set magnetic compasses in aviation as well as for the regular air navigation over the territory of the state.

In areas of interest, it is necessary to synthesize partial knowledge and geophysical data using integrated geophysical 3D modelling. Modelling can provide a new perspective on the structure and properties of the Earth's lithosphere as well as tectonic faults. The synthesis of partial knowledge is necessary for complex analyses of geohazards and subsequent risks.

FINANCIAL ASPECTS

Annual membership fee: minimum: EUR 40 000; set at: EUR 73 000

PARTNERSHIP

Institute of Earth Sciences SAS, Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava, Faculty of Science, Comenius University in Bratislava, Progseis, s.r.o., Faculty of Civil Engineering, Slovak Technical University in Bratislava, Dionýz Štúr State Geological Institute. The participating institutions in Slovakia have signed a cooperation agreement for the purposes of the EPOS project.

CONTACT DETAILS

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Mgr. Kristián Csicsay, PhD.,
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LIFEWATCH

e-Science European Infrastructure for Biodiversity and Ecosystem Research

www.lifewatch.eu

EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

LifeWatch is an electronic infrastructure to support research on the conservation and sustainable use of biodiversity and ecosystems as well as the scientific community and other users in the public, commercial and management spheres. LifeWatch provides the basic infrastructure of integrated information systems with an analytical platform for improving knowledge of a comprehensive biodiversity system. LifeWatch is based on local and national institutions which collect and store ecological data on terrestri-

al and aquatic ecosystems or the atmosphere. LifeWatch's mission is to address major environmental challenges and support strategic, knowledge-based environmental solutions. LifeWatch wants to fulfill this mission by providing access to a range of databases, services and tools that enable the creation and operation of Virtual Research Environments (VREs). LifeWatch was transformed in 2017 into a research infrastructure consortium (ERIC) based in Spain.

ACTIVITIES

The statutory headquarters and technical offices coordinate and manage the construction, maintenance, deployment and operation of the electronic ICT infrastructure. The service centre provides an interface for the scientific community examining biodiversity and ecosystems, identifies the needs of user groups from different fields, and coordinates the development and operation of related services. It also assists in the deployment of LifeWatch ERIC services, including those that enable the discovery, visualization and download of data and applications for the analysis, synthesis and modelling of scientific topics. Virtual Labs and the Innovation Centre coordinate and manage requirements and needs analysis, design and implementation of scientific case studies, and construction of LifeWatch ERIC virtual labs. These e-labs are implemented and deployed through the distributed facilities of the LifeWatch ERIC electronic ICT infrastructure. They are made available to the scientific community in the field of biodiversity and ecosystem research through the Service Centre. LifeWatch ERIC builds capacity for large-scale scientific development, accelerates data logging, and supports knowledge-based decision-making in biodiversity and ecosystem management.

SOCIO-ECONOMIC IMPACT

LifeWatch will enable its users to enter new research areas backed by its electronic infrastructure. LifeWatch will build capacity to support new opportunities for large-scale scientific development, to increase data recording capacity thanks to new technologies, to support knowledge-based decision-making on biodiversity and ecosystem management, and to support educational programs. Efforts have been made to ensure that the design of infrastructure functionalities is driven by scientific and societal needs. LifeWatch enables new ways of collaboration between science, politics and society, providing an adequate virtual research environment for user-driven research, education and innovation activities, collaborating with the private sector to develop the best ICT technologies needed to build and operate it, providing innovative applications resulting from research.

PARTICIPATING COUNTRIES

ES (leader), NL, IT, RO, PT, GR, BE.
Observers: FR, SE, FI, NL, HU, SK.

PARTICIPATION OF SLOVAKIA

Slovakia's position: unofficial observer

PREVIOUS ACTIVITIES OF SR

Slovakia joined LifeWatch as an observer relatively recently. Therefore, LifeWatch Slovakia is in the early stages of its construction. In the early stages, Slovakia's potential to join LifeWatch-ERIC in the draft document RIS3 (11/2013) was recognized. In the draft national ESFRI Roadmap (02/2015) Slovakia declared it will continue to support its participation in those ESFRI projects in which it already participates as an observer - including LifeWatch. In 2016, Slovakia has assumed the position of official observer

in LifeWatch following the acceptance of the application submitted by the Ministry of Education, Science, Research and Sports of the Slovak Republic. During this period, the Slovak representative in LifeWatch became involved in commenting on the basic documents of LifeWatch, including the statutes. At the national level, a proposal for building LifeWatch Slovakia was drawn up. In March 2017, LifeWatch was transformed into the LifeWatch ERIC research infrastructure consortium. However, Slovakia has not become a member of the newly formed consortium LifeWatch ERIC and is therefore currently in the position of an unofficial observer.

PLANNED ACTIVITIES

Communication with the LifeWatch ERIC management is currently underway. LifeWatch confirmed its willingness to participate in the preparation of the LifeWatch information seminar in Slovakia, including direct involvement in the seminar and promotion of LifeWatch ERIC activities. After determining the general interest of stakeholders in participating in LifeWatch Slovakia, institutions interested in building LifeWatch Slovakia will be addressed. Potential partners in LifeWatch Slovakia include mainly universities, institutes of the Slovak Academy of Sciences active in the field of biology, research institutions of the Ministry of Agriculture, the Ministry of the Environment and its subordinate organizations (State nature protection of the Slovak Republic, Slovak Environment Agency). The preparation of the concept of the national LifeWatch platform will follow. After its approval, the participating organizations will prepare a program and implementation plan for LifeWatch Slovakia. The implementation plan will define which e-services and e-laboratories will be included in LifeWatch Slovakia and which will have to be designed and developed. The inclusion of existing national centres of excellence in biodiversity, facilities recently developed with the support of national infrastructure projects, as well as the development of new capacities in promising areas, is expected. The first phase of building LifeWatch Slovakia will be completed once the LifeWatch Slovakia website is fully functional.

Lagoon Tagging October 2021

BENEFITS FOR SLOVAKIA

One of the important benefits is access to a wide range of biological and ecological data and databases which are currently isolated and used mainly by their authors and related institutions. Both the scientific community and the public administration will benefit from such disclosure. Cooperation in the design and creation of virtual laboratories and the opportunity at the level of LifeWatch is yet another benefit. This will allow better and faster interpretation of research data.

FINANCIAL ASPECTS

LifeWatch ERIC sets membership fees according to GDP. For Slovakia, in the case of full membership, the annual fee would be EUR 75,000. At the same time, the membership also implies a commitment to invest EUR 2,125,000 in LifeWatch ERIC-related activities over 5 years (i.e. investments in research and research infrastructure at national level).

PARTNERSHIP

The national platform is under construction, Slovakia is represented in LifeWatch ERIC by the Institute of Landscape Ecology of the Slovak Academy of Sciences.

CONTACT DETAILS

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ECRIN ERIC

European Clinical Research Infrastructure Network

www.ecrin.org

EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

The European Clinical Research Network (ECRIN) is a non-profit international organization supporting international academic clinical trials in Europe. Since 2013, ECRIN has had the legal status of the European Research Infrastructure ERIC. ECRIN's vision is to generate scientific evidence to optimize clinical practice. By managing and supporting international clinical trials, interconnecting national networks and implementing policy, ECRIN supports knowledge transfer, competitiveness and integration into European clinical research. Countries and many European infrastructures involved in clinical research cooperate through the ECRIN organizational structure, which includes the Paris core team, European correspondents („EuCos") based in each member and observer country, and national scientific partners.

ACTIVITIES

ECRIN was included on the ESFRI map in 2006 and was listed in the „Landmark Infrastructure" category in the „ESFRI 2016" roadmap. ECRIN currently has a total of 60 international projects in its portfolio with an average of 6 per country and represents 350 million people in Europe. The aim of these projects is, for example, to enable data sharing between different countries and their re-use with regard to the protection of personal data, the development of research infrastructures and the promotion of international cooperation in non-commercial trials. The clinical trials themselves are able to use the tools, results and findings of the projects, thus increasing the efficiency of the infrastructure.

SOCIO-ECONOMIC IMPACT

ECRIN fulfills the vision of a society in which all decisions in medical practice are based on scientific evidence stemming from quality clinical research. ECRIN is a key tool for addressing major health challenges and has a significant impact on citizens and the economy. Clinical trials which evaluate the safety and efficacy of new medicines lead to innovations in healthcare and have a significant impact on the healthcare industry. At the same time, infrastructure development projects help in the development of the digital environment aimed at creating a single open space for the re-use of pre-clinical and clinical data, while strictly respecting the GDPR.

PARTICIPATING COUNTRIES

Leading country: FR. **Members:** CZ, DE, ES, HU, IE, IT, NO, PT, **Observers:** CH, PL, SK.

PARTICIPATION OF SLOVAKIA

Position of Slovakia: member

SLOVAK CLINICAL RESEARCH NETWORK
WWW.SLOVACRIN.SK

SLOVACRIN
SLOVAK CLINICAL RESEARCH INFRASTRUCTURE NETWORK

ECRIN ERIC

PREVIOUS ACTIVITIES OF SR

Slovakia joined the ECRIN-ERIC network in 2018 through the Ministry of Health of the Slovak Republic (hereinafter referred to as „MH SR"). The Slovak Republic hold a position of an observer through the national partner SLOVACRIN, which is coordinated and funded by the Medical Faculty of Pavel Jozef Šafárik University in Košice (hereinafter referred to as MF PJŠU). MF PJŠU ensured the creation of a national node (SLOVACRIN as a separate department within MF PJŠU). SLOVACRIN represents a national research infrastructure connecting workplaces carrying out academic clinical research. SLOVACRIN supports all types of clinical research, especially where there are innovative drugs and approaches involved, e.g. oncology and rare diseases. Slovak patients thus have a unique opportunity to access innovative treatment methods as well as drugs that are not commonly available.

Another benefit is a significant saving of funds from public health insurance. SLOVACRIN, in cooperation with the Ministry of Health of the Slovak Republic / Institute of Research and Development (hereinafter „RDi") and the National Oncology Institute (hereinafter „NOI"), supports academic clinical trials in the field of oncology. Four clinical trials are currently financially subsidized by the Ministry of Health of the Slovak Republic through the National Oncology Program 2018-2020, Action Plan no. 5: „Supporting cancer research and improving the availability of clinical trials for patients", where continuity and further development is planned. SLOVACRIN is preparing a national roadmap for clinical trial sites. At present, 18 framework agreements have been signed with various partners. In April 2019, the Ministry of Health of the Slovak Republic, through the RDI and in cooperation with SLOVACRIN and the National Oncology Institute, organized the first certified course for coordinators and heads of clinical trials departments in medical facilities; these activities are set to continue in the future.

The Faculty of Medicine at Pavol Jozef Šafárik University in Košice

PLANNED ACTIVITIES

Establishment of a network of national clinical trial units in healthcare facilities that are necessary for the conduct of clinical research. We plan to establish a quality system which would serve as a technical standard for conducting clinical trials in clinical trial units (model internal regulations, standardized work procedures, model organizational structures of clinical trial departments, including competencies within the organization). We are implementing systematic training of employees of the clinical trials department - one of the key actions aimed at improving the quality of services provided and competitiveness. SLOVACRIN plans long-term and targeted training for network members. Providing related professional activities before and during the clinical trial, in particular regulatory activities, monitoring and local pharmacovigilance. SLOVACRIN is also preparing for its role of sponsor and coordinator of clinical trials. Within the ECRIN working group, SLOVACRIN participates in the preparation of central pharmacovigilance activities. We anticipate further inter-ministerial cooperation on the part of the Ministry of

Education, the Ministry of Health of the Slovak Republic (RDI / BioHub) and other relevant ministries.

BENEFITS FOR SLOVAKIA

SLOVACRIN is building a research infrastructure for academic clinical trials. It speeds up and streamlines access to innovative treatment for patients, increases the prestige of doctors and scientists, and enables publishing activities. Moreover, it helps reduce public health insurance costs, creates new jobs and provides continuing education. SLOVACRIN increases the quality of national and international clinical research. International partnerships significantly reduce financial costs and enable the transfer of the latest knowledge in a relatively short time. At the time of the COVID-19 pandemic, SLOVACRIN brought an international, multicentre, adaptive clinical trial funded through H2020. The trial will focus on providing safe and up-to-date therapy for patients with this disease. SLOVACRIN also participated in mapping the pandemic situation in Slovakia through prevalence studies.

FINANCIAL ASPECTS

Covering costs of setting up the national node, in particular securing EuCos job positions and covering the costs of ECRIN-related business trips, increasing the number of core team's job positions. Covering clinical trials experts' costs (specialists, small and medium-sized enterprises „SMEs"), costs of the operation of the workplace and business trips within the Slovak Republic. Costs of participating in ECRIN meetings and international activities of ECRIN working groups. During the period of full membership, the payment of the ECRIN ERIC membership fee in the estimated amount of EUR 20,000 / year. Providing long-term training activities for infrastructure professionals.

PARTNERSHIPS

MF UPJŠ Košice - coordinator, Ministry of Education, Science, Research and Sports of the Slovak Republic, Ministry of Health of the Slovak Republic, NOI, medical facilities, universities, SAS, scientific institutions and parks, SMEs and partner countries ECRIN.

CONTACT DETAILS

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Euro-BioImaging ERIC

European Plate Observing System

www.eurobioimaging.eu

EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

Distributed infrastructure with registered office in Finland. Specialization: biomedicine, natural sciences, photonics / electronics (imaging methods).

Euro-BioImaging (EuBI) is a European research infrastructure that provides users with open physical access to a wide range of state-of-the-art technologies in biological and biomedical imaging. In addition

EURO-BIOIMAGING ERIC

to imaging technologies, EuBI also offers support for the analysis and interpretation of large-scale image data (data-mining, big-data) in connection with other excellent European infrastructures (e.g. ELIXIR, CORBEL). EuBI ERIC was established by the EC implementing the Decision no. 2019/1854 of 29 October 2019 as a distributed European network of excellent workplaces with a central coordination and control centre - Hub (Finland, Italy and EMBL) and 21 local national Nodes in 8 countries, which form a network of specialized imaging workplaces providing machine time and services in the field of bioimaging, medical imaging and image data processing in the form of international user access, user training and imaging infrastructure providers. The ultimate goal of the EuBI project is to enable major advances in knowledge of the molecular mechanisms of disease and health which would lead to new and faster advances in drug development, better diagnosis, therapy and disease prevention. In addition, EuBI will provide a basis for finding innovative solutions to other major challenges in the areas of food security, bioeconomy, inclusive and innovative societies.

ACTIVITIES

The preparatory phase of EuBI began with the signing of the Memorandum of Understanding („Memorandum of Understanding Concerning the Process of Establishing Euro-BioImaging"), which was signed on behalf of the Slovak Republic on 27 January 2014. From May 2016 to October 2019, EuBI operated in Interim Operation mode and provided open access to 28 nodes in 11 countries and in the EMBL. At present, 36 different imaging technologies are available to users in order to continuously monitor and add new bioimaging technologies to the portfolio. Based on the evaluation of the Euro-BioImaging project in the ESFRI forum from 2018 the European Commission decided to make the project a recommended research infrastructure to support research in biomedical imaging across Europe (Landmark infrastructure).

SOCIO-ECONOMIC IMPACT

Advanced and innovative imaging technologies in biomedicine are extremely important for the analysis of molecular dynamics in cells and organisms, as they provide information more easily than standard biochemical methods. However, European researchers often do not have access to state-of-the-art technologies for displaying and analysing large-scale image data. EuBI reduces this shortcoming by coordinating the distributed display infrastructure with open access for external users from other research institutions. This open access model brings many benefits to the scientific community: it alleviates the shortage of professionals, increases the return on the cost of installing the latest imaging technologies for partners and users; it promotes international cooperation and strengthens the transfer of knowledge between European researchers as well as the transfer of knowledge into practice. Better research conditions for researchers will increase European competitiveness, reduce the outflow of excellent staff abroad and open up new areas of research.

PARTICIPATING COUNTRIES

Leading country: FI. **Members**: IT, FR, NL, UK, AT, IL, BG, CZ, HU, NO, PT, DK, EMBL. **Observer:** BE. **Potential members:** ES, PL, SK.

PARTICIPATION OF SLOVAKIA

Position of Slovakia: perspective member

PREVIOUS ACTIVITIES OF SR

On the initiative of prof. P. Miškovský and Dr. D. Chorvat a subgroup of the Slovak Biophysical Society (SKBS) called Slovak BioImaging was established in 2013. This subgroup gave rise to the concept of the Slovak BioImaging Network (SkBIN). SR represented by the then-minister D. Čaplovič on 27 January 2014 signed a Memorandum of Understanding on the process of establishing the EuroBioImaging consortium and nominated its representatives to the EuBI Transitional Council. The task of the representative was to prepare the framework for the emerging EuroBioImaging ERIC organization (see „Contact details"). The SkBIN network unites workplaces forming a potential Slovak node in the EuBI network coordinated by the University of P.J. Šafarik in Košice. In 2015, SkBIN was assessed by an independent panel of international experts and recognized by the EuBI Transitional Council as the future national node of the Slovak Republic in the Euro-BioImaging network. SkBIN's area of expertise is multi-modal advanced light microscopy.

PLANNED ACTIVITIES

The Slovak participants in the EuBI project will be involved mainly in the activities of providing access and solving user projects in the national SkBIN infrastructure, as well as in international user training and networking activities.

The process of establishing EuBI ERIC ended in 2019, thus effectively terminating the original Memorandum of Understanding. At its meeting on 30 November 2017, the Commission for the Coordination of Activities of the Slovak Republic in ESFRI Projects Oriented to Materials, Physical Sciences, with Application Potential in Biological and Medical Sciences, Chemical Sciences and IT declared its interest in continuing to participate in the EuBI ERIC projects an Observer. To meet this goal, it will be necessary to submit an application to join the EuBI ERIC consortium on behalf of the Slovak Republic. As of October 31, 2020, no such application has been written by the Ministry of Education.

BENEFITS FOR SLOVAKIA

Through the EuBI ERIC consortium, researchers from Slovakia will have access to state-of-the-art imaging technologies in the biological and medical sciences, as well as expertise and infrastructure for image data analysis. An important benefit is also closer involvement of Slovak workplaces in projects and international cooperation. This is a unique opportunity to become a direct organizational part of a top international consortium of excellent research for selected workplaces in Slovakia.

FINANCIAL ASPECTS

Return on investment: high qualification and extensive network of cooperation gives the prospect of a quick return on investment needed to participate in the EuBI ERIC project (up to EUR 50,000 / year as a full member, 30% of this amount as an observer). Projects for direct financial support of EuBI nodes are continuously submitted also under the ongoing calls H2020. The budget of these projects for individual nodes is comparable to the expected costs, with the prospect of added value in the form of participation in excellent international research.

PARTNERSHIP

The Slovak BioImaging Network (SkBIN) is a network built within the Slovak Biophysical Society, currently connecting the UPJŠ Interdisciplinary Biosciences Centre in Košice, the International Laser Centre

in Bratislava, the Institute of Biochemistry and Animal Genetics of the Slovak Academy of Sciences and SAFTRA Photonics s.r.o. (startup UPJŠ), with the possibility of expanding to other workplaces.

CONTACT DETAILS

The interests of the Slovak Republic in EuBI were represented until 2019 by EuBI Interim Board delegates:

prof. RNDr. Pavol Miškovský, DrSc., CIB UPJŠ in Košice, pavol.miskovsky@upjs.sk

RNDr. Dušan Chorvát, PhD., International Laser Center, dusan.chorvat@ilc.sk

INSTRUCT-ERIC

Integrated Structural Biology Infrastructure

www.instruct-eric.eu

EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

The complexity of research in the biological and medical sciences requires an integrated approach to problem solving by applying several experimental techniques. The INSTRUCT infrastructure is aimed at providing access to a wide range of the latest technologies, expertise, training, as well as the development of relevant techniques in the field of structural and cellular biology. The aim is to support basic research into the study of biomolecules to understand their functions at the cellular level. The acquired knowledge will enable innovations in the field of biological and medical sciences. Biomolecular structure research, supported by the INSTRUCT infrastructure, also helps the development of the biotechnology and pharmaceutical industries, as defined in the objectives of Horizon 2020.

Instruct Centre CEITEC in the Czech Republic

ACTIVITIES

INSTRUCT makes available the most advanced technologies (cryo-electron microscopy, NMR (Nuclear Magnetic Resonance) at strong magnetic fields, X-ray structural analysis, cryo-electron tomography, X-ray imaging, single molecule techniques, in-cell NMR, etc. (https://www.structuralbiology.eu/)) enabling research into the structure of biomolecules

in so-called centres. In addition to technologies, expert reviews of individual methodologies, sample preparation, structural and cellular characterization, as well as analysis of the obtained data are also provided. INSTRUCT also supports small pilot projects, exchanges and training programs. In the last five years, 49 professional courses were conducted in the presence of a total of 695 participants who gained knowledge and skills in the latest research methods. The project also supported 26 exchanges and 35 research projects.

Instruct Centre FR1

SOCIO-ECONOMIC IMPACT

Structural biology has a significant impact on academia as well as on the commercial sphere. INSTRUCT has a direct impact on more than 35,000 researchers in the field of structural biology. Promotional and educational activities carried out among other biologists can increase this number to more than 100,000. INSTRUCT is involved in the drug development process through collaboration with several European companies and an EU-funded vaccine development network. INSTRUCT aims at contributing to the design of innovative, effective and safe drugs through structural approaches.

PARTICIPATING COUNTRIES

Leading country: UK. **Member countries:** BE, CZ, ES, DK, FI, FR, IL, IT, LT, LV, NL, PT, SK, EMBL. **Potential members:** AT, DE, GR, HU, SI, SE

PARTICIPATION OF SLOVAKIA

Position of Slovakia: member

PREVIOUS ACTIVITIES OF SR

Until 2018, Slovakia was an observer. Since July 2018, Slovakia has become a full-time member of the INSTRUCT-ERIC infrastructure. So far, we have focused mainly on informing the scientific community about the possibilities that the INSTRUCT-ERIC project offers. The existing experimental infrastructure was used by the Institute of Chemistry of the Slovak Academy of Sciences in the field of glycobiology in cooperation with renowned workplaces. Glycoproteins were analysed as required by the University of Oxford and University College London. Previous analyses have been performed on a commercial basis; the income brought amounted to EUR 6,000. Based on the results, the Institute of Chemistry of the Slovak Academy of Sciences established itself as a partner laboratory focused on glycan analysis (https://instruct-eric.eu/submit-call/glycan-analysis-); the only laboratory of this type in INSTRUCT-

ERIC). There are currently two open calls for PhD students and PhD holders to work on glycan structure measurement projects. So far (November 2020), four projects have submitted their applications under this call (two applications from the University of Exeter, UK, and Åbo Akademi, Turku FI and Sapienza University, Rome, IT each sent one application). The INSTRUCT-ULTRA project was created to support the expansion of the scientific community in individual countries and to encourage the use of the possibilities offered by INSTRUCT-ERIC. Under the project, researchers had the opportunity

to participate in three workshops (2017, 2018 and 2019; 40 - 45 participants at each event), where lectures on structural biology by researchers from SAS, universities and abroad (CZ, IT, UK) were given. Abstract books and compilations were published from all three events. The INSTRUCT-ULTRA grant also supported the participation of researchers and PhD students from several SAS institutes and universities in conferences in Brno and Madrid (INSTRUCT Biennial Structural Biology Conference 2017 and 2019).

PLANNED ACTIVITIES

In the next period, we will support the use of equipment and devices in EU countries as well as the cooperation of our laboratories with those that are members of the INSTRUCT program. As part of the activities of the partner laboratory INSTRUCT, we will continue to analyse glycans. The international conference INSTRUCT-CTB (https://www.instruct.sav.sk/) (planned to take place in November 2020) on structural biology was rescheduled to the COVID-19 pandemic and will take place in the autumn of 2021. However, the gradual expansion of the national infrastructure is important for other activities to take place. This depends on the financial possibilities (budget) of individual institutions.

BENEFITS FOR SLOVAKIA

INSTRUCT has a direct impact on the scientific community in the field of structural biology in Slovakia. Researchers and PhD students have the opportunity to use the best infrastructure in Europe in their research and establish cooperation with renowned workplaces. PhD students can take part in trainings and courses and also find new opportunities for collaboration (or places for a postgraduate study stays) with laboratories across Europe. Young people can take advantage from study stays opportunities. There is also the possibility for small and medium-sized enterprises to cooperate with research institutions in INSTRUCT.

FINANCIAL ASPECTS

Membership fee: EUR 52,000 per year.
Annual maintenance costs of the current infrastructure: EUR 25 000.
As the current infrastructure will be obsolete in 4 to 6 (maximum) years, the acquisition of new equipment will require additional investments in the range of EUR 2 to 3 million.

PARTNERSHIP

Departments of SAS and universities (so far STU Bratislava, PriF UK Bratislava and UPJŠ Košice).

CONTACT DETAILS

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EUROPEAN XFEL

European X-ray Free Electron Laser Facilty

www.xfel.eu

EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

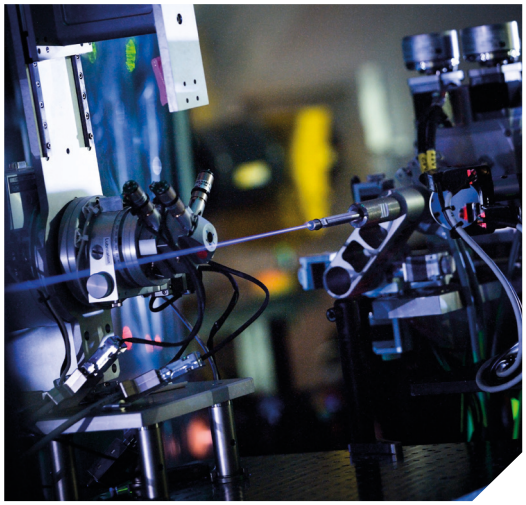
The European project of 3.4 km long X-ray laser being built in Hamburg, called the European X-ray Free Electron Lacer Facility (XFEL), will be a source of X-rays of exceptional quality beyond all current world photon sources. It will be the world's leading X-ray burst device with high repetition rates and a luminosity that is billions of times higher than today's best synchrotron X-ray sources.

European XFEL is opening up areas of research that were previously unavailable. Using X-ray flashes, scientists will be able to map the atomic details of viruses, distinguish the molecular composition of cells, make three-dimensional images of the nanoworld, film chemical reactions, and study processes „under extreme conditions," such as those that take place deep within planets.

ACTIVITIES

The facility is currently under construction and its legal status will be that of non-profit limited liability company under German law - GmbH. Construction began in 2009 and the SASE1 beam was officially launched on September 1,

2017. The goal is to use these X-rays for revolutionary scientific experiments in a variety of disciplines, including physics, chemistry, materials science, and biology. Some of the expected scientific benefits include the study of changes in molecular configurations during chemical reactions to levels less than picoseconds (ps), fluctuation dynamics at unprecedented time and length scales. Thanks to this facility, researchers will have access to materials that are currently only found in astrophysical research laboratories. A possibility to the study the structure of individual macromolecules up to atomic resolution without the need for crystallization is one of the major benefits.



European X-ray beam XFEL

SOCIO-ECONOMIC IMPACTS

The scientific areas on which XFEL will have a decisive impact include: structural biology, chemistry, research on atoms, ions, molecules and clusters, plasma physics, solid state physics, materials research, optics and nonlinear processes, etc. The specific development of detector and accelerator technology brings innovations and the transfer of know-how to industry. The expected major research discoveries in materials, chemistry and catalysis and macromolecular structure will also bring innovation. European XFEL offers the opportunity to educate a new generation of frontier researchers in nanomaterials in a transnational, open environment that supports the European dimension of knowledge and its international mobility.

MEMBER COUNTRIES

Leading entity: European XFEL. **Member states:** CH, DE, DK, ES, FR, HU, IT, PL, RU, SE, SK, UK.

PARTICIPATION OF SLOVAKIA

Position of Slovakia: member

PREVIOUS ACTIVITIES OF SR

SR is a 1.1% shareholder and since 2006 it has been actively involved in the creation of the company and the construction of the facility. The activities of the Slovak Republic in the construction and management of European XFEL GmbH are coordinated by the Science and Technology Section of the Ministry of Education, Research and Sports of the Slovak Republic through the Commission for Coordinating Slovak Activities in ESFRI projects focused on materials, physical sciences, Chemical Sciences and IT '(hereinafter the Commission).

The Commission meets regularly, at least twice a year, and takes measures to ensure scientific progress and promotion activities. Activities are directed to the following areas:

Active participation of Slovak representatives in the company's bodies:
P. Sovák, K. Saksl v E-XFEL Council
P. Sovák, M.Šponiar AFC XFEL
K. Saksl. J. Uličný, I. Barák – committee of consortia Serial femptosecond crystallography and single-particle imaging at XFEL (SFX XFEL) and X-ray Biology Instruments (XBI XFEL).

Scientific projects and development of methodologies: experiments in ESRF, DESY, FLASH for the development of imaging methods of structures.

Education: organization of the School of Synchrotron Radiation and Future Users of XFEL „SFEL" for students, PhD students and young researchers, workshops and consultations for Slovak users organized and provided by representatives of the Slovak Republic in E-XFEL, student participation in DESY Summer School organized annually by DESY Hamburg.

Promotion in the form of popular lectures, press releases.

PLANNED ACTIVITIES

Experiment design at two endpoint experimental sites that XFEL is building from user consortium contributions. SR is a member of the SFX XFEL and XBI XFEL consortia of users. After putting XFEL into full operation (all 3 SASE beams) from on April 1, 2019, the aim is to engage in materials research at the Materials Imaging and Dynamics XFEL (MID XFEL) site. In the future, the possibility of obtaining very accurate diffraction data for the study of the experimental electronic structure of inorganic, organic and coordination compounds as well as various materials is expected.

BENEFITS FOR SLOVAKIA

Slovakia does not have any similar infrastructure at its disposal that could be used for top-level research into the structure of living and non-living nature. Research in this area is important for a wide area of basic and applied research in the Slovak Republic which might lead to unique discoveries of world importance. XFEL is important for basic and applied research in the field of structural biology, femptochemistry, materials research, condensed matter physics and plasma physics. Possibility of creating research networks for projects H2020 and FP9. Possibility of popularization in the field of biomedicine, physics, chemistry, IT. Strengthening the position of the Slovak Republic in this area with a view of commercializing intellectual property.

FINANCIAL ASPECTS

Pursuant to the international agreement of the founders of XFEL, the individual shareholders participate in covering the operating costs in the amount of shares they own. Since 1 April 2019, experiments have been carried out on all three SASE beams, so the task group has prepared a qualified estimate of annual operating costs in the coming years in the range of up to EUR 145 million. EUR 1.5-1.7 million per year is budgeted for the Slovak Republic in the horizon of the next 5 years.

PARTNERSHIP

Pavel Jozef Šafárik University in Košice, Slovak Technical University Bratislava, Comenius University Bratislava, Technical University of Košice, University of Žilina, International Laser Center, Institute of Physics SAS, Institute of Molecular Biology SAS, Institute of Experimental Physics SAS, Institute of Materials Research SAS, Institute of Geotechnics SAS and others according to interest.

CONTACT DETAILS

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HL-LHC

High-Luminosity Large Hadron Collider

hilumilhc.web.cern.ch

EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

The Large Hadron Collider (LHC) at CERN is the world's largest and most powerful particle accelerator. The LHC experiments (ALICE, ATLAS, CMS, LHCb, LHCf and TOTEM) have yielded a large number of significant physical results summarized in more than 2,000 publications in professional scientific journals. The most important was the groundbreaking discovery of the Higgs boson predicted by the Standard Model (SM) and confirmed by ATLAS and CMS experiments in 2012. This discovery launched a grandiose program aimed at measuring the characteristics of this particle as accurately as possible to test the validity of SM and search for new physics. To expand its research potential, the LHC will be upgraded to the High Brightness LHC (HL-LHC) in order to increase the data sample size for experiments. In order to take full advantage of the increased statistics, LHC detectors will also need to be improved, as well as the computing infrastructure needed to handle the increased data flows. The full use of the LHC's potential, including the HL-LHC, has been identified as a top priority for European particle physics in the European Strategy for Particle Physics update approved by CERN in May 2013. The HL-LHC project is considered a high priority component in national plans of countries around the world.

HL-LHC magnets and cold matter in building 180

ACTIVITIES

It will take almost ten years to design and commission the accelerator and detector systems for the HL-LHC project. The accelerator is based on a range of innovative technologies, including a combination of state-of-the-art superconducting magnets, ultra-precision superconducting radio frequency resonators to accelerate the particle beam, and high-performance superconducting links. In addition, higher luminosity places new demands on achieving high vacuum, high-quality cryogenics and radiation protection. It will also require new concepts for beam collimation and diagnostics to maximize physical output from particle collisions. The success of the HL-LHC experiments will depend on an innovated instrumental detector base.

The main goal is to move the validation of SM further to the maximum available energies, especially by the widest possible study of the so-called Higgs sector, especially by measuring the characteristics of the Higgs particle and its links to the vector bosons and the top quark as accurately as possible in order to identify deviations from the SM predictions. The second objective is to investigate whether the Higgs particle is accompanied by other new particles in the TeV energy scale that could play a role in addressing issues in particle physics such as the nature of dark matter or the asymmetry of matter and antimatter in space.

SOCIO-ECONOMIC IMPACT

The LHC is a unique international infrastructure dedicated to the study of the basic components of matter and their interactions. A significant increase in the luminosity of the existing LHC will allow it to reach its full scientific potential and help plan its scientific program by at least 2035. The CERN scientific community consists of more than 13,000 users worldwide, the vast majority of whom work at the LHC. The HL-LHC and its associated facilities will require the full range of supplies and services needed to upgrade and operate the accelerator and experiments. Achieving the HL-LHC's physical goals will require collaboration with a wide range of industries and businesses. The company will benefit significantly from the knowledge and technology that will be developed during the HL-LHC project. Many young physicists and engineers trained during the project will transfer their expertise to society and industry. Undoubtedly, the HL-LHC will affect many research infrastructures.

PARTICIPATING COUNTRIES

Leading entity: CERN. **Member countries:** AT, BE, BG, CH, CY, CZ, DE, DK, EL, ES, FI, FR, HU, IL, IN, IT, LT, NL, NO, PK, PL, PT, RO, RS, SE, SI, SK, TR, UA, UK. **Perspective member:** HR.

PARTICIPATION OF SLOVAKIA

Position of Slovakia: member

PREVIOUS ACTIVITIES OF SR

The Slovak Republic has participated in the LHC project since its inception, focusing on ATLAS and ALICE experiments. The ATLAS experiment is a universal multi-purpose experiment focused primarily on deep-inelastic proton-proton processes characterized by large transferred momentums, which allow us to study the basic constituents of matter and their interactions on a spatial scale below 10-20 m. This will not only allow us to know the structure of matter and the nature of the forces between its constituents, but can greatly deepen our understanding of the evolution of the universe, especially in its early stages. In terms of detector development, Slovakia participated in the development and testing of the hadron Tile calorimeter (Comenius University, BA) and the hadron EndCap calorimeter (IEF SAS Košice). In terms of physics, research focused the top quark (one of the most important areas of SM

testing and the search for new physics) and the so-called soft hadron physics, which is important for understanding the processes associated with quark arrest. The ALICE experiment is mainly focused on investigating the phase transition between a substance in the form of baryon mass (so-called normal mass) and the phase of quark-gluon (QG) plasma. The aim is also a deeper understanding of the issue of quark entrapment, which can lead to immediate applications in the field of nuclear technology. Comenius University BA, Institute of Experimental Physics SAS, UPJŠ and TUKE are involved in the ALICE project. In terms of detector development, research focused on the development and testing of TPC chambers (time projection chambers) (Comenius University Bratislava) and the development of electronics for trigers (workplaces in Košice). From a physical point of view, it was the production of strange particles which proved to be an important marker of the existence of QG plasma.

PLANNED ACTIVITIES

As part of detector development, we will deal with testing new photo-multipliers for TileCal, which presupposes the construction of a laboratory for these tests in our country. We will also participate in methodological work related to the so-called on-line electronic calibration of ATLAS calorimetry. As far as physics is concerned, we want to continue in the research of top-quark processes. Thanks to this research, it will be possible to measure basic top-quark characteristics with greater accuracy and thus validate SM at a higher level or see deviations from SM leading to new physics. We also want to continue research in the field of soft hadron physics.

BENEFITS FOR SLOVAKIA

By becoming a member of the HL-LHC, Slovak particle physicists have the opportunity to work on top particle experiments. This provides opportunities for making contacts and cooperating with top experts in the field of particle physics and also gives the opportunity for professional growth, especially for our young scientists. It provides us with unique methods, software products developed at CERN and also advanced technologies used in detector development. At the same time, these products can be used in a much wider field than just particle physics, especially in medical applications. HL-LHC also represents a great opportunity for Slovak companies, which are offered the opportunity to win orders, often high-tech. In the past, when building the LHC, our companies were very successful - the coefficient of return (the ratio of the value of contracts and the membership fee of the Slovak Republic in CERN) was more than 1.5.

FINANCIAL ASPECTS

Slovakia pays for CERN membership (not only LHC, but also opportunity to take part in other experiments such as NA62, ISOLDE as well as the possibility to use facilities in CERN) about 5 million EUR per year - it is a variable item based on the GDP of the member. To this sum, another EUR 900,000 which goes directly to science, i.e. mainly to experiments must be added. More than 100 employees are involved in our activities at CERN.

PARTNERSHIP

Comenius University in Bratislava (UK BA), Institute of Experimental Physics SAS Košice (ÚEF SAS), Institute of Physics SAS (FA SAS), Pavel Jozef Šafárik University in Košice (UPJŠ), Technical University in Košice (TUKE), Matej Bel University in Banská Bystrica, University of Žilina in Žilina.

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NEUTRONS FOR SOCIETY

www.ill.eu

ILL

Institut Max von Laue – Paul Langevin

EUROPEAN LEVEL

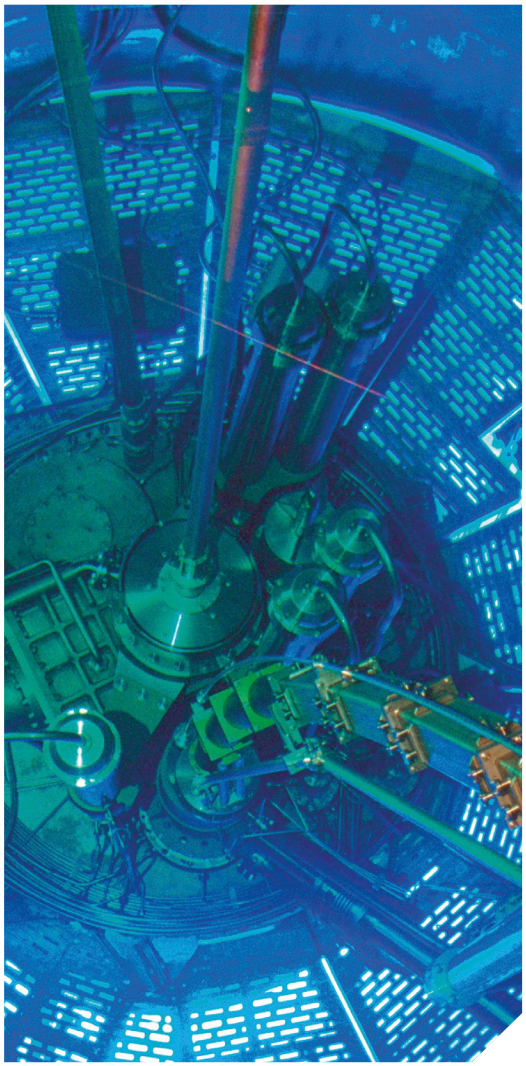
INFRASTRUCTURE DESCRIPTION

The Max von Laue-Paul Langevin Institute (ILL) is an international research centre for cutting-edge neutron science and technology in Grenoble, France, which supports scientists in various fields - condensed matter physics, chemistry, biology, nuclear physics and materials science - and makes their combined know-how available to the scientific community.

ACTIVITIES

ILL operates the world's most intensive neutron reactor source, producing neutrons for a set of high-performance spectrometers (approximately 40). Most of these spectrometers are managed directly by the ILL, while about 10 spectrometers are handled by external consortia. Each piece of instrumentation is designed to be state-of-the-art in a specific area of research and undergoes continuous improvements to a world-class level. The continuous instrument upgrade programs aim to increase the signal-to-noise ratio, the luminosity of the incident beam, as well as the resolution of the spectrometer to adapt the instruments to the changing research environment and offer users new innovative technology.

The ILL 20/20 project was included in the 2006 ESFRI Roadmap to support the overall modernization of ILL research facilities and to strengthen world leadership in meeting the needs of scientific users in Europe and beyond. Every year, 1,400 researchers from more than 40 countries visit ILL, and perform more than 850 ex-



periments. The result is about 600 publications. ILL is a leader in neutron sciences and neutron-using sciences, covering all relevant scientific fields: soft condensates (14%), nuclear and particle physics (5%), biology (9%), chemistry (12 %), materials science (20%), physics including magnetism and nanoscience (36%), other (4%).

SOCIO-ECONOMIC IMPACT

Technologies developed by ILL and partner companies are often used by national and international facilities and laboratories. The ILL Industrial Contact Unit is a single point of contact for all potential users in industry and services and offers industrial clients a choice of specific approaches from rapid special research to combined research (involvement of academia) for maximum innovation.

ZÚČASTNENÉ KRAJINY

Leading entity: ILL. **Founders:** DE, FR, UK. **Members:** AT, BE, CH, CZ, DK, ES, IT, PL, SE, SK.

PARTICIPATION OF SLOVAKIA

Position of Slovakia: member

PREVIOUS ACTIVITIES OF SR

Over the course of the Slovak Republic's participation, ILL has recorded approximately 40 users from various scientific institutions in the Slovak Republic. In particular, our specialists are involved in structural studies of magnetic nanofluids in electric and magnetic fields. The effect of pH on the structure of magnetoferritin due to its potential use in drug production (under different physicochemical conditions) has been studied. The structure of the biological membrane has been the subject of studies using small-angle neutron diffraction. Attention has been paid to the incorporation of Amyloid-beta peptides, which today are mainly associated with conformational disorders of proteins leading to Alzheimer's disease.

With the help of neutron reflectometry, it was possible to solve the problem posed by interfacial stoichiometry of thin films formed from polyelectrolytes and surfactants. In particular, the influence and effect of the charge of the aggregates and their ionic strength were studied. The results obtained expand knowledge in the field of special nanomaterials (with the properties of polymers and surfactants) and thus help in the synthesis of materials for future applications. Measurements using neutrons and polarized neutrons were performed to study the spin density distribution in the Ni (III) complex. Along with measurements at the APS synchrotron in Argonne, a publication in the top magazine IUCrJ is being prepared in collaboration with the staff of the University of Nancy (Fr.).

PLANNED ACTIVITIES

With regard to the results of Slovak experts working at ILL so far, the continuing interest in the use of the ILL instrumental base is expected. Maintaining access to the neutron source at the ILL also seems important due to the declining number of neutron centres in Europe and the world. Further experimental proposals in the field of nanofluids that have application potential in the electrical engineering industry will be prepared. Using the available ILL equipment, the structure of nanofluids during its flow will also be studied (in-situ rheology and neutron scattering). Another goal is to study the influence of the electric field on the structure of na-

tive ferritin and its synthetic derivatives as in vitro model systems. Electric field can lead to the transformation of the inorganic nucleus and oxidative damage to various biomacromolecules in the body.

BENEFITS FOR SLOVAKIA

By becoming a member of the ILL, the scientific community of the Slovak Republic primarily gains the direct access to the core facilities and laboratories not available at home. Slovak scientists are particularly active in the fields of solids and metallurgy, nuclear physics, polymers, nanoparticles and pharmaceutical research. The results of these projects are published annually in peer-reviewed scientific journals and are presented on numerous scientific forums around the world.

The membership of the Slovak Republic in ILL also seems to be beneficial in the field of education, where it enables to obtain a scholarship for post-graduate studies directly in ILL. ILL also offers four-week scholarship courses for graduate students and a one-month course for PhD students.

FINANCIAL ASPECTS

Slovakia pays for its membership in ILL and thus for the possibility to carry out experiments (0.12% of the measurement time) according to the valid agreement. The Committee for the Coordination of the Slovak Republic's Participation in ESFRI Projects recommended increasing our participation to the level of 0.37%, thus meeting the increasing demands of specialists from the Slovak Republic. The fee amounts to EUR 380,000 per year.

Active participation in the experiments is supported through the reimbursement of travel and subsistence expenses for members of the scientific group from the membership fee. The scholarship for post-graduate students is also paid from the membership fee.

PARTNERSHIP

ILL registers users from various scientific institutions in the Slovak Republic: Faculty of Pharmacy, Comenius University in Bratislava; Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava; Institute of Inorganic Chemistry SAS in Bratislava; Institute of Molecular Biology of the Slovak Academy of Sciences in Bratislava; Institute of Experimental Physics of the Slovak Academy of Sciences in Košice; Institute of Electrical Engineering of the Slovak Academy of Sciences in Piešťany; Slovak Technical University in Bratislava; J. Selye University in Komárno.

CONTACT DETAILS

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CESSDA

Consortium of European Social Science Data Archives

www.cessda.eu

EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

CESSDA provides integrated and sustainable data services in the field of social sciences. It connects data archives across Europe to present the results of social science research supporting national and international research and cooperation. CESSDA is a scientific infrastructure, defined in the ESFRI Roadmap since 2006.

ACTIVITIES

CESSDA is a distributed infrastructure that brings together national social science data archives with headquarters in Bergen, Norway.

CESSDA's strategy is based on three pillars: technology, training, and trust. The technology provides stable and up-to-date support for the services provided, such as single sign-on access (facilitates the storage and use of data). The training focuses on „coach training" and on new ways of training (webinars, MOOCs) to gain new users, an explanation of the handling of personal data, etc. Trust refers to the position of service providers as trusted repositories which can ensure the quality of stored data and reliable and secure access. CESSDA has working groups for each of these pillars. CESSDA's projects and coordination meetings are carried out by these working groups.

SOCIO-ECONOMIC IMPACT

The CESSDA ERIC infrastructure brings together European social science data archives. These data archives document

CESSDA Head Office

and make available scientifically valuable social science data for analysis by a wide national and international professional community. For the most part, this is data obtained from public funds. Making them available to other researchers increases the efficiency of the initial investment, and contributes to the dissemination of knowledge and its independent verification. The possibility of linking new research to the research carried out helps in the cumulative cognition and implicitly and explicitly contributes to methodological advances in social science research.

PARTICIPATING COUNTRIES

Leading country: NO. **Member countries:** AT, BE, CZ, DE, DK, FI, FR, GR, HR, HU, MK, NL, PT, RS, SE, SI, SK, UK. **Observers:** CH.

PARTICIPATION OF SLOVAKIA

Position of Slovakia: member

WWW.SASD.SAV.SK

PREVIOUS ACTIVITIES OF SR

As a distributed infrastructure, CESSDA implements its services in the scientific community through national service providers. In Slovakia, this task is performed by the Slovak Social Data Archive (SASD), founded in 2004 and jointly operated by the Institute of Sociology of the Slovak Academy of Sciences and the Department of Sociology, Faculty of Arts, Charles University in Bratislava. The SASD archives data from empirical sociological research, especially quantitative, carried out on a representative sample of the population of the Slovak Republic. The archive provides its services through its website http://sasd.sav.sk.

At the request of the Minister of Education, Science, Research and Sports of the Slovak Republic dated March 24, 2017, Slovakia became a founding member of the pan-European consortium of scientific infrastructure CESSDA ERIC on June 14, 2017.

PLANNED ACTIVITIES

In the case of securing institutional funding through the Ministry of Education, the archive can, through new trained staff, ensure mandatory archiving of social science research carried out with the support of public funds as well as other research that its authors are willing to make available and meet CESSDA methodological technical standards.

BENEFITS FOR SLOVAKIA

Our involvement in CESSDA through the Slovak Social Data Archive enables us to document and make available scientifically valuable social science data to a wide national and international professional community. For the most part, this is data obtained from public funds. Making them available to other researchers increases the efficiency of the initial investment, and contributes to the dissemination of knowledge and its independent verification.

In the case of institutional support for the operation of the archive at the national level, the archive will also be able to take part in CESSDA-funded project activities and working group activities, which will enable co-financing of the archive's activities in Slovakia.

FINANCIAL ASPECTS

By becoming a member of CESSDA ERIC, the Slovak Republic has committed itself to supporting the operation of the national service provider, the Slovak Social Data Archive (SASD), operated by the Institute of Sociology of the Slovak Academy of

Sciences in cooperation with the Faculty of Arts, Charles University.

In addition to the membership fee of approximately EUR 3,600 per year, the requirement is to finance the operation of SASD in the amount of EUR 36,000 per year (thus creating three jobs for archive staff). Compared to the costs of running the archive in the surrounding countries, this is a very efficient investment.

Additional costs for the operation of the archive would be borne by the Institute of Sociology of the Slovak Academy of Sciences, alternatively together with the Faculty of Arts, Charles University through the national platform CESSDA SK.

PARTNERSHIP

Slovak Academy of Sciences (Institute of Sociology SAS)

Comenius University (Department of Sociology, Faculty of Arts)

CONTACT DETAILS

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CLARIN ERIC

European Research Infrastructure for Language Resources and Technology

www.clarin.eu

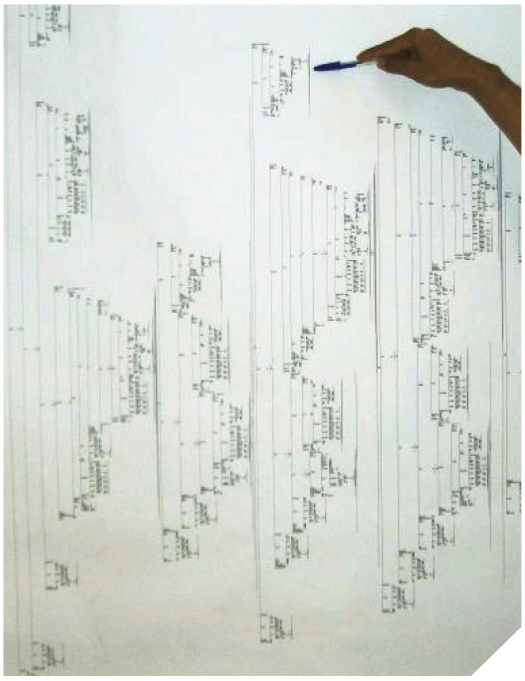
EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

CLARIN is a distributed research infrastructure created with the vision to make all digital language resources and tools from across Europe and beyond accessible through a single online login environment to support researchers in the humanities and social sciences. In 2012, CLARIN ERIC was established with aim of creating and maintaining an infrastructure to support the mutual provision, use and sustainability of language data and research tools in the humanities and social sciences. CLARIN currently provides easy and sustainable access to digital language data (in written, spoken or multimodal form) for researchers in the social sciences and humanities and beyond. CLARIN also offers advanced tools for searching, examining, using, commenting, analysing, and combining such data files, no matter where they are located. This is made possible through interconnected centres: language data repositories, service centres and knowledge centres with a single approach for all members of the academic community in all participating countries. Tools and data from different centres are interconnected so that data collections can be combined and tools from different sources can be combined to perform complex operations to support researchers in their work.

ACTIVITIES

The national nodes within the international CLARIN network are being set up aimed at free exchange and reciprocal provision of language data and technologies for scientific research. CLARIN's main components are technical centres, in particular service centres - CLARIN B centres for short. These centres provide the scientific community with access to resources, services and knowledge on a sustainable basis. Therefore, there are strict criteria for selecting CLARIN B-Centres. There are currently about 20 certified B-centres and several candidate centres. The process of obtaining and sharing data in the legal, technological and educational fields is also coordinated. Joint projects in the relevant areas are being prepared and implemented. CLARIN also works closely with research communities to create and expand a knowledge infrastructure that can support developers of language resources and tools, as well as end-users of available data and services.



A printout of the LXGram output for the sentence Todos os computadores têm um disco („All computers have a disk") in a 6 point font.

SOCIO-ECONOMIC IMPACT

Linking existing resources and international cooperation in creating new technologies is a basic precondition for the development of any area. CLARIN stimulates the re-use of available research data, thus enabling students and researchers in the social sciences and humanities (including the digital humanities) to increase their productivity. In addition, it opens up new research opportunities in disciplines and between disciplines that deal with one or more societal tasks of language.

PARTICIPATING COUNTRIES

Leading country: NL. **Members:** AT, BG, CZ, DE, DK, EE, FI, GR, HR, HU, IT, LT, LV, NO, PL, PT, SE, SI (DLU). **Observers:** FR, UK. **Unofficial observers:** SK.

PARTICIPATION OF SLOVAKIA

Position of Slovakia: member

PREVIOUS ACTIVITIES OF SR

The Slovak Republic is not yet an official member in the given infrastructure. In recent years, several members, especially from Central European countries, turned to the staff of the Slovak National Corpus of the Ľudovít Štúr Institute of Linguistics of the Slovak Academy of Sciences (hereinafter referred to as SNC LSIL SAS) with an invitation to become a member or at least participate in infrastructure activities. Representatives of SNC LSIL SAS participated in several events organized by the CLARIN infrastructure (especially in Prague and Vienna; mostly at their own expense). Selected data from the syntactically annotated SNC corpus are part of the LINDAT CLARIN repository in Prague.

PLANNED ACTIVITIES

The SNC LSIL SAS workplace in Bratislava, where various language resources for Slo-

vak are created, managed and made available to the public, has long been (since 2002) co-financed from the resources of the Ministry of Education, Youth and Sports of the Slovak Republic and the Ministry of Culture of the Slovak Republic, thereby meeting the characteristics of the national infrastructure that could be a member of the European CLARIN ERIC infrastructure. The main activity in the first phase would be the establishment and administration of a repository of existing language resources for Slovak language, their further expansion and improvement. Naturally, the workplace would become involved in CLARIN's activities, joint or multilateral projects with the aim of improving Slovak language resources and technologies and making better use of existing Slovak resources in European research and technology development, including machine translation (where the SNC LSIL SAS workplace is involved e.g. within the ELRC - European Language Resource Coordination - Managing Authority for the coordination of language resources).

The Slovak Republic is involved in the ELRC through two representatives, the so-called National Anchor Points. The ELRC National Anchor Points are individuals who support the data collection process in each of the 30 participating States. Together, they form the Language Resources Council, the managing authority in an effort to coordinate European language resources. Each state is represented by one Technology National Anchor Point and one Public Services National Anchor Point. For the Slovak Republic, the technological representative is an employee of the LSIL SAS and the representative of the public services administration is an employee of the Ministry of Culture of the Slovak Republic. A technology representative is a recognized expert in language or language technology. It assumes an excellent academic or research education or represents a national language institution (in the case of the Slovak Republic it is LSIL SAS). A public sector representative is a representative of a national public service, public administration or ministry. The public sector representative acts as a contact point for national, regional and local administrations and is able to effectively mobilize and disseminate information on the importance of ELRC language resources and efforts among public authorities / ministries in each state. A list of technology and public administration representatives can be found on the website http://www.lr-coordination.eu/anchor-points.

BENEFITS FOR SLOVAKIA

The interconnection of language resources and technologies offer a huge benefit for Slovak language and its computer processing, both in terms of expanding usable language resources and technologies, as well as in terms of integrating existing corpus and computer processing of Slovak into a broader framework of language resources and technologies existing for advanced European languages. (compare *The Slovak Language in the Digital Age, http: //www.meta-net.eu/white-papers/volumes/slovak*). Joint projects will enable the Slovak Republic to take part in the international scientific research in this area and in activities that will bring not only a direct financial effect in the form of funds obtained for research and development, but also the indirect financial effect in the form of savings for independent development and in the form of sustainability of the achieved results.

FINANCIAL ASPECTS

Within the European CLARIN infrastructure, the Slovak Republic would probably be included among the countries with a basic membership fee, which was set at 2019 at EUR 13,554. In the following years, an annual fee increase of 2% is expected.
The existence and activities of the SNC LSIL SAS are currently supported from the resources of the Ministry of Education, Youth and Sports of the Slovak Republic and the Ministry of Culture of the Slovak Republic in the amount of EUR 150,000

per year (EUR 75,000 from each ministry), wage costs are taken care of by the SAS (in 2019 approximately EUR 150,000 + levies). To create and operate a national node, it would be necessary to create 2 - 3 jobs - the position of IT specialist (approximately EUR 50 – 70,000 per year + levies). In the first phase, the technological equipment would represent costs in the amount of approx. EUR 200,000 in the following years approx. EUR 300,000 annually. Necessary equipment replacements and new investments would take place at 3-5 year intervals.

PARTNERSHIP

Apart from the SNC LSIL SAS, no organization systematically participated in the activities of the CLARIN ERIC infrastructure on behalf of the Slovak Republic. In the case the Slovak Republic will become an official member of this infrastructure, the establishment of a consortium could be considered. The consortium would cooperate with relevant specialized workplaces from the Institute of Informatics SAS, Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava and Technical University in Košice.

CONTACT DETAILS

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Mária Šimková, Slovak National Corpus SNC LSIL SAS, maria.simkova@korpus.juls.savba.sk Deputy Head of Department.

DARIAH-EU

www.dariah.eu

DARIAH ERIC

Digital Research Infrastructure for the Arts and Humanities

EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

The DARIAH infrastructure aims to develop, maintain and operate infrastructures to support ICT-based research practices and to support researchers in their use to build, analyse and interpret digital resources. It is a network of people, expertise, information, knowledge, content, methods, tools and technologies from individual member countries. In cooperation with research communities, areas and information on research results are expanded, and compliance with best practices, methodological and technical standards is ensured.

ACTIVITIES

The connecting elements within the DARIAH infrastructure activities are working groups specialized in various fields of art and humanities, e.g. music, history, literature, architecture, language. Activities include the joint sharing of digitized resources and tools for working with them,

their improvement and dissemination, joint research projects, publications, education and training. Through these activities, DARIAH supports the further development of research methods in the arts and humanities, documents the current situation, and supports the storage and processing of research data.

DARIAH operates through pan-European networks of virtual competence centres (VCCs) and their working groups. Each of the four VCCs is interdisciplinary, multi-institutional, international and focuses on a specific professional field. VCC1, e-infrastructure, is responsible for the technological foundations of DARIAH. It maintains a digital environment that allows data and tools to be shared and ensures the quality, sustainability and growth of technical services for the arts and humanities. VCC2 acts as the primary interface between the research and education communities. VCC3 deals with the management (Content Management) of research data in various phases from creation, development and dissemination to the pooling of scientific digital resources and results for reuse. VCC4 focuses on advocacy, influence and information, connection with key influential figures in the arts and humanities. Within this structure, DARIAH has more than 20 dynamic working groups to integrate national services into specific operational categories.

SOCIO-ECONOMIC IMPACT

DARIAH affects four interconnected areas: research, education, culture and the economy. Already, the information on existing digital resources available in one place has shown its effect – there is no need to digitize resources which have already been digitized, thus having a direct economic impact. The opportunity to share available digital resources in the field represents further benefits for streamlining research projects, but also for making teaching in the arts and humanities more effective and attractive. The consortium supports the sustainable development of digitally supported research in the arts and humanities by building services for researchers working using ICT-based methods. It helps them further develop their research and ensures the long-term availability of their work, thus directly contributing to the understanding of cultural, economic, social and political life in Europe and beyond. In addition, it offers teaching material as well as opportunities for teaching and developing digital research skills.

PARTICIPATING COUNTRIES

Leading country: FR. **Members:** AT, BE, CY, DE, DK, GR, HR, IE, IT, LU, MT, NL, PL, PT, RS, SI. **Cooperating countries:** BG, FI, HU, CH, NO, RO, SE, SK, UK.

PARTICIPATION OF SLOVAKIA

Position of Slovakia: unofficial observer

PREVIOUS ACTIVITIES OF SR

The Slovak Republic is not officially involved in activities within the DARIAH infrastructure, but from the workplace of the Slovak National Corpus of the Ľudovít Štúr Institute of Linguistics of the Slovak Academy of Sciences has taken several initiatives to establish a national infrastructure needed for a membership in DARIAH. To this end, the project of the Digital Humanities Centre of the Slovak Academy of Sciences was developed, which was discussed by the SAS board, and several presentation seminars and

subsequent bilateral negotiations were held. Contacts with the foreign community are maintained through individual consultations, especially with partners in the Czech Republic and Hungary (compare also involvement in the Central European regional hub https://www.dariah.eu/about/regional-hubs/), participation in international events and publishing activities.

PLANNED ACTIVITIES

Workshops on the possibilities of research and development in the field of DH have shown there is a great interest in this field, in particular on the part of various workplaces in the Slovak Academy of Sciences, universities as well as entities outside the academic sphere. There is a relatively sufficient number of digitized resources in the Slovak Republic, but they are not connected, there is no information about them, there are no technologies available for their use, so the final research efficiency of digitization remains very low. The members of the international evaluation panel also repeatedly drew attention to these facts when assessing the workplaces of the SAS. In the first phase, it would therefore be necessary to create the Digital Humanities Centre as a national hub, in which information on available data and technologies used in Slovakia would be systematically gathered, as well as directly existing digitized resources, the provision of which for such use would be legally protected. An initial consortium would be set up, which would include relevant entities from the SAS, university workplaces and the non-academic sphere, and which would be open to the involvement of other entities. All activities would be continuously presented, either at home (the Slovak Republic) or abroad. Discussions on topics regarding digital humanities at one of the universities would be appreciated.

BENEFITS FOR SLOVAKIA

Slovakia's involvement in this European infrastructure is relatively crucial for several reasons:

- science and research in Slovakia are chronically undersized, especially in the humanities,
- even though the means to digitize some resources have been found, there is a lack of means to develop / purchase the relevant software,
- the development of technologies is advancing at such a pace that it is highly inefficient for the Slovak Republic to try independent solutions in this area (these would prove unsustainable in the long run),
- history and art of the Slovak Republic are unique and could be better used in research within the EU.

FINANCIAL ASPECTS

The participation entails a direct payment in the amount approximately EUR 3,000 per year for the Slovak Republic, and further payments up to approximately EUR 25,000 per year for the Slovak Republic. The establishment of the Digital Humanities Centre of the Slovak Academy of Sciences as a national infrastructure will require significant initial investments (approximately EUR 1.5–2 million) and additional funds for subsequent operation and development (approximately EUR 700,000 per year).

PARTNERSHIP

In addition to LSIL SAS, the DARIAH infrastructure could involve workplaces from other SAS institutes, universities (especially Constantine the Philosopher University in Nitra), non-academic environment (University Library, etc.), Slovak National Museum, Slovak National Gallery and National Education Centre. Negotiations have already taken place with some of them, but there is a lack of support for systematic and coordinated work in this area and there is no coordinator (DH SAS Centre was considered). Several negotiations and efforts to create this national infrastructure (also towards the Ministry of Education, Youth and Sports of the Slovak Republic) have already taken place, but to no avail.

CONTACT DETAILS

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ESS ERIC

European Social Survey

www.europeansocialsurvey.org

EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

The European Social Survey is an international, comparative, social academic survey conducted every two years since 2001. It is coordinated by the Core Scientific Team, headed by Dr. Rory Fitzgerald of City University London. The basic objectives of the ESS include:

- to chart stability and change in social structure, conditions and attitudes in Europe and to interpret how Europe's social, political and moral fabric is changing;
- to achieve and spread higher standards of rigour in cross-national research in the social sciences, including for example, questionnaire design and pre-testing, sampling, data collection, reduction of bias and the reliability of questions;
- to introduce soundly-based indicators of national progress, based on citizens' perceptions and judgements of key aspects of their societies;
- to undertake and facilitate the training of European social researchers in comparative quantitative measurement and analysis;
- to improve the visibility and outreach of data on social change among academics, policy makers and the wider public

ACTIVITIES

Every two years, empirical data are collected on representative samples of the population of the participating countries using a standard methodology of around 300 questions, which consists of two parts: i) the basic module contains items that are constantly repeated in order to analyse trends; ii) the rotating modules are specific and their inclusion in the questionnaire is decided by the Scientific Advisory Board of the project in the competition of international teams. ESS topics cover a wide range of issues, e.g. civic participation and perception of democracy, family and working life, personal and social well-being, attitudes towards aging, trust in social institutions, attitudes towards climate change. The data collected are processed by the NSD Norway and the resulting databases of the implemented ESS rounds are freely accessible to all interested parties. As of April 2020, the project had 159,239 registered data users from more than 240 countries. The number of data users from Slovakia increased to 490.

SOCIO-ECONOMIC IMPACT

The ESS is intended primarily for the academic community. However, ESS data are also used by the European Commission, the European Parliament, the governments of the participating countries, Eurostat and the statistical offices of the countries as thematic reports on the state of society and serve as a source of information in policy-making at different levels of government. The ESS transfers knowledge directly to policy makers and holds seminars in the European Parliament, some national parliaments, the OECD, the European Commission and elsewhere.

COUNTRIES PARTICIPATING IN THE ESS ROUND 9

Leading country: UK. **Member countries:** AT, BE, BG, CY, CZ, DE, EE, FI, FR, HU, IE, IS, IT, LT, LV, NL, NO, PL, PT, SE, SI, SK. **Observers:** CH. **Visiting countries:** AL, DK, ES, IL, ME, RS.

PARTICIPATION OF SLOVAKIA

Position of Slovakia: member

WWW.EUROPEANSOCIALSURVEY.ORG/ABOUT/COUNTRY/SLOVAKIA
WWW.SVUSAV.SK/PROJEKTY/EUROPSKA-SOCIALNA-SONDA

PREVIOUS ACTIVITIES OF SR

Out of the nine rounds of the ESS so far, the Slovak Republic participated in six. In 2018, the Ministry of Education, Youth and Sports signed an agreement with the ESS ERIC consortium on compliance with the Deed of Adherence, paid a membership fee and thus, the Slovak Republic became a full member of the ESS ERIC. At the same time, the Ministry of Education, Youth and Sports provided funding for the implementation of the ESS Round 9 in the Slovak Republic (2018-2019) and ESS Round 10 in the Slovak Republic (2020-2021). A review of the publication „European Social Survey (ESS) Round 9 in Slovakia" was reviewed by national coordinators Denisa Fedáková and Michal Kentoš.

PLANNED ACTIVITIES

The role of the national teams is to implement the ESS rounds in their country according to a uniform prescribed procedure. The tasks of the national team in the Slovak Republic are performed by the Institute of Social Sciences CSPV SAS (ISS CSPV SAS). The Social Psychological Sciences Centre of the Slovak Academy of Sciences has created personnel and material conditions for the implementation of this long-term, large-scale and demanding project (3 organizational units based in Bratislava and Košice). Preparations are currently underway for the ESS Round 10, under which consultations and translations of country-specific variables, methodology, a representative sample selection plan approved by the team of experts and the selection process for the empirical data collection agency were discussed and approved. The data collection will take place using tablets (technology), the preferred method of data collection is personal interviews in strict compliance with COVID-19 guidelines. Video chats are scheduled as an alternative way to collect data.

BENEFITS FOR SLOVAKIA

The main output of the ESS are databases, which have so far been used by 490 users in the Slovak Republic (April 2020), mainly from the academic sphere (more than 80%), but also from government institutions, the private sector and the media. The benefits of the project can be seen in the comparative nature of data (comparison of the situation and trends in the monitored topics in Slovakia and other countries), the possibility of their generalization (thanks to representative population samples), and top methodology used (social surveys try to implement technical standards created in ESS).

FINANCIAL ASPECTS

ESS rounds are implemented in two-year cycles. The financial requirements under the two-year period: (i) ensuring and implementing all procedures related to data collection; (ii) payment of the membership fee. According to the Statute of the ESS (August 2018), the membership fee for the years 2018-2021 will remain the same (for the Slovak Republic it amounts to EUR 21,855 per year). The budget for two years of implementing one round of the ESS at national level amounts to EUR 208,300, with increasing demands on the quality of the sample and the sample size (currently the sample size is 3,801 respondents).

PARTNERSHIP

When implementing the project, the national team cooperates and plans to cooperate with other SAS organizations, in particular the Statistical Office of the Slovak Republic, the Science and Research Section of the Ministry of Education and Research, the UPJŠ Faculty of Arts in Košice (lectures, supervision of diploma and dissertation theses using ESS data). The ESS national team succeeded in an international competition and successfully implemented a pilot project under ESS Round 9. The ESS national team is currently working on the project „Electronic Questionnaire Device".

CONTACT DETAILS

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Mgr. Michal Kentoš, PhD., ESS coordinator; kentos@saske.sk

PRACE

Partnership for Advanced Computing in Europe

www.prace-ri.eu

EUROPEAN LEVEL

INFRASTRUCTURE DESCRIPTION

PRACE is an international non-profit association (AISBL) based in Brussels, founded with the support of the European Commission in 2010. It currently brings together 26 Member States, whose representative organizations form a pan-European High Performance Computing Infrastructure (HPC). Since starting the 2017 stage (PRACE-2), up to five members (Germany, France, Spain, Switzerland and Italy) has been providing the highest performance computers infrastructure TIER-0 (hereinafter referred to as HM Hosting members) to other member (in the amount of approximately 2 billion core hours under one call) (see activities) on 7 systems (see http: //www.prace- ri.eu/prace-resources/)

ACTIVITIES

Members of PRACE are able to use resources and services of this infrastructure to design state-of-the-art scientific and technical computing applications for scientists researching any scientific discipline. To do so, it is necessary to submit an application for the allocation of machine time under a specific call (issued approx-

imately twice a year). Machine time is allocated exclusively on the basis of the scientific quality of the projects, which is assessed by the „Scientific Selection Committee". The Commission evaluates the technical possibilities of the project and allocates machine time on individual systems. PRACE also seeks to support HPC users in the industry through various initiatives. It is very interested in improving the energy efficiency of computing systems and thus reducing impact on the environment. Close cooperation with the ongoing EuroHPC initiative is expected in the future.

SOCIO-ECONOMIC IMPACT

The costs of providing PRACE infrastructure, including staff and operating costs, amounted to EUR 600 million in 2010-15, and approximately EUR 120 million per year since then. Since its inception, PRACE and its members have been supported by the European Commission through FP7 and H2020 projects - PRACE-1IP, 2IP, 3IP, 4IP and currently PRACE-5IP (subsidies in the amount of EUR 97M). The consortium of beneficiaries consists of PRACE members, while the share of the allocated funds reflects i) the amount of the non-monetary contribution mentioned above; (ii) the principle of equality (given the same basic membership fee).

PARTICIPATING COUNTRIES

Leading countries: FR, DE, IT, ES, CH. **Member countries:** AT, BE, BG, CY, CZ, DK, EL, FI, HU, IE, IL, LU, NL, NO, PL, PT, SE, SI, SK, TR, UK. **Observers:** RO, HR.

PARTICIPATION OF SLOVAKIA

Position of Slovakia: member

WWW.SIVVP.SK

PREVIOUS ACTIVITIES OF SR

In 2013, the Slovak Republic was admitted to the PRACE as an observer, and became a member country with full rights at the 14th meeting of the PRACE Council in Barcelona, 16 October 2014. The Computing Centre of the Slovak Academy of Sciences (since 05/2018 a separate organizational unit of the Centre of Joint Activities of the Slovak Academy of Sciences - hereinafter referred to as the CC SAS) became the representative of the Slovak Republic in PRACE as the coordinating workplace of high-performance computing infrastructure in the Slovak Republic. Since the Slovak Republic became a member of

PRACE, the CC SAS has been actively involved in PRACE projects financed under the calls H2020 of EU programs, namely PRACE-4IP (2015-17), PRACE-5IP (2017-19). These activities include, in particular, the preparation of scientists for HPC computing, the adaptation of software necessary for the computers of the future and the gradual integration of SIVVP systems into the PRACE infrastructure at the TIER-1 level.

PLANNED ACTIVITIES

Activities referred to above will continue. Participation in the PRACE-6IP (starting on 1 January 2019 (the Agreement has already been signed) as well as in other activities directly coordinated by the PRACE Council are to begin soon.

BENEFITS FOR SLOVAKIA

The main benefit is the ability to obtain high value machine time on a state-of-the-art HPC infrastructure. In 2018, the Slovak Republic achieved its first success, when the project with 35% of Slovak researchers was allocated machine time in the amount of approx. 0.5 mil. EUR. Thanks to the membership in PRACE, the Slovak representative and its partners from the Slovak Republic are able to participate on consortium projects under EU programs (H2020). The current subsidy allocated for the Slovak Republic in 2015-18 amounted to EUR 400,000, i.e. about 100,000 EUR per year.

FINANCIAL ASPECTS

In its first phase (2010-2016), PRACE was governed by (i) the original "Initial Period Agreement" signed by the 16 founding members; ii) the Statute; iii) and since 2011 by the Rules of Procedure of the PRACE Council. In the first stage, a single basic membership fee was set at EUR 60,000 per year for maintaining the secretariat. This fee was reduced at the time of Slovakia's accession to PRACE in 2014 (temporarily) to EUR 40,000. In the first stage, HMs provided machine time worth EUR 100 mil. at the highest level of HPC TIER-0. For the second stage of PRACE 2.0 (since 2017), a resolution was approved according to which members should contribute to the operation of TIER-0 infrastructure (membership fee is now calculated based on GDP). Since 2019, PRACE AISBL thus provided up to EUR 3.3 mil to fund 6-member High Level Support Teams (HLSTs) to be established at HMs. The estimated minimum and maximum annual membership fee for the years 2019-2023 under the current rules is EUR 69,234 - 89,234. The membership fee is composed of a basic membership fee (EUR 40,000 - 60,000 per year) and a PRACE2-HLST contribution (EUR 29,234 per year). Slovakia's membership fee may be amended as soon as 2021 due to the increase in the GDP. Membership fees may get reduced provided new members will join.

PARTNERSHIP

According to the PRACE statute, one representative organization which coordinates high-performance computing within the academic sphere was chosen for each member country. SR is represented by the CC SAV. Any institution in the Slovak Republic (or its employees), including industrial partners, can participate in activities and calls for the allocation of machine time on PRACE infrastructures. These include universities and SAS organizations that currently use the infrastructure of the SIVVP, especially the faculties of the Slovak University of Technology, Comenius University, Pavel Jozef Šafárik University, Technical University in Košice, University of Žilina, Matej Bel University, Institute of Physics SAS, Institute of Experimental Physics SAS, Institute of Inorganic Chemistry SAS, Institute of Chemistry SAS, Centre for Plant Biology and Biodiversity SAS.

CONTACT DETAILS

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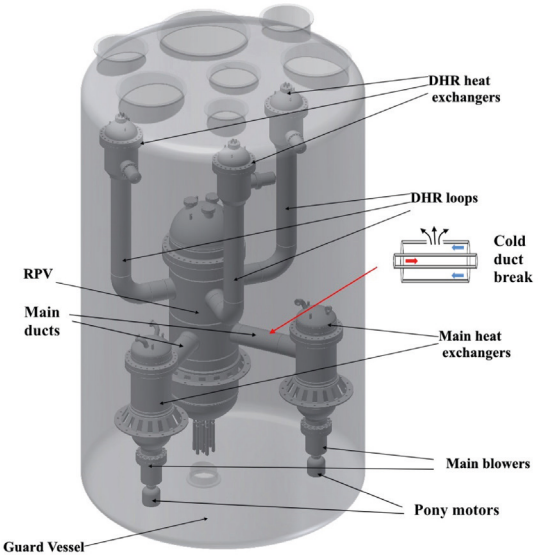
4.2 4.2UPCOMING ESFRI PROJECTS IN THE SLOVAK REPUBLIC

The ESFRI Roadmap is an ongoing process. The future Roadmap will be published in 2021. The preparation of project proposals for the ESFRI Roadmap is a long-term process the related activities already underway. Based on the current knowledge of some preparation processes, it can be stated that the Slovak scientific and professional community is taking part in the preparation of the following proposals for European infrastructures:

- ALLEGRO – Gas Cooled Fast Reactor Demonstrator (Energy)
- EMP - European Microkelvin Platform (Energy)
- UNIVNET - University and Industrial Research and Education Platform of the Recycling Society (Energy)
- EIRENE – European EnvIRonmental Exposure Assessment NEtwork (Environment)
- BBMRI-ERIC - Biobanking and Biomolecular Resources Research Infrastructure (Health and Food)
- FNH-RI – Food, Nutrition and Health Research Infrastructure (Health and Food)
- MEDem – Monitoring Electoral Democracy (Social and Cultural Innovations)
- GUIDE – Growing Up in Digital Europe: EuroCohort (Social and Cultural Innovations)

ALLEGRO – Gas Cooled Fast Reactor Demonstrator (Energy)



The main goal of the prepared ALLEGRO research infrastructure (coordinated by the Slovak Republic) is research, development, implementation and operation of the ALLEGRO facility, representing a prototype of a fast, gas-cooled, fourth-generation nuclear reactor. The result of the ALLEGRO research infrastructure will be a commercially usable GFR project in various forms (e.g. a small modular reactor, etc.), including related technologies for the use of high-potential energy. The Slovak industry will be able to prove its skills and knowledge in the construction of nuclear units.

The construction of the ALLEGRO research infrastructure in Slovakia will positively affect the technical development and

economics of Slovak research and production organizations during the entire research period in the design as well as unit production stages. In the coming decades, the Centre will be a driving force for cutting-edge research and technology.

The acquired know-how in the field of construction and operation of fast reactors will place Slovakia among the developed countries in the field of nuclear technologies and will enable Slovak companies to participate in the construction of new reactors in the EU and across the world. The outputs of the project may facilitate the direct production of new materials and equipment that will also be used outside the energy sector.

Leading country: HU. **Founding members:** CZ, SK, FR, DE, PL.

CONTACT DETAILS

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EMP – European Microkelvin Platform (Energy)

emplatform.eu

The European Microkelvin Platform is an advanced European research infrastructure in the field of ultra-low temperature physics and technology and extremely sensitive measurement techniques, focusing on quantum technologies and quantum materials. The European European Microkelvin Platform is a consortium of 17 leading European academic, technological and industrial institutions active in the field of ultra-low temperature physics and technology (http://emplatform.eu). The EMP has been established in 2014 following the Mikrokelvin project (EU FP7 project) in 2009 - 2013. In the following years, it gradually formed and grew into the European Micro Kelvin Platform - with the ambition of becoming“ a European laboratory of ultra-low temperatures“. On 4 January 2019, the EMP was awarded a Horizon 2020 project under the Call-H2020-INFRAIA-2018-1 Integrating Activities for Advanced Communities worth approx. EUR 10 million, a significant part of which will be used to finance external users‘ access to EMP. The Slovak partner Centre for Low Temperature Physics at the Institute of Experimental Physics of the Slovak Academy of Sciences will receive more than EUR 1 million. The EMP project (and the EMP consortium) is coordinated by Prof. Christian Enss from the



University of Heidelberg (Germany). The core of the EMP consortium consists of 8 top European academic institutions providing their experimental laboratories to external users. Together with the Košice Center for Low Temperature Physics, the core of the EMP consortium consists of: Aalto University (Finland), Basel University (Switzerland), CNRS Grenoble (France), Heidelberg University (Germany), Lancaster University (UK), Royal Holloway University London (UK) and Vienna University of Technology (Austria). EMP consortium technology partners: Physikalisch - Technische Bundesanstalt, Berlin (Germany), VTT - Technical Research Centre of Finland (Finland) and Chalmers Technical University (Sweden) and industrial partners: Basel Precision Instruments GmbH (Switzerland), Bluefors Cryogenics Oy (Finland) , CryoConcept (France), Leiden Cryogenics (Netherlands), Magnicon GmbH (Germany) and Oxford Instruments (UK). These form the basis for the use of technological innovation and the transfer of scientific and technical results into practice. The EMP consortium aims to explore new phenomena, materials and nanotechnologies that are also key to the European Commission's recently launched Quantum Technology Flagship initiative. Within the consortium, new technology and new measurement methods will be developed and the implementation of experiments will be extended to the area of ultra-low-nanokelvin temperatures. In addition to the joint scientific research activities of the consortium, an important pillar of the project is the provision of access to the top European research infrastructure made up of EMP as a European laboratory of ultra-low temperatures for external users. Justification: This forthcoming project is one of the major ESFRI initiatives.

PARTICIPATING COUNTRIES

Member countries: FR, FI, UK, DE, AT, CH, SE, SK, NL.

CONTACT DETAILS

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UNIVNET - University and Industrial Research and Education Platform of the Recycling Society (Energy)

univnet.sk

The main goal of the UNIVNET project, which brings together a critical mass of research, development and application potential in the Slovak Republic, is to focus on new technologies and techniques for effective waste recovery, especially in the automotive industry. Relevant institutions such as the Slovak University of Technology in Bratislava, the University of Economics in Bratislava, the Technical University in Košice, the University of Žilina in Žilina and the Technical University in Zvolen are currently involved in the project. In the following period, the project intends to expand its activities by reaching out to foreign partner institutions with the aim of establishing a distributed research infrastructure under which the Slovak Republic will be a founding member and leader of the new research infrastructure within ESFRI.

PARTICIPATING COUNTRIES

Founding members: SK.

CONTACT DETAILS

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EIRENE – European EnvIRonmental Exposure Assessment NEtwork (Environment)

EIRENE aims to build a Europe-wide platform to assess environmental exposure and its potential impacts on human health, using existing experimental capabilities, monitoring and biomonitoring programs, analytical laboratories, information databases and by promoting scientific excellence, it will also focus on collection, analysis, interpretation and implementation of harmonized and validated outputs. The platform will enable the development of improved and harmonized methods for sampling and analysis, data management and the introduction of new validated exposure and impact biomarkers. Knowledge gained will enable better assessment and management of chemicals risks, informed decision-making and policy-making in the environment, health and food safety sectors in order to improve the protection of the health of EU citizens. The proposal for the inclusion of EIRENE in the ESFRI Roadmap was submitted by the Czech Republic in 2018, the proposal was not supported, but after incorporating comments and finalizing some parts, the proposal was re-submitted to be included in the next ESFRI Roadmap update in 2021. A research consortium of the Slovak Medical University in Bratislava, Comenius University in Bratislava and the Slovak University of Technology in Bratislava participates in the preparation process on behalf of the Slovak Republic.

PARTICIPATING COUNTRIES

Founding members: SK.

CONTACT DETAILS

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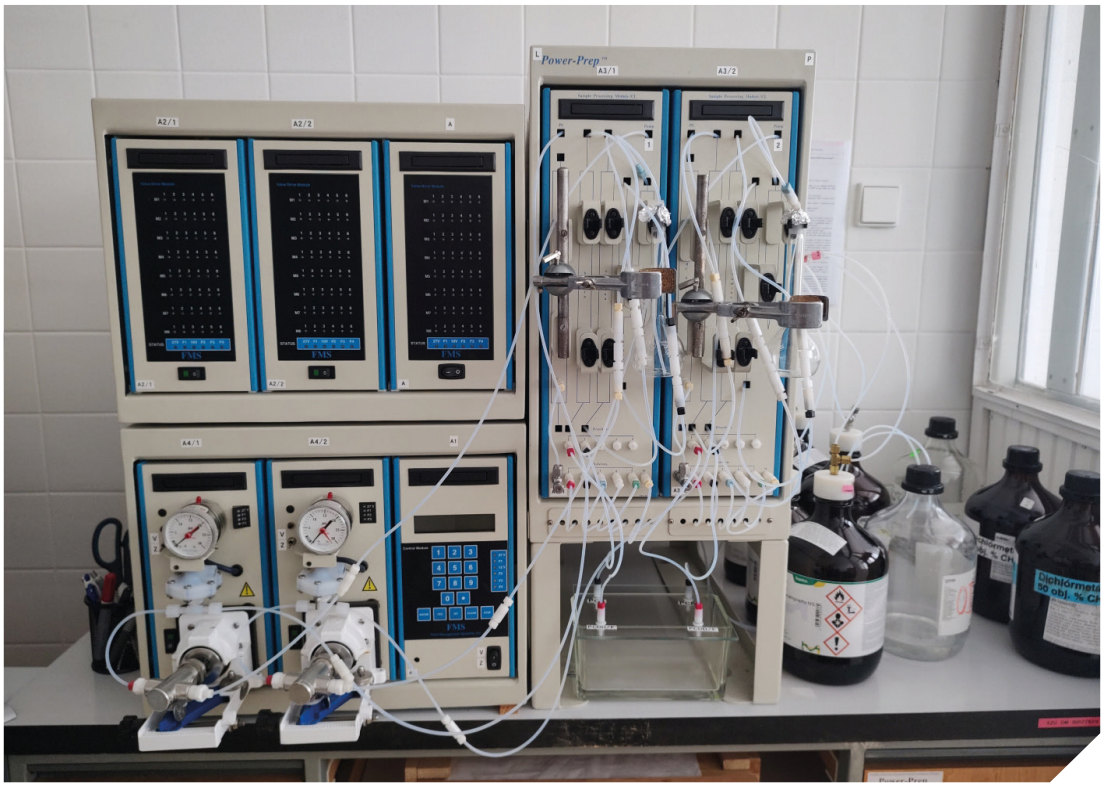

PowerPrep - purification of extracts

BBMRI-ERIC - Biobanking and Biomolecular Resources Research Infrastructure (Health and food)

bbmri-eric.eu

The biomedical environment of the Slovak Republic necessarily requires a basic systemic and internationally standardized comprehensive system for the development of biobanks with a direct link to biomedicine - a systemic biobank infrastructure including the access to the pan-European biobank consortium Biobanking and Biomolecular Resources Research Infrastructure (BBMRI-ERIC). The need for a modern biobank system for biomedical research and development stems from the Summary Report of the Entrepreneurial Discovery Process (hereinafter referred to as EDP) Domain no. 4 Smart Specialization RIS3: in the Implementation Plan of the Research and Innovation Strategy for Smart Specialization of the Slovak Republic entitled „Public Health and Medical Technology", where the interviewed organizations identified this area as one of the most important for the development of excellent biomedical research in the Slovak Republic.

Biobanking, a sophisticated, highly organized system of long-term storage of biological material with relevant clinicopathological, epidemiological and biomolecular information, is a prerequisite for quality biomedical research and development. The system is also important in obtaining information on disease biomarkers and discovering new target molecules - the "targets" in the development of innovative medicines. The absence of a biobank infrastructure limits the biomedical research and development due to the lack of high-quality and validated samples of biological material crucial for this type of research. This system interlinks all crucial processes - from informing the healthy population and patients and obtaining their consent to the donation of biological material, data collection, collection of biological material, storage and warehousing, quality control, cataloguing, accessibility, processing to distribution and classification of samples to the biobank system centres by type. At present, it is not possible to develop excellent biomedical research that is competitive on an international scale without an established system of national biobanks. In accordance with this activity, the Ministry of Health of the Slovak Republic (hereinafter referred to as the "Ministry of Health of the Slovak Republic") through the Institute of Research and Development (hereinafter referred to as the "IRD") created a working group in 2019 the aim of which is to prepare a draft amendment to Act no. 576/2004 Coll., Act no. 578/2004 Coll. on health care providers, health care workers, professional organizations in health care and on the amendment of certain laws, as amended (Act No. 576/2004 Coll. and Act No. 578/2004 Coll.), Decree of the Ministry of Health of the Slovak Republic No. 84/2016 Coll., which establishes the defining features of individual types of medical facilities (Decree of the Ministry of Health of the Slovak Republic No. 84/2016 Coll.), on biomedical research and definition of the biobanks and biobanking, issuing a permit for the operation of a biobank and minimum requirements for staffing and material and technical equipment of the biobank in order to implement biobanking in our legislation.

This initiative in the field of oncology is reflected in the Action Plan No. 5 of the National Oncology Program 2018-2020 and also in the support provided by the Ministry of Health of the Slovak Republic / IVV in the development of biobank infrastructure at the National Oncology Institute in Bratislava, which began in 2019 (and is planned to continue well into 2020). This form of funding (from national sources) also creates synergies within the project of building a national biobank at the Jessenius Faculty of Medicine in Martin and Comenius University in Bratislava, entitled „Establishment and operation of

biobank infrastructure in accordance with international standards with direct follow-up to research and development in this area ", which is to be funded (in case of contracting) from the resources of the European Structural Funds, specifically the Operational Program Research and Innovation (hereinafter referred to as" OPVaI "), which in accordance with Government Resolution no. 522 of 23 October 2019 merged with the Operational Program Integrated Infrastructure (hereinafter „OP II") within the programming period 2014-2020. The Ministry of Health of the Slovak Republic / IRD, which is a partner in this project MH SR / IVV, participated in the preparation and creation of both the project plan and the project itself. The project was submitted to the Research Agency at the Ministry of Education, Science, Research and Sports of the Slovak Republic in December 2019. As part of the event International Clinical Trials Day 2019 (Slovak ICTD 2019), which took place on May 31, 2019 under the auspices of the Ministry of Health of the Slovak Republic / IRD in the context of the V4 Presidency of the Slovak Republic (the then BBMRI General Director Eric Steinfelder also attended the event), the conditions of the entry of the Slovak Republic into the BBMRI-ERIC consortium in 2020/ 2021 were discussed. This strategy reflects the long-term initiative of the Ministry of Health of the SR / IRD to establish a systemic biobank platform in Slovakia (see references) and link it with European research infrastructures. The biobank platform would primarily support the development of innovative diagnostics and innovative treatments for our patients, and thus the competitiveness of Slovak applied biomedical research, as well as the overall development of the knowledge economy in the Slovak Republic and its diversification.

PARTICIPATING COUNTRIES

Member countries: NO, FI, SE, CZ, EE, LV, PL, DE, UK, BG, NL, IT, AT, CZ, BG, GR, MT.
Potential members / observers: FR, CH, TR, SK, CY.

CONTACT DETAILS

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FNH-RI – Food, Nutrition and Health Research Infrastructure (Health and food)

Within the European Research Area, in coordination with Wageningen University & Research in the Netherlands, the FNH-RI research infrastructure (https://fnhri.eu) is being formed. Its aim is to unite the most important research organizations focused on food, nutrition and health research.

FNH-RI is based on the need to improve the health of the population by improving their nutrition – preference of local food and increasing the quality, safety, production and competitiveness of Slovak food producers. The National Platform AgroBioFood Nitra and its members aim at establishing a cooperation between the subjects of the „knowledge triangle" to connect education, research and business to create conditions for effective information sharing.

The aim is to create a digital infrastructure that will allow researchers to connect and use research data gathered from public, private and consumer sources. In September 2020, the FNH-RI applied for inclusion in the European Research Infrastructures Roadmap ESFRI Roadmap 2021. Given the high level of preparedness and presence of a complementary national scientific and professional community in this field, the Slovak Republic has the opportunity to become one of the founding Member States (including Denmark, Italy, the United Kingdom, Northern Macedonia and Spain) of this European research infrastructure along with the Netherlands. The Slovak University of Agriculture in Nitra and the National Agricultural and Food Centre participate in the activities of the platform. The institutions cooperate with business entities and innovation policy makers in the agri-food sector within the AGROBIOFOOD platform (http://bioeconomy.sk/platformy-a-siete/agrobiofood-nitra/.

The AgroBioFood Nitra national platform was established in 2016 on the basis of a Memorandum of Cooperation concluded between the Slovak University of Agriculture in Nitra, the National Agricultural and Food Centre and the Bioeconomy Cluster. FNH-RI will provide services to scientists aimed at data generation and sharing. The emphasis is placed on the collection, integration and standardization of data, information, knowledge and expertise of consumers, public and private stakeholders. The scientific services that FNH-RI will provide will enable authorities, policy makers, NGOs, the food industry, farmers and consumers to make responsible decisions and choices for the benefit of the entire food system. FNH-RI will thus be ready to address current and future scientific issues.

The FNH-RI will enter its implementation phase in 2025-2029 and will develop new and clear research technical standards for a sustainable food supply system and an understanding of consumer behavior in the areas of food, nutrition and health. FNH-RI will assist in the transition from the current unsustainable food system to a sustainable and healthy food system.

PARTICIPATING COUNTRIES

Leading country: BE. **Founding members:** UK, NL, DK, IT SK.

CONTACT DETAILS

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MEDEM – Monitoring Electoral Democracy (Social and Cultural Innovation)

monitoringdemocracy.eu

MEDem aims to facilitate and stimulate innovation in the study of electoral democracy and study elections in their broad social context of electoral behavior, elites, parties and governments, as well as the media in the broadest sense by collecting and pooling data to enable such research. The principles of building this infrastructure were formulated in the project of the 7th EU Framework Program „Providing an Infrastructure for Research on Electoral Democracy in the European Union" (PIREDEU). The proposal will be submitted by some of the following countries: Sweden, Denmark, France and Germany, a final decision has not yet been made. The Institute of European Studies and International Relations of Comenius University in Bratislava and the Institute of Sociology of the Slovak Academy of Sciences are participating in the preparation on behalf of the Slovak Republic.

PARTICIPATING COUNTRIES

Leading country: AT. **Potential members / observers:** IT, CZ, SK, PT, ES, SE, CH, BE, HR, DK, DE, FR.

CONTACT DETAILS

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GUIDE - Growing Up in Digital Europe: EuroCohort (Social and Cultural Innovation)

In 2020, a new European consortium of research institutes was set up under the leadership of University College Dublin in Ireland. The consortium presented a new research infrastructure called Growing Up in Digital Europe (GUIDE): EuroCohort to ESFRI Roadmap 2021. The aim of the GUIDE research infrastructure is to carry out a Europe-wide comparative longitudinal research on the quality of life of children and young people (newborns to the young people aged 25). The aim is to provide important data and to map the development of human life since birth. The aim of the research infrastructure is to provide high-quality research data that will enable better social policies targeting children, youth and families to be adopted based on the evidence-based research. University of St. Cyril and Methodius in Trnava (UCM) coordinated the establishment of a national consortium - a national research infrastructure in the field of research into the quality of life of children and young people in Slovakia and Europe. Several academic and research institutes in Slovakia have shown interest in becoming part of the national research infrastructure, as evidenced by the Agreement on the Establishment of a Consortium concluded between: University of Ss. Cyril and Methodius in Trnava, Slovak Academy of Sciences in Bratislava, Matej Bel University in Banská Bystrica, University of Prešov, IUVENTA - Slovak Youth Institute.

PARTICIPATING COUNTRIES

Leading country: IE. **Potential members / observers:** UK, DE, PT, ES, SK, HU, HR, GR, EE, LV, GE.

CONTACT DETAILS

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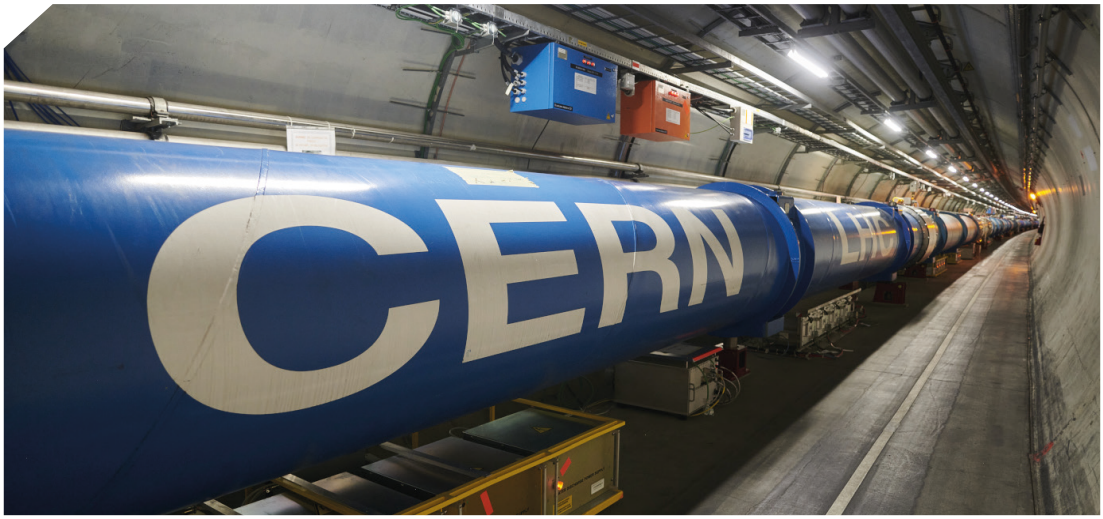
4.3 COMPLEMENTARY INTERNATIONAL RESEARCH INFRASTRUCTURES

When creating and implementing the national strategy in the field of research infrastructures, it is necessary to take into account the material, organizational and financial links to existing and established physical as well as virtual R&D clusters, as these will be linked to individual ESFRI priorities. For this reason, in addition to ESFRI projects and infrastructures, other large research infrastructures of which the Slovak Republic is a member and which significantly contribute to the formation of the European Research Area, the acquisition and transfer of knowledge and experience between the participating countries need to be included in the strategic management of research infrastructures. These are mainly the following research infrastructures:

- CERN – European Organization for Nuclear Research
- JINR - Joint Institute for Nuclear Research
- EMBL - European Molecular Biology Laboratories
- ICGEB - International Centre for Genetic Engineering and Biotechnology

CERN – European Organization for Nuclear Research

CERN (*Conseil Européen pour la Recherche Nucléaire* based in Geneva, Switzerland) is the most important international governmental organization in the field of research of elementary particles and the structure of matter and is a world leader in this field. Founded in 1954, it currently unites 21 member countries, with the Slovak Republic acceding to the agreement on 1 July 1993. CERN membership opens the doors to the most important laboratories in the world and top companies. The Slovak Republic, as a member country of CERN, is a co-owner of new technologies developed at CERN (especially computer codes, programs, libraries, IT, electron-



LHC dipole magnets

ics, cryogenics, CERN is a leader in the development of detectors for medicine, superconducting magnets, computer networks, the web was born at CERN). Thanks to its membership in this organization, the Slovak Republic participates through its experts in basic and applied research of world importance. Slovak companies (VVÚ ZŤS Košice and SES Tlmače) are also involved in the construction of CERN facilities, thus helping to educate experts in working with nuclear facilities. Slovak students, PhD students and young researchers work at CERN thanks to scholarships and research stays.

JINR - Joint Institute for Nuclear Research

The Joint Institute for Nuclear Research (JINR) in Dubna (Russian Federation) is an international intergovernmental organization founded on March 26, 1956 to unify the efforts and material potential of member states in research into the fundamental properties of matter. It is located in Dubna, Moscow region.

At present, the JINR has 17 regular member states - Armenia, Azerbaijan, Belarus, Bulgaria, the Czech Republic, Georgia, Kazakhstan, Cuba, Moldova, Mongolia, Poland, Romania, the Russian Federation, Slovakia, Ukraine, Uzbekistan and Vietnam. In addition, it has 6 associated members - Egypt,

South Africa, Hungary, Germany, Serbia and Italy. The Slovak Republic has been a full member of the JINR since 1 January 1993, but cooperation has already taken place within the former Czechoslovak Socialist Republic, which was one of the founding members of the JINR. Regarding participation in JINR activities and joint work, the Slovak Republic is one of the leading countries.

Cooperation between the Slovak Republic and the JINR is coordinated by the Committee for Cooperation between the Slovak Republic and the JINR, headed by its chairman, the Government Plenipotentiary for Cooperation between the Slovak Republic and the JINR. The mission of this Committee is to ensure cooperation between Slovak scientific and academic institutions and the JINR. The Committee is also an advisory body to the Government Plenipotentiary for Cooperation between the Slovak Republic and the JINR.

IBR-2 reactor

EMBL – European Molecular Biology Laboratory

Main laboratory and headquarters in Heidelberg

EMBL (*European Molecular Biology Laboratory*) is one of the world's leading research institutions and one of the European leaders in research in all areas of life sciences. It is a non - profit organization whose research institutes (Heidelberg - DE, Hinxton - UK, Grenoble - FR, Hamburg - DE, Monterotondo - IT) are publicly funded by 21 Member States. The Slovak Republic, thanks to the work of the Ministry of Education, Research and Sports of the Slovak Republic in 2014, together with Hungary and Poland, became a full member of this prestigious international organization in 2018.

EMBL research is currently conducted by approximately 85 independent groups covering a wide range of molecular biology. EMBL membership its offers the opportunity to use state-of-the-art equipment of the laboratories, drawn on funds (for PhD students) and join special international projects.

The most important EMBL's initiatives are ELIXIR at the Sanger Institute in Hinxton and Euro-BioImaging, which have been included in the list of major research infrastructures of European importance (part of the European Strategy Forum on Research Infrastructures (ESFRI).

ICGEB – International Centre for Genetic Engineering and Biotechnology

ICGEB (*International Centre for Genetic Engineering and Biotechnology*, based in Trieste, Italy) is an international organization dedicated to research and education in the field of molecular biology. It is a major international information science hub in the field of genetic engineering and biotechnology. Membership in this prestigious organization allows Slovakia to use modern methods, instruments, laboratories of molecular biology and biotechnology, as well as patents. In addition

to the Slovak Republic, another 82 countries are involved in cooperation with ICGEB. This international organization is represented on the territory of the Slovak Republic by the National Centre of the Institute of Neuroimmunology of the Slovak Academy of Sciences.

ICGEB's main activities include support for international cooperation in the development and use of genetic engineering and biotechnology, strengthening scientific and technological capacities, support for the application of genetic engineering and biotechnology to address economic and social practices, education and training for scientists and technologists, networking support national and supranational institutions in the field of genetic engineering and biotechnology.

ICGEB headquarters in Trieste, Italy

4.4 SIGNIFICANT NATIONAL RESEARCH INFRASTRUCTURES

The most important research infrastructures of the Slovak Republic include the following university science parks, research centres and centres of excellence along with their specializations and field of expertise:

- University Science Park STU Bratislava
- Comenius University University Science Park in Bratislava
- University Science Park for Biomedicine Bratislava
- Medical University Science Park in Košice (MediPark, Košice)
- University Science Park „CAMPUS MTF STU" - CAMBO
- University Science Park of the University of Žilina
- TECHNICOM University Science Park for Innovative Applications Supported by Knowledge Technologies
- ALLEGRO Research Centre
- Centre for Applied Research in New Materials and Technology Transfer
- Research Centre for Advanced Materials and Technologies for Current and Future Applications PROMATECH
- AgroBioTech Research Centre
- Research Centre of the University of Žilina in Žilina
- Martin Centre for Biomedicine (BioMed Martin)
- Centre for research and Development of Immunologically Active Substances
- Centre of Excellence for NPPC Animal Genetic Resources Research
- Centre of Excellence for Contaminants and Microorganisms in Food
- National Gene Bank of the Slovak Republic
- Centre of Excellence LignoSilva

National platforms such as groupings of key research and development institutions of the Slovak Republic in the relevant professional field and its complementary branches are an emerging type of research infrastructures.

In the conditions of the Slovak Republic, a university science park can be defined as a space (territory) usually in the physical vicinity of a university or SAS (or in the vicinity of their research institutes), in which the following conditions were created:

a. conditions for the implementation of applied research,
b. conditions facilitating the emergence of new businesses that are able to put the results of this applied research into practice,
c. conditions which support mutual interaction between these businesses and university workplaces/ SAS conducting applied research.

University science parks are research institutes of the best Slovak universities / SAS in which top applied research is carried out and the transfer of knowledge from the academic sphere to economic and social practice is ensured through the transfer of technology (licenses, spin-offs, other forms of knowledge processing). A prerequisite for the implementation of university science park projects is the applicant's partnership (established cooperation) with other universities and research organizations/ business entities (as recipients of research results). The aim is to ensure synergy of the best research capacities in the relevant research area. The cooperation takes place mainly in the area of the university science parks.

In this sense, a university science park is usually a complex project which:

- focuses on the systematic development of the territory of key scientific institutions,
- builds multi-purpose research buildings,
- creates space for brainstorming and for new innovative businesses to be conceived thanks to applied research,
- is well-managed and follows good practices recommended by renowned science parks abroad and which also ensures quality management and sustainability of the university science park,
- not only supports research and development, but also provides development impetus to the region.

Another tool for the development of research are also research centres and centres of excellence of departmental research institutions, which have semi-operational monitoring and verification capacities designed for the direct transfer of knowledge into practice. These experimental operations in departmental research institutions and private sector partners, e.g. in the agri-consumer sector, are the basis of the concept of so-called living labs. Their cooperation is developing within the framework of long-term strategic research projects under the Operational Program Research and Innovation (OPVAI - OPII).

Research centre projects are projects of a less complex nature, either in terms of territorial development or in terms of the breadth of their focus. The following types of projects are supported most often:

- top laboratories built in a specific field of science for the best research institutions,
- which aim to increase the quality and prestige of research and development in areas relevant to social and economic practice,
- which have high-quality, efficient scientific management, based on good experience in renowned research and development centres abroad and which

will ensure quality management and sustainability of the research centre,

- which will support the improvement of the interconnection of domestic and foreign research and will help Slovak institutions to become more actively involved in research activities and projects in the European Research Area.

A total of 14 projects were supported within the calls aimed at supporting the construction of UVP and VC, of which 7 were UVP and 7 were VC projects.

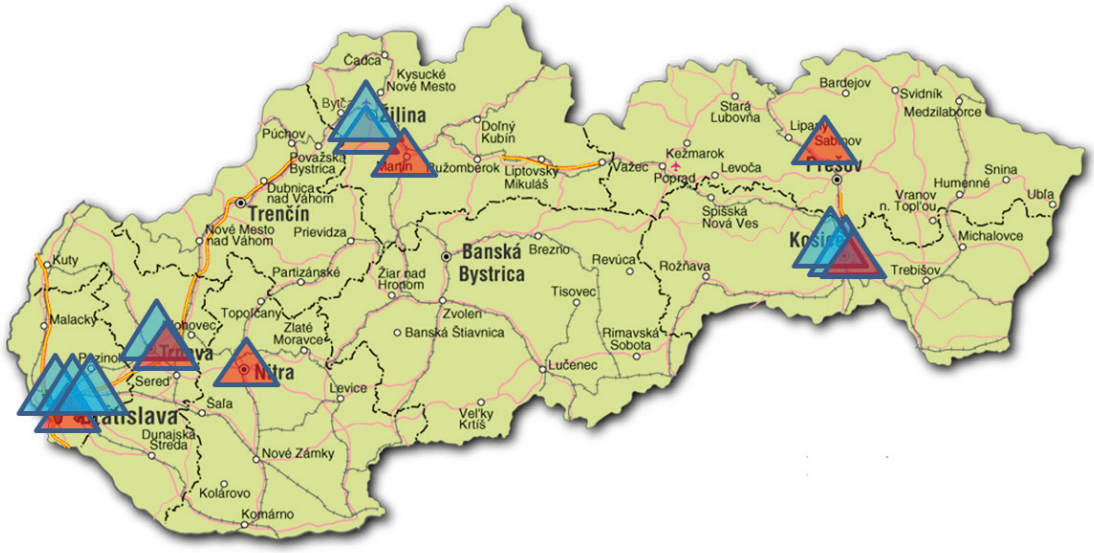


Figure 2 Territorial distribution of supported UVP and VC projects
Source: ITMS (developed by Grant Thorton)

An important prerequisite for the effective use of research and technical infrastructure built from public sources, e.g. within the framework of SF funds at SAS workplaces and universities, is the implementation of the necessary measures at the national level and the creation of a framework enabling the use of research infrastructure by the business sector for a fee, which will be defined on the basis of the I and II. Action Plan for the Implementation of the Roadmap of Research Infrastructures.

University Science Park STU Bratislava

Coordinator: Slovak Technical University in Bratislava
Partners: Institute of Electrical Engineering SAS, Institute of Inorganic Chemistry SAS

ITMS project code: 26240220084
Call code: OPVaV-2012/4.2/08-RO

Eligible project costs: 42,019,716.29 EUR
Project implementation: 04/2013 to 06/2015

Scientific fields: ICT, materials research and nanotechnology, biotechnology and biomedicine, agriculture and environment
Domains of smart specialization: Industry for the 21st Century, Public Health and Medical Technology, Healthy Food and Environment, Digital Slovakia and Creative Industries, Vehicles for the 21st Century
ESFRI: physical sciences and engineering, health and diet, environment
Project implementation location: Bratislava region

Main goal: Strengthening cooperation in research and development between the economic and academic spheres by creating a university science park focused on selected scientific disciplines.

SPECIFIC GOALS

1. Establishment and building of USP at STU Bratislava
2. Applied research
3. Support for the transfer of technology and knowledge into practice

STU's University Science Park specializing in information and communication technologies, electrical, chemical, engineering and construction industries and new industries using nanotechnologies and knowledge of industrial biotechnology.

LABORATORIES BUILT

- Physical properties of building structures laboratory
- Statics and dynamics of load-bearing structures laboratory
- Building materials laboratory
- Buildings for the protection of the territory and geohazards laboratory
- Modelling objects and phenomena in space laboratory

SELECTED TOP INFRASTRUCTURE

- **Auger electron spectrometer.** Specification: Equipment for sample and interface composition analysis. Schottky-type cold cathode electron gun. Acceleration voltage up to 30 kV. Hemispherical secondary electron analyser. Auger electron spectroscopy mapping of surface mapping (up to 2 x 2 cm) required.
- **Microscope.** Specification: cold cathode electron source microscope for maximum lateral resolution and minimum electron beam diameter. Device equipped with STEM Cs corrector.

Beam diameter on the sample - of the order of at least 0.1 nm. Resolution - under 1 Å. Acceleration voltage up to 200 kV

- **Equipment equipped with EDS system, EELS system.** Specification: Equipment for plasma sample cleaning, cryogenic ion beam sample cutting, possibility of vapor deposition of metal and aluminium layers is required for sample preparation. The device is fully controlled by a computer with "user friendly" software.
- **Equipment for the preparation of diamond nanostructures.** Specification: Diamond research equipment for large-scale plasma formation of thin films. It is actually a CVD (Chemical Vapor Deposition) system supported by plasma. Area of generated samples: 30 x 20 cm2. Substrate - sample system thickness up to 1 cm. An important part is the gas filling system - at least 4 channels for reactive gases and 2 channels for Ar and N2 are required.
- **Single crystal diffractometer** with Cu micro-focused X-ray source with optical focusing at the output and Mo micro-focused X-ray source. Specification: State-of-the-art four-circuit diffractometers with two X-ray micro-sources Ag (K-alpha) and Cu (K-alpha), Cu (detector) the most accurate measurement of Bragg diffractions at temperatures of 90 to 300 K. Suitable both for the study of experimental electronic

structure and protein structure. This is a project expenditure related to the lead partner.
- **Gas chromatograph** in conjunction with a high-resolution flow-through mass spectrometer (GC-HRTOF MS).

DEVELOPMENT TRENDS

The following development areas have been identified at the STU:
- Information and communication technologies:
- Virtual computing environment for data processing and electronic services - "Cloud computing" - and analysis of extensive data, including methods for "Data mining" and "Process mining"
- Collaborative programming in hierarchical teams, including remote collaboration
- Analysis, design and evaluation of user properties of software applications on computer systems, including mobile
- Mobile and fixed networks based on LTE, DVB and IP standards, applications for mobile and multimedia networks and systems
- Computer vision, computer graphics and interactive computer technology
- Design and testing of embedded systems on various platforms
- Modelling of objects and phenomena in space
- Electrical engineering, automation and control systems:
- Preparation, characterization and optimization of micro / nano-electronic structures and systems, mainly based on organic materials for applications in sensors and photonics
- Power engineering
- Electrotechnologies and materials with a focus on nuclear energy and technology
- Development, testing and measurement of microwave, optical sensor and communication systems for practical applications
- Industrial biotechnology:
- Development of new production strains of microorganisms and enzymes and their application in biocatalysis
- Biocatalysis and biotransformation of products
- Development and structural analysis of biomaterials
- Chemical engineering:
- New materials and advanced aluminium-based technologies
- Technological and material uses of biomass
- Regulation and control of chemical processes
- Advanced technologies focused on environmental aspects of chemical technologies / green chemistry
- Civil engineering:
- Systems for increasing the construction and ecological quality of buildings
- Methods of design of load-bearing structures in extreme situations
- Materials for progressive building structures and low-energy construction
- Integrated water resources management in the context of global change
- Methods of geodetic monitoring and modelling of objects and phenomena on the earth's surface

Comenius University Science Park in Bratislava

Coordinator: Comenius University in Bratislava
Project partners: Slovak Technical University in Bratislava, Institute of Zoology of the Slovak Academy of Sciences

ITMS project code: 26240220086
Call code: OPVaV-2012/4.2/08-RO

Eligible project costs: 41,906,375.70 EUR
Project implementation: 06/2013 to 06/2015

Scientific fields: biotechnology and biomedicine
Domains of smart specialization: Industry for the 21st Century, Public Health and Medical Technology, Healthy Food and Environment, Digital Slovakia and Creative Industries, Vehicles for the 21st Century
ESFRI: Health and food, Environment
Project implementation location: Bratislava region

Main goal: Establishment of the University Science Park at Comenius University with activities in the field of molecular medicine, environmental medicine and biotechnology

SPECIFIC GOALS

1. Establishment and management of USP at Comenius University
2. Applied research in molecular medicine, environmental medicine and biotechnology focused on transferable results
3. Construction of technical and research infrastructure of specialized workplaces of USP at Comenius University

The Comenius University Science Park in Bratislava is a specialized research and development department of the Comenius University focusing on biomedicine, environmental medicine and biotechnology.

LABORATORIES BUILT

- Proteomics laboratory
- Genomics laboratory
- Metabolomics laboratory
- Biotechnology laboratory
- Environmental Medicine laboratory
- Geological and geophysical systems
- GIS laboratory

SELECTED TOP INFRASTRUCTURE

- Spectral instruments and optical systems with accessories: A set of spectral instruments and optical systems such as UV-VIS spectrometers, fluorescence spectrometers, IR spectrometers, microscopes, fluorescence microscopes, DSC analysers, MS and ICP spectrometers and others, which are used for:
  - study of the structure of the monitored substances in the mixture of reaction products,
  - for the analysis of reaction products, metabolites, etc. of molecules using spectroscopic and optical methods,
- Liquid chromatographs with specific detection and accessories. A set of HPLC and UHPLC liquid chromato-

graphs with specific detection of MS, IR, DAD and others, which are used for: 1) preparation of pure fractions from a mixture of reaction products, 2) analysis of reaction products, metabolites, etc. of molecules using HPLC methods,

- Gas chromatographs with selective detection and accessories. A set of gas chromatographs with selective detection (MS, TOF and others), which are used for the analysis of reaction products, metabolites, etc. of molecules with sufficient vapor pressure for GC analysis,
- Unique and combined chemical analysis instrument systems with accessories. A set of unique state-of-the-art chemical analysis instruments and systems such as HPLC-MS / MS-tandems, HPLC-MS / TOF systems, GCx-GC-MS systems and more that are used for high-precision and high-resolution analysis of molecules up to 3000 AMU used as biomarkers.
- Standalone and combined molecular medicine instrumentation systems with accessories. A set of standalone state-of-the-art molecular medicine instruments and systems such as Microarray readers, Microplate detection platforms, Genome analysers, DNA scanners, cell sorters, cytometers, culture chambers and others used for analysis molecular structures in cells and their individual parts.

DEVELOPMENT TRENDS

The following development areas have been identified:

In the field of biomedicine:

- **Genomics and proteomics** for biomedical research at the level of world-renowned research laboratories - the laboratories include 2nd generation sequencers (NGS) based on Illumina technology, which is currently the best solution for determining genomic variability down to a single nucleotide

level. Utilization of biology-based procedures and methods in heterological experimentation and production of recombinant proteins and other biologically active substances with potential use in biotech - pharmaceutical industry; use and design of new expression systems, optimization of downstream processes, protein chip development, and the like.

- **Metabolomics** - is part of the so-called personalized medicine (21st century medicine), which focuses on the individualized approach to the search, prevention and therapy of disorders and diseases. The aim of research and development is to expand the existing knowledge in this area by focusing specifically on the preparation of comprehensive methods of search, diagnosis and / or screening of selected groups of human diseases.
- **New substances and materials for diagnostics** - laboratories studying new substances and materials for diagnostics focus on disseminating knowledge in the field of substances and materials used for research or diagnostic purposes, focusing specifically on use in molecular medicine (e.g. labelled substances and materials used as standards in biosensors, etc..).

In the field of environmental medicine:

- Biotic and abiotic factors and their impact - the aim is to develop methods and procedures for detecting, minimizing and preventing the negative effects and impacts of biotic as well as abiotic factors acting in anthropized ecosystems on public health.
- Geographic info-system and environmental health - the aim of the research is to use geographic information systems (GIS) technologies for integration, analysis and access to environmental data and public data on indicators and health status of the population, as well as development of IT tools to assess the impact of environmental risk factors on the health of the population.

In the field of biotechnology:

- design and selection of specific recombinant proteins and peptides with therapeutic potential (e.g. recombinant human growth hormone, recombinant human thrombin, specific proteases, peptides and industrially useful recombinant enzymes),
- construction of own expression systems for heterologous expression (production) of recombinant proteins and peptides,
- isolation of phages and creation of their collection usable in medical practice, as well as in the food industry,
- research in the field of phytoremediation and fixation of CO2 in biomass with the aim of its practical application of its results.

University Science Park for Biomedicine Bratislava

Coordinator: Slovak Academy of Science
Project partners: University of Economics in Bratislava, Comenius University in Bratislava, Institute of Experimental Endocrinology SAS, Institute of Experimental Pharmacology and Toxicology SAS, Institute of Experimental Oncology SAS, Institute of Measurement SAS, Institute of Molecular Physiology and Genetics SAS, Institute of Normal and Pathological Physiology SAS, Institute of Virology of SAS

Call code: OPVaV-2013/4.2/09-RO
ITMS project code: 26240220087

Eligible project costs: 39,547 160.10 EUR
Project implementation: 04/2013 to 12/2015

Scientific fields: biotechnology and biomedicine
Domains of smart specialization: Domains of smart specialization: Industry for the 21st Century, Public Health and Medical Technology, Healthy Food and Environment, Digital Slovakia and Creative Industries
ESFRI: Health and Food
Project implementation location: Bratislava region

Main goal: From the management of the University Science Park of Comenius University with activities in the field of molecular medicine, environmental medicine and biotechnology

SPECIFIC GOALS

1. Establishment and management of USP at Comenius University
2. Applied research in molecular medicine, environmental medicine and biotechnology focused on transferable results
3. Construction of technical and research infrastructure of specialized workplaces of USP at Comenius University

UVP BIOMED is the largest multidisciplinary biomedical research facility in Slovakia (more than 18,000 m2 of laboratory and office space) with a total capacity of more than 500 employees. Its construction began in 2013 and ended in December 2015 with the opening of the Pavilion of Medical Sciences as the main element of its infrastructure.

The main part of the UVP BIOMED infrastructure is the building of the Pavilion of Medical Sciences, in which SAS organizations operate directly with all their scientific, educational and administrative capacities and with instrumentation, which was largely built from structural funds projects, including UVP BIOMED. This gives UVP BIOMED a unique position among other university parks in the Slovak Republic and its sustainability.

All projects and scientific activities taking place in the workplaces of the partners operating in the Pavilion of Medical Sciences could not be carried out without UVP BIOMED, so the scientific research outputs of these partners are also the outputs of UVP BIOMED.

UVP BIOMED has top experts and instrumentation for research in the fields of oncology, genetics, molecular and cellular biology, biochemistry, physiology, toxicology, virology and clinical research.

EUR 39.5 million was invested in the construction of UVP BIOMED, of which more than EUR 33.6 million was paid from the operational program Research and Development and more than EUR 5.9 million was provided from the state budget.

LABORATORIES BUILT

- Laboratory of Diabetes and Metabolic Disorders
- Laboratory of Pharmacological Neuroendocrinology
- Laboratory of Cell Endocrinology
- Laboratory of Human Endocrinology
- Laboratory of Functional Neuromorphology
- Laboratory of Molecular Endocrinology
- Laboratory of Neurohumoral Regulation
- Stress Research Laboratory
- Metabolic Studies Laboratory
- Developmental Genetics Laboratory
- Laboratory of Neurobiology
- Laboratory of Developmental and Behavioral Toxicology
- Laboratory of Regulatory Mechanisms of the Cardiovascular System
- Laboratory of Integrative Neuroscience
- Laboratory of Bioorganic Drug Chemistry
- Cell Culture Laboratory

The following departments were built:

- Department of Muscle Cell Research
- Department of Cell Physiology and Genetics
- Department of Transport Proteins (OTP)
- Department of Pharmacology of Inflammation
- Department of Excitable Tissues
- Department of Cell Pharmacology
- Department of Optoelectronic Measurement Methods
- Department of Magnetometry
- Department of Theoretical Methods
- Department of Biomeasurements

SELECTED TOP INFRASTRUCTURE

- Triple quadrupole hybrid mass spectrometer combined with a linear trap for small molecule analysis. Hybrid mass spectrometer based on a triple quadrupole combined with a linear trap with a mass range of 5 - 2,000 amu. Ionization source. The system is equipped with an ionization source for ESI and APCI ionization. Ionization type change is achieved by changing ESI and APCI probes and vice versa, ESI and APCI probes are coded for automatic instrument recognition and parameter selection. Flow range for ESI without splitting: 5 - 3000 µl / min, flow range for APCI without splitting: 50 - 3000 µl / min. Drying gas temperature up to 750 ° C. The device has a direct short capillary-free interface between the atmospheric and the vacuum part (interface length <2 mm) The interface must remove the maximum neutral mass by means of a shielding gas flow.
- Advanced X-ray kit for the study of bionanomaterials and bionanstructures. Basic set for measuring small-angle X-ray scattering (SAXS, GISAXS) and diffraction (WAXS, GIWAXS) containing microfocused air-cooled X-ray radiation source, collimation system, vacuum experimental chamber, evacuated transport tubes and two-dimensional area detectors for SAXS, GISAXS, WAXS and GIWAXS measurements.
- Massive parallel nucleic acid sequencing system. Sequencing of small ge-

nomes, sequencing of gene sets, analysis of gene expression, sequencing of complete transcriptomes, the price is in accordance with the winning offer and the concluded contract.

- Fully digital, fluorescence-activated high-speed cell sorter with closed system signal detection. Four air-cooled lasers with non-linear excitation at wavelengths of 488 +/- 10 nm, 633 +/- 10 nm, 445 +/- 10 nm and 355 +/- 10 nm. 3. Possibility of extension by another 3 lasers to a total of 7 non-linear lasers.
- Device for combined sensing of fluorescent, luminescent signal in combination with micro CT. The system features a camera with a minimum quantum efficiency> 85% at 500 - 700 nm and> 30% at 400 - 900 nm, with a maximum pixel size of 13.5 µm, a minimum detectable radiation of 70 photons / s / sr / cm2, a field of view of at least 23 x 23cm, minimum pixel resolution of 20 µm, noise <3 electrons per bin = 1,2,4 and <5 electrons per bin = 8,16. The dark current of the system must be <100 electrons / s / cm2.
- Recombinant protein production systems, antibody production, development of immunotherapy. Target molecule / protein separation and purification - chromatographic system for automated, multistep protein purification process scale.

DEVELOPMENT TRENDS

The following development areas have been identified within the biomedicine USP Bratislava:

- technologies and services to support the health, active life, healthcare, diagnosis and treatment of the population,
- new opportunities for young people in a changing environment,
- promoting the health and quality of life of an aging population,
- research, development and implementation of new technologies in research, development and practice,
- importing the most modern technologies and know-how from abroad,
- intelligent technologies focusing on special medical procedures, chemical and pharmaceutical substances.

The socio-economic benefit of USP BIOMED lies mainly in the fact that it concentrates the scientific capacities involved in solving the problems of basic and applied research in the field of biomedicine. This research is primarily focused on modern diseases of civilization, such as cancer,

diseases of the cardiovascular system, metabolic disorders such as diabetes, obesity or immune disorders. Among other things, it focuses on the use of advanced therapies, e.g. using stem cells as well as the development of state-of-the-art diagnostic procedures using human genome sequencing and other molecular analyses.

University Science Park CAMPUS MTF STU – CAMBO

Coordinator: Slovak University of Technology in Bratislava Faculty of Materials Technology based in Trnava
Project partners: -

ITMS project code: 26220220179
Call code: OPVaV-2012/2.2/08-RO

Eligible project costs: 42 098 439,62 EUR
Project implementation: 03/2013 to 12/2015

Scientific fields: materials research and nanotechnology, ICT
Domains of smart specialization: Industry for the 21st Century, Vehicles for the 21st Century, Health Food and the Environment
ESFRI: physical sciences and engineering
Project implementation location: Trnava region

Main goal: Construction of a modern and unique university integrated science park (USP), ensure it is operated by highly qualified staff, operation and management.

SPECIFIC GOALS

1. Create the preconditions and conditions for innovations through science parks in academia
2. Applied research
3. Support when transferring knowledge into practice

The University Science Park of the Slovak University of Technology in Bratislava boasts a top infrastructure in the field of materials engineering, in particular ion and plasma technologies, automation and informatization of industrial processes.

LABORATORIES BUILT

- Laboratory of Control Systems,
- iCIM Laboratory (Intelligent CIM),
- Laboratory of Information and Control Systems Integration.

SELECTED TOP INFRASTRUCTURE

- **6MV high beam current tandem accelerator system for ion beam analysis (IBA) and ion implantation.** Specification: 6MV high beam current tandem accelerator system for ion beam analysis (IBA) and ion implantation designed specifically for research in areas such as: solid state physics, ion beam material modification, atomic physics, ion beam material analysis (IBA), astrophysics, ecology. It combines features that commonly available devices of this type do not have. These functions include the following: full range of element weights, wide range of achievable energies, very high mass resolution, ability to use multiple charged ions, ultra-high vacuum, the possibility of using low energy ions, a complete range of ion sources.
- **Multi-purpose 500kV air-insulated acceleration system for ion implantation.** Specification: Equipment for ion implantation technology used for the following purposes: material - wear and tear protection, improved hardness, corrosion protection, nanostructure, nanolayers, nanoporosity, modification

of electrical, magnetic, physical and chemical properties of surfaces, for research.

- **PIII for three-dimensional substrates.** Specification: Plasma immersion implantation device for three-dimensional substrates equipped with at least a process module (stainless steel chamber), load lock module with accessories, gas management system and control system, gas plasma is excited from an ICP source.
- **Magnetron system with pulsed dual MS separation - 2.5 kW.** Specification: Reactive unidirectional pulse sputtering system. Equipment for coating metal targets in reactive and non-reactive ways, especially oxides and nitrides, for optics, electronics (GaN, InN), photovoltaics (ITO, AZO, TiO2) and for display technology (ITO, AZO) and all suitable materials for reactive unidirectional pulse sputtering.
- **Magnetron system with pulsed dual MS separation - 5kW.** Specification: Prefabricated radio frequency sputtering system. Reactive unidirectional pulsed sputtering system made of various target materials such as reactive metal oxides and metals and designed for coating items. Suitable for simultaneous sputtering of metal oxides and insulating materials by radio frequency spraying/ metals by unidirectional sputtering for high refractive index materials and composites.
- **LRSPRS.** Specification: Control Systems Development and Design Research (PRS) - The system contains software resources for computer-aided design and documentation of automated control systems. It includes hardware components and work panels for simulation and testing of designed solutions, as well as a server with I / O cards, which allows software to simulate various technological processes.

DEVELOPMENT TRENDS

The following development areas have been identified within USP CAMBO:

- materials engineering in the field of ion and plasma technologies - scientific research institute of materials with

Center of Excellence for Materials Diagnostics

laboratories which perform basic and applied research in the field of materials engineering, as well as modification and analysis of solid surfaces using ion beam technology. A very important part of research is the use of low-energy ions and the use of pulsed plasma to create metastable phases, specific textures, nanostructures, thin films with high specific gravity, films with extremely good adhesion;

- automation and informatization of industrial processes - scientific workplace focusing on automation and informatization of production processes and systems with laboratories focusing on progressive trends and technologies of the "factory of the future", in particular building knowledge systems and related databases, visualization and optimization at all levels of information and management structures monitoring of not only economic but also energy indicators, information security, mobile and wireless technologies and sustainable development.

Center of excellence's 5-axis CNC machine HSC Ultrasonic 20 linear- 5-axis milling center with ultrasound support

University Science Park of the University of Žilina

Coordinator: University of Žilina
Project partner: Výskumný ústav dopravný, a.s. Žilina

ITMS project code: 26220220184
Call code: OPVaV-2012/2.2/08-RO

Eligible project costs: 41 069 161,76 EUR
Project implementation: 06/2013 to 12/2015

Scientific fields: transport infrastructure and means of transport
Domains of smart specialization: Industry for the 21st Century, Public Health and Medical Technology, Healthy Food and Environment, Digital Slovakia and the Creative Industries, Vehicles for the 21st Century
ESFRI: environment
Project implementation location: Žilina region

Main goal: Building an excellent university science park with internationally comparable outputs in the field of research and development, emphasizing economic growth and development of the region.

SPECIFIC GOALS

1. Supporting the innovation culture, extensive support for applied research and knowledge transfer into practice and support for regional knowledge and innovation development,
2. Building the physical infrastructure of the science park (as a unified technological unit)
3. Implementation of top research and development in the field of intelligent transport and production systems.

The University Science Park of the University of Žilina is a top scientific infrastructure focusing on intelligent transport systems, intelligent production systems, progressive materials and technologies and information and communication technologies.

LABORATORIES BUILT

- Processing and Analysis of Multimedia Data Laboratory
- Laboratory for Measuring and Evaluating the Safety of Freight Transport (Road, Rail, Water and Air Transport)
- Intelligent Production Systems Laboratory
- Wave Diagnostic Methods Laboratory
- Railway Traffic Management Laboratory
- Intelligent Transport Systems Laboratory
- Laboratory for Processing and Analysis of Multimedia Data
- Laboratory of Advanced Materials and Technologies

SELECTED TOP INFRASTRUCTURE:

- **Technology for research of progressive prototype technologies for industrial, biomedical and bionic research.** The technology is to enable 3D and 2D panoramic imaging, acquisition and processing of 3D models and 3D projection of prostheses and models, production of dental prostheses by milled technique. Minimum technical parameters: - digital panoramic tomograph (integrated standard 2D panoramic X-ray and 3D X-ray with simple switching without the need to replace the 2D / 3D sensor), software for planning models and implants, software for con-

necting the scan and 3D scan from the digital panoramic tomograph, laboratory dental scanner, laboratory milling cutter, kiln, 2 pcs. PC and high-quality colour printer with high resolution. It is a complex device which also includes software. The price was determined on the basis of a market research.

- **Technology for research in the field of traffic simulators.** Min. tech. parameters: air traffic simulators simulating real-life conditions with the possibility of feedback. The simulator hardware must have dimensions of the Class B (or Class C) airplane according to the selected model. At the same time, it must meet the requirements placed on a simulator of this type "EASA FFS Level C" (D). Functionality: visualization system supporting 3D display. Cylindrical coverage in min. range of 45 ° vertical and 180 ° horizontal or similar "Collimated" 40 ° x 200 ° viewing system; HDTV. 3D laser data and orthophotos image projection; cockpit simulator matches real instrument layout, the cockpit of the simulator min. for 2 crew members; all components of the simulator are certified by the Air Office SR in accordance with valid technical standards; open database navigation points (Europe) and linked to an online database; connection to external outputs and sensors; feedback platform; low vibration and ambient noise; open system for further connection of sensors and detectors from other laboratories. More in the project description. It is a complex device which includes hardware and software and implementation services related to the implementation of technology.

- **Technology for research and development of optimization algorithms for transport system analysis and road traffic management.** Min. technical parameters: sensor systems for data collection on running on red light, overloaded vehicles, vehicles exceeding max. speed limit, license plate recognition, ADR recognition, KPI display on the map (web portal and mobile devices), traffic densities, vehicle counting, public transport vehicle positions (using GPS sensors). It is a complex device which includes hardware and software and implementation services related to the implementation of technology.
- **CAD / CAE technology designed for numerical scientific calculations, modelling and simulations.** CAD / CAE technology enabling the creation and optimization of 3D virtual models of parts of technical systems. It will be used in research projects focusing on creation, verification and optimization of technical systems using structural, dynamic and kinematic analyses. Min. technical parameters: CAD / CAE technology must allow for application features of geometric models to be identified (volume, dynamics, heat, life, flow, empirical calculations, etc.) and then automatically run these analyses and evaluate the impact of changes on the monitored quantities - sensitivity analysis function, multidisciplinary optimization, frequency of occurrence etc. The technology must also include motion analysis of mechanisms. It is a complex device which also includes software. The price was determined on the basis of a market research.

- **Combined stress sample testing technologies.** Technology for testing and accurate measurement of samples made of various materials by combined stress - tensile and torsional tests to determine the life curves of these materials. The technology will be used to create a database of life curves of tested materials and accurate measurement of samples with micrometric accuracy.

  The core of the workplace will be a test device able to apply variable stress pressure-pull min. 100 kN and torsion min. 1 kNm using the drive of two hydraulic motors + appropriate hardware and software support with the possibility of describing the loading process - periodic, random, as well as post-stress measuring equipment for measuring samples. E.g. ultra-powerful portable 3D laser scanner:
  - accuracy 0.005 mm
  - scanning 1,000,000 dots / s
  - software for modelling the scanned object into a 3D model.

DEVELOPMENT TRENDS

The following development areas have been identified within the University of Žilina's USP:

- Intelligent transport systems with emphasis on:
  - human factor in transport,
  - monitoring of transport processes,
  - technologies and applications in intelligent transport systems.
  - quality of the environment (meeting of the Smart Cities vision),
  - increase in productivity (company's commercial activities);
- Intelligent production systems with emphasis on:
  - prototyping in intelligent production systems,
  - solutions for advanced production systems,
  - production technologies and new assembly concepts,
  - modelling and simulation of intelligent production systems;
- Progressive materials and technologies with emphasis on:
  - optical fibers and photonic elements,
  - biomedical engineering,
  - unconventional drives.

In terms of research and development of system applications based on optical fibers and photonic elements, the emphasis is mainly placed on the study, design, production and implementation of new materials and technologies in electronic and optical systems and sensors based on heterostructures, thin film structures for new communication technologies and transport systems. These are used in the field of intelligent transport systems, intelligent production systems, monitoring of transport infrastructure and new advanced materials and technologies. The research goals are set to follow the latest trends and activities in the field of new materials and thin-film technologies.

- Information and communication technologies with emphasis on:
  - processing of vague information,
  - photonic applications,
  - knowledge technologies,
  - decision support.

Medical University Science Park in Košice (MediPark, Košice)

Coordinator: Pavel Jozef Šafárik University in Košice
Project partner: Technical University of Košice, Institute of Neurobiology SAS, University of Veterinary Medicine and Pharmacy in Košice

ITMS project code: 26220220185
Call code: OPVaV-2012/2.2/08-RO

Eligible project costs: 32,774,923.63 EUR
Project implementation: 07/2013 to 06/2015

Scientific fields: biotechnology and biomedicine
Domains of smart specialization: Industry for the 21st Century, Public Health and Medical Technology, Health Food and the Environment, Vehicles for the 21st Century
ESFRI: health and food
Project implementation location: Košice region

Main goal: Establishment of USP MediPark as a top national and international centre for applied research, development and transfer of knowledge and results into practice - medical field.

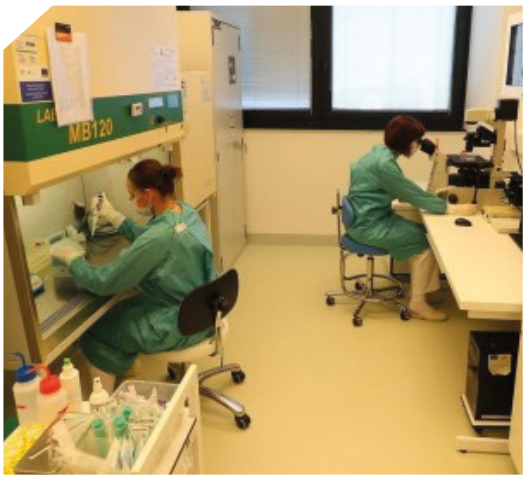
ŠPECIFICKÉ CIELE

1. Organizational and management support of MediPark aimed at creating quality scientific management, sustainability and increasing the use of IPR protection.
2. Building the physical infrastructure of USP MediPark as a sophisticated technological unit (1. stage of building USP).
3. Top applied research and development in 5 basic scientific programs MediPark, including its socio-humanitarian dimension.

USP MEDIPARK is the largest academic research facility focusing on biomedical research in eastern Slovakia. Research activities are focused on medical areas - pharmacogenomics and individualization of treatment, regenerative medicine and cell therapy, metabolic disorders, study of neurodegenerative and traumatic CNS disorders and study of serious infectious diseases in human and veterinary medicine.

LABORATORIES BUILT

- Laboratory for Working with Cells and Cell Cultures
- Flow Cytometry and Immunophenotypic and Cytogenetic Analysis Laboratory
- Experimental Study of Angiogenesis Laboratory
- Laboratory for Study of New Anticancer Drugs
- Laboratory for Study of Gene Polymorphisms
- Molecular-Biological Laboratory
- Biophysical Laboratory
- Laboratory for Behavioral Testing of Small Laboratory Animals
- Light and Fluorescence Microscopy Laboratory
- Electrophysiological Measurements Laboratory
- Cell and Tissue Cultures Laboratory
- Additive Biomedical Processes Laboratory



SELECTED TOP INFRASTRUCTURE

- Technologies for 3D production of biological tissue replacements. 5-axis CNC equipment. Suitable for machining min. zirconium and PMMA. Furnace with continuous temperature distribution and chamber with a volume of min. 0.8 l. Homogeneous ZrO2 colour blocks. Biocompatible photopolymer material for contact with the skin and mucous membrane designed for 3D printing. Universal photopolymer material for 3D printing. Universal transparent photopolymer model material, designed for 3D printing. Micromotor for materials processing in order to cut the structure from the residual material. Torque at least 5 Ncm. Laser production equipment using additive production technology with an applied layer thickness of max. 100 micrometers. Maximum device weight 1,300 kg. Equipment for 3D printing of plastic models and prototypes. Device using the principle of photopolymerization or laser sintering. Possibility of 3D printing of plastic biological structures up to a size of at least 200 x 200 x 100 mm. Rapid prototyping device, enabling processing of several types of biological materials and materials for 3D implant printing. Steam cleaner with water tank max. 5 l for cleaning the milled implant structure. Sufficient pressure to clean implants and replacements.
- Central experimental infrastructure of the USP. Hardware to ensure smooth operating conditions of the USP. Hardware will be integrated into a single functional unit with strictly defined logic, high availability and security, minimizing operating and energy costs and overall environmental impacts.
- System supporting scientific research, archiving and data distribution supporting fast access to operational data as well as long-term archiving of scientific data. Software solution needed to create a comprehensive environment for the performance of scientific activities - research, processing and enrichment of scientific objects in electronic form. Minimum scope of functionality: management of scientific information; publication of scientific outputs with the possibility of linking to the systems of management and monitoring of publishing activities and to the system of patent and copyright management; planning, management and dynamic use of technological research tools with the possibility of cost monitoring; provision of data storage services, including allocated capacity management, data lifecycle, data access; provision of long-term archiving services, provision of content protection.
- Unique and combined instrumentation systems for molecular medicine with accessories. A set of unique state-of-the-art instruments and systems for genomics laboratories.
- Unique and combined instrumentation systems for molecular medicine with accessories. A set of unique state-of-the-art instruments and systems for proteomics laboratories.

DEVELOPMENT TRENDS

The following development areas have been identified within MEDIPARK:

- Pharmacogenetics and tailored treatments focusing on:
  - study of markers associated with the therapeutic effect and side effects of drugs and the importance of antiangiogenic drugs,
  - mechanisms of photodynamic treatment of tumors,
  - genetic markers of cancer, mechanisms of cell death and intercellular interactions,
  - the contribution of innovative approaches in the treatment of oncological diseases;
- metabolism - atherosclerosis - aging with a focus on:
  - the role of cell stress in the mechanisms of cell death in the processes associated with aging,
  - the interaction of genotype and environment in the mechanisms contributing to metabolic disorders, diabetes and atherosclerosis,
  - cellular mechanisms of metabolic disorders and atherosclerosis and clinical manifestations of atherosclerosis and their impact on the health of the population;
- Neurosciences focusing on:
  - regenerative mechanisms after spinal cord trauma,
  - neurodegenerative and neuroreparative mechanisms, clinical manifestations and complications
  - neurological diseases;
- Regenerative medicine focusing on:
  - study of innovative possibilities of regeneration and repair of bone, joint and cartilage tissues after injury and in degenerative and autoimmune diseases,
  - use of stem cells and bioengineering in regenerative medicine;
- Zoonoses and major infectious diseases with a focus on:
  - significant infectious diseases from the point of view of epizootiology, improvement of their laboratory diagnostics and prevention,
  - innovative approaches in preventive measures, diagnosis and treatment of major infectious diseases in human medicine.

The Laboratory for Translational Research in Respiratory and Metabolic Diseases was established - it arose from the need to implement scientific plans under the "from the bench to the bedside" focusing on studying the effects of hypoxia on metabolic processes on three levels: cells, tissue and organs and whole organism (patient). The research workplace is unique as it monitors numerous physiological functions of the organism during waking hours and sleep. Data is then processed by computer and sent to molecular-biological and biophysical laboratories.

TECHNICOM University Science Park for innovative applications with the support of knowledge technologies

Coordinator: Technical University of Košice
Project partners: Pavel Jozef Šafárik University in Košice University of Prešov in Prešov

ITMS project code: 26220220182
Call code: OPVaV-2012/2.2/08-RO

Eligible project costs: 41,984,703.52 EUR
Project implementation: 06/2013 to 12/2015

Scientific fields: information and communication technologies sustainable energy
Domains of smart specialization: Industry for the 21st Century, Public Health and Medical Technology, Healthy Food and Environment, Digital Slovakia and Creative Industries, Vehicles for the 21st Century
ESFRI: e-Infrastructures, Energy, Physical Sciences and Engineering
Project implementation location: Košice region

Main goal: Make TECHNICOM an internationally recognized research and technology transfer centre in the field of innovative applications with the support of knowledge technologies

SPECIFIC GOALS

1. Organizational and management support in building and operation of USP TECHNICOM
2. Build functioning infrastructure of the park and make it a sophisticated research and technological unit
3. Top research and development in selected areas of science, including its socio-humanitarian dimension

Science and research at TECHNICOM are focused on the following fields of science and technology: Information and Communication Technologies, Electrical Engineering, Automation and Control Systems, Mechanical Engineering, Civil Engineering and Environmental Engineering.

LABORATORIES BUILT

- Intelligent Data Analysis Laboratory
- Knowledge Technology Laboratory
- Laboratory of Intelligent Interfaces of Communication and Information Systems
- Advanced Communication Technologies Laboratory
- Laboratory of Safe Car Sensor and Communication Networks
- Automotive Electrical Engineering Laboratory
- Technological Laboratory for Research of Progressive Materials
- Laboratory for Modification and Testing of Progressive Materials Properties
- Modelling and Measurement Laboratory for Automotive Electronics
- EMC Laboratory of Electronic Devices and Biological Systems
- UWB Sensor Systems Laboratory

SELECTED TOP INFRASTRUCTURE

- Impedance and materials analyser. The device and accessories are needed for innovations in the field of electrical engineering and electronics to extend the frequency range of measurements of complex permittivity of dielectric materials and properties of magnetic materials in the 3GHz band. The de-

vice measures the properties of progressive magnetic materials as well as the temperature dependence in the extended frequency range. Impedance and materials analyser in the band up to 3GHz.

- Thermophysical dilatormetric analysis. 1 piece of the thermophysical dilatormetric analyser at a unit price of EUR 142,046.00 with VAT will be used to measure the changes in lengths of solids in the temperature range -180°C – 2,000°C, measuring the kinetics of high temperature processes by isothermal and non-isothermal methods. Minimum technical specifications: equipment
- Digital microscope. Digital microscope with 3D scanning, magnification up to 5,000x, the possibility of measuring surface roughness, measuring profiles.
- CNC milling station. CNC milling machine with working space min. 500x450x400, min. 3 + 2 axes, tool set, chip conveyor, set of adjusting elements, set of adjusting elements, specialized add-on modules.
- CNC laser cutting station. CNC laser cutter, min. table size 1,000x500 mm designed for the production of complex shapes of blanks for the production of semi-finished sheets, accessories.

DEVELOPMENT TRENDS

The following development areas have been identified at TECHNICOM:

- Information and communication technologies linked to two centers of excellent research (hereinafter "CER") for knowledge systems: intelligent speech communication systems; 3D / stereoscopic imaging systems, navigation and human-computer interfaces, virtual reality; process analysis IT tools and services; integrated cloud technologies and services; artificial intelligence for "smart" systems; non-destructive

process diagnostics. Intelligent applications for the "SmartCity" and "SmartData" concepts. Relevant cooperation with the ZATIPS Competence Centre (Support for joint R&D projects and workplaces with businesses in the field of progressive ICT applications, multimedia communication, information security, intelligent data analysis, perception and cognition solutions);
- Electrical engineering, automation and control systems with a link to one CER: UWB sensor systems - joint workplace of TUKE and TU Ilmenau Service GmbH-ILMSENS; autonomous electromechanical systems; energy innovation engineering; intelligent autonomous components for production systems. Integrated R&D cooperation with the ZATIPS Competence Centre;
- Mechanical engineering with a link to one integrated CEV: modelling and simulation of mechanical and mechatronic systems; reconfigurable intelligent robotic and manufacturing systems; development and implementation of prototype research facilities;

technical, environmental and human risks, additive technologies in proteomics and biomechanics;

- Civil engineering (construction, transport, geodesy) linked to integrated CER focusing on: progressive building structures, materials and technologies: intelligent load-bearing systems and structures; intelligent architectural structures and structures; intelligent building decision making and management systems; Integral R&D cooperation with the VUKONZE Centre (R&D in the field of systems and technologies of renewable energy sources / 12 specialized laboratories) KC at USP;
- Environmental engineering (mining, metallurgy, water sciences) with a link to two CERs focusing on: systems for efficient processing of raw materials; progressive renewable materials and products; recycling of metallurgical and electrical waste. Integral cooperation with VRP ZaSS (R&D in the field of technologies for sourcing and processing of raw materials).

ALLEGRO Research Center

Coordinator: Slovak Academy of Science
Project partners: Institute of Materials and Machine Mechanics SAS, Institute of Inorganic Chemistry SAS, Institute of Physics SAS, Institute of Electrical Engineering SAS, Slovak Technical University in Bratislava

ITMS project code: 26220220198
Call code: OPVaV-2013/2.2/09-RO

Eligible project costs: 16,214,711.54 EUR
Project implementation: 10/2014 to 12/2015 Scientific fields: materials research
Domains of smart specialization: Industry for the 21st century
ESFRI: physical sciences and engineering
Project implementation location: Trnava region

Main goal: Construction of the ALLEGRO Research Centre

SPECIFIC GOALS

1. Support for the development of research and development institutions and their scientific and technical infrastructure
2. Cooperation within the academic sector in the implementation of applied research and development
3. Improving the quality of knowledge and technology transfer into social and economic practice

The infrastructure of the ALLEGRO Research Centre is intended primarily for research into the properties of energy materials with an emphasis on their microstructural and mechanical properties. The centre uses methods of non-destructive and destructive examination of materials and components of energy equipment using X-ray 3D computed tomography, ultrasound, eddy currents, acoustic emission, tensile and compressive tests, creep and impact notch toughness.

LABORATORIES BUILT

- Laboratory of Destructive and Non-destructive Testing of Materials
- Experimental Helium Loop Laboratory
- Laboratory of Microstructural Analysis of Materials
- Ceramic Components Laboratory
- Atomic Force Microscopy Laboratory (AFM)
- Laboratory of Nuclear Methods and Nuclear Physics

SELECTED TOP INFRASTRUCTURE

- **Universal tearing machine with accessories** - testing machine for measuring the mechanical properties of metallic materials using physical, non-contact and optical measuring methods. The machine is equipped with accessories, a range of drawbars and pushers, a furnace with a regulator, a temperature chamber with a cooler for low temperatures and software.
- **Fatigue test machine with accessories** - pulsator for dynamic testing of materials at lower and higher temperatures with the possibility of evaluating multi-axial fatigue with hydraulic clamping of samples, electronic control system, equipped with sensors of force and deformation effects.
- **X-ray 3D computed tomograph with microfocus and with accessories** - device for non-destructive analysis of 3D visualization and measurement of porosity damage and defects of materials in high resolution based on X-rays. The device is housed in a protective case that provides protection against the risk of exposure to X-rays
- **Instrument for measuring the deformation properties of materials with accessories** - thermomechanical simulation system with a closed thermal loop - hot deformation of samples with a diameter of up to 20 mm with a very high heating rate up to 10,000 C / s
- **Atomic force microscope with accessories** - AFM complete automated evaluation of surface, electrical and magnetic properties of samples before and after stress, temperature, after application of extreme doses of radiation
- **Pendulum impact hammer with accessories** - machine for impact tensile and impact bending tests of metals according to Charpy, Izold with complete accessories for tests at low and higher temperatures. Possibility to perform conventional and instrumented tests
- **Electromechanical testing system with accessories** - testing machine designed for testing metals at very low strain rates up to 1um / h by static method as well as dynamic method up to 1Hz with high resistance to side loading based on servohydraulic load frame with servoelectric piston.

DEVELOPMENT TRENDS

The following development areas have been identified within the ALLEGRO Research Centre:

Laboratory of Destructive and Non-destructive Testing of Materials:

- Description of material and mechanical properties of components for power industry
- Destructive and non-destructive testing
- Microstructural analysis of materials

Experimental Helium Loop Laboratory:

- research on heat removal from the GFR (Gas Cooled Fast Reactor) and determination of its basic safety characteristics
- verification of the thermodynamic and hydraulic properties of the circuit with the included heat source to simulate the development of residual heat in the shutdown reactor and with the heat exchanger designed for its removal

- modelling of changes in dissipated power, temperature and pressure of helium
- verification of the properties of the natural circulation of helium in the primary circuit of the helium loop

Laboratory of Microstructural Analysis of Materials:

- Radiation effect on construction materials of nuclear reactors
- Non-destructive testing of materials
- Defect analysis in materials Ceramic Components Laboratory:
- Solutions to problems of high-temperature corrosion of construction materials
- Use of inorganic salt melts
- Study of ceramic composites based on silicon carbide (SiC) and zirconium diborides (ZrB2) and titanium (TiB2)

Atomic Force Microscopy Laboratory (AFM):

- Structural analysis of surfaces at the nano-level and micro-level
- Measurement of electrical and magnetic properties
- Surface roughness measurement

Laboratory of Nuclear Methods and Nuclear Physics:

- Study of surfaces of materials using nuclear methods
- Study of gamma emissions in nuclear reactions
- Study of fission of heavy nuclei
- Study of exotic nuclear reactions

Creeping station

Belt transport system TATRA

Centre for Applied Research in New Materials and Technology Transfer

Coordinator: Slovak Academy of Science
Project partners: Institute of Electrical Engineering,SAS, Institute of Physics SAS, Slovak Technical University in Bratislava, Institute of Inorganic Chemistry SAS, Institute of Materials and Machine Mechanics SAS, Institute of Polymers SAS, Academy of Fine Arts

ITMS project code: 26240220088
Call code: OPVaV-2013/4.2/09-RO

Eligible project costs: 24,879,433.75 EUR
Project implementation: 08/2013 to 12/2015
Scientific fields: materials research and nanotechnology, ICT Domains of smart specialization: Industry for the 21st century
ESFRI: Physical Sciences and Engineering
Project implementation location: Bratislava region

Main goal: Establishment of a Centre for Applied Research in New Materials and Technology Transfer.

SPECIFIC GOALS

1. Support for the development of research and development institutions and their scientific and technical infrastructure
2. Cooperation within the academic sector in the implementation of applied research and development
3. Improving the quality of knowledge and technology transfer into social and economic practice

The Centre for Applied Research focuses on developing new materials, the research of the structure and properties of materials (atomic level) and testing of prototypes using these materials, the development of technologies. The Centre focuses on preparation of ceramic materials, thin-walled structures for electronics, metallic materials and nanomaterials.

LABORATORIES BUILT

- Ceramic Materials Laboratory
- Electrical Engineering Material Laboratory (Elektro-mat)
- Metallic Materials Laboratory
- Nanomaterials Laboratory (Nano-mat)
- Laboratory of Structural Analysis of Materials (Struktur-mat)

SELECTED TOP INFRASTRUCTURE

- **Tunnel graphite furnace with controlled atmosphere** - ceramic line. Continuous high temperature graphite furnace designed for sintering of ceramic bodies based on carbides, nitrides or oxides with the possibility of working in a reducing atmosphere of nitrogen or argon. Technical specification: graphite insulation, working temperature up to 1,900 ° C, smooth movement of graphite conveyor belt with adjustable speed up to 50 mm / min., hot zone length min. 3 m, hole size 70x220 mm, inert gas supply (argon, nitrogen) with a flow of approx. 160 l / min., temperature and pressure measurement in individual parts of the furnace, CO detector, automatic control of the whole process with adjustable parameters (temperature, gas flow,

feed rate, cooling intensity). The price was set in accordance with the winning bid (contract already concluded)

- **MOCVD apparatus for III-N heterostructures** - research and development technology line for modern electronic components. The device must allow the growth of epitaxial heterostructures based on GaN (AlGaN / GaN, InAlN / GaN), GaAs (InGaAs, AlGaAs, InP) on substrates with a minimum diameter of 50 mm (2"). Vertical reactor. Max. growth temperature 1,200 °C. Required parameters of heterostructures: growth rate for undoped GaN min. 2mm / h, background level in unsubsidized layer max.1 * 1,017 cm-3, mobility at room temperature min. 350 cm2 / Vs. The device must contain at least a two-stage wet scrubber and monitoring system for H2, NH3, AsH3, PH3. The price was set in accordance with the winning bid (contract already concluded).
- **Scanning electron microscope for el. lithography** - the device must allow the study of samples in high vacuum mode (vacuum min. 6 * 10-4 Pa) as well as low pressure (10-130 Pa). Resolution min. 1.2 nm at 30 kV for high vacuum mode, min 1.4 nm for low pressure mode. Max. magnification min. 2,000,000x (24 "LCD monitor). Stability of the autoemission source at least 0.4%. Current density of the electron beam up to 200 nA., The price was set in accordance with the winning bid (contract already concluded).
- **Dry forming device** - equipment for dry forming of samples with a diameter of min. 100 mm (2 ") must operate in inductively coupled plasma mode with a frequency of 13.6 MHz with a power of at least 1,500 W. The device must allow the connection of 8 types of gases, of which 3 are corrosive gases (e.g. SiCl4, Cl2, BCl3). The device must be pumped using turbomolecular pump with a pumping speed of at least 1,300 l / s. The device must contain a vacuum loadlock with a dry vacuum pump. The device must contain a separate wet scrubber. The price was set in accordance with the winning bid (contract already concluded.
- **Exposure device for optical lithography** - exposure device for exposing samples with a diameter of min. 100 mm (4 "). Sample and mask adjustment with an accuracy of at least 1 μm. The instrument must include an optical microscope with a magnification of 100x to 400x. Exposure lamp with adjustable power from 300 to 400 W. Sample holder for dimensions from 5 * 5 mm up to a diameter of 100 mm. The device must allow the use of universal optics for UV250 / 300/400 nm. The price was set in accordance with the winning bid (contract already concluded).
- **Confocal Raman microscope combined with AFM** - the confocal Raman microscope must have at least three excitation lasers at 325, 532 and 785 nm. The device must allow recording of 3D Raman maps. The device must allow AFM sample measurements. The device must allow the mapping of photo- and electroluminescence in the range of at least 220-2,000 nm. The price was set in accordance with the winning bid (contract already concluded).
- **Vacuum induction furnace** - the vacuum induction furnace will be used for the preparation and gravity casting of

alloys in a vacuum or in a protective atmosphere. Material is in a ceramic crucible which is then tilted – melted material fills in ceramic molds, The price was set in accordance with the winning bid (contract already concluded).

DEVELOPMENT TRENDS

The following development areas have been identified within the Centre for Applied Research, SAS:

Ceramic Materials Laboratory – focus:

- research and development of technologies for the production of ceramic components
- research of properties of ceramic materials
- preparation of demonstration items; balls and rollers for bearings, ceramic fittings, boards for cutting tools, ceramic bio-implants

Electrical Engineering Material Laboratory – focus:

- research and development of advanced electronic components
- preparation of thin films for GaN-based transistors
- preparation of thin films for GaAs-based detectors
- research of properties of superconducting wires in high magnetic fields

Metallic Materials Laboratory – focus:

- research and development of precision casting technologies based on TiAl
- research and development of powder metallurgy technologies for composite materials
- sample preparation from titanium alloys, high-temperature alloys, intermetallic alloys and aluminium alloys
- research of components' properties

Nanomaterials Laboratory – focus:

- preparation of new 2D nanomaterials, components and structures based on 2D nanomaterials
- integration of components and structures based on 2D nanomaterials into systems with new functionality and areas of use
- research of nanomaterial's properties
- commercialization of nanomaterials and nanocomposites

Laboratory of Structural Analysis of Materials - focus:

- development of procedures for observation and analysis of various materials
- microstructure of materials

AgroBioTech Research Centre

Coordinator: Slovak University of Agriculture in Nitra
Project partners: Constantine the Philosopher University in Nitra, Institute of Plant Genetics and Biotechnology SAS

ITMS project code: 26220220180
Call code: OPVaV-2012/2.2/08-RO

Eligible project costs: 26,308,960.30 EUR
Project implementation: 04/2013 to 10/2015

Scientific fields: biotechnology and biomedicine, agriculture and environment, sustainable energy and energy
Domains of smart specialization: Healthy food and the environment, Industry for the 21st century
ESFRI: health and food, environment
Project implementation location: Nitra region

Main goal: Construction of a comprehensive, innovative and competent regional research centre focusing on agrobiology, agroecology, biotechnology and bioenergetics.

SPECIFIC GOALS

1. Build a research, innovation and competence regional centre at SUA in Nitra
2. Build a research, innovation and competence regional centre at CPU in Nitra
3. Build a research, innovation and competence regional centre at the Institute of Plant Genetics and Biotechnology SAS in Nitra

The AgroBioTech SAU Research Centre in Nitra carries out innovative research in agrobiology, agricultural product processing technology and agri-food, biotechno-

logy, genetic technologies and agroecology, bioenergetics and bioeconomics.

LABORATORIES BUILT

Agrobiology-oriented research

- Laboratory of Production Physiology and Ecophysiology of Plants
- Laboratory of Plant Nutrition and Ionomics
- Laboratory of Explant Cultures
- Laboratory of Special Seed Methods
- Laboratory of Agrobiodiversity and Genetic Technologies
- Laboratory of Experimental Botany

Research focused on agricultural processing technologies and food industry

- Laboratory of Animal Origin Food
- Laboratory of Cereal Technologies
- Laboratory of Beverages
- Experimental Brewery Laboratory
- Laboratory of Fats and Oils
- Sensory Laboratory
- Laboratory of Physical Properties of Raw Materials and Food
- Human Nutrition Laboratory
- Laboratory of Analyses of Biologically Valuable Substances

Research focused on biotechnology and experimental biology

- Laboratory of Animal Biotechnology
- Laboratory of Plant Biotechnology
- Laboratory of Experimental Biology
- Laboratory of Experimental Microbiology

Genetics-oriented research

- Laboratory of Genetic Analysis
- Laboratory of Agrobiodiversity and Genetic Technologies

Bioenergy-oriented research

- Biomass Analysis Laboratory for Bioenergy
- Bioenergy Resources Laboratory
- Biomass Gasification Laboratory

Bioeconomy-oriented research

- Economic Studies Laboratory
- Laboratory of Neuroeconomics and Consumer Decision Making

Landscape-oriented research

- Laboratory of Urban Environment and Landscape Modelling

SELECTED TOP INFRASTRUCTURE

- FT-NIR spectrometer. The device is designed for the analysis of all types (liquid, paste-like and solid) of food products and raw materials.
- Microarray system. The device is designed for microchips hybridization, their evaluation and interpretation. It is an effective tool for studying the relationships between gene expression and their phenotypic expression.
- Automatic system for phenotypic parameterization and plant screening. The device is used to analyse the morphology, architecture and physiology of whole plants on the basis of 3D images (these yield a number of quantitative parameters).
- Second generation sequencer. The device is designed for complex identification of microorganisms in food, allows to analyse changes in genes, it is able to quantify these changes, to identify all biological components of food.
- Terrestrial laser scanner. The device is designed to acquire accurate 3D models of objects urbanized and natural landscapes, including complex elements of vegetation. Applicant's expenditure.
- Transmission electron microscope. The device is designed for mixing biological materials for a wide range of applications.

DEVELOPMENT TRENDS

The following development areas have been identified within the AgroBioTech research centre:

agrobiology:

- Laboratory of Production Physiology and Ecophysiology of Plants - specialization: testing of newly introduced methods of optical scanning of surface and internal structures of whole plants / crops within the phenotyping platform at SAU in Nitra; testing the e-infrastructure of the phenotyping platform; experimental activities in the field of testing genetic resources of strategic and non-traditional or hobby crops for traits and characteristics suitable in the conditions of a changing climate;
- Laboratory of Plant Nutrition and Ionomics - specialization: development of methodologies for determination of elements in plant and animal material. Analyses focus mainly on biological matrices, environmental samples (fungi, fish and wild game tissues), but also biological material of plants; microwave mineralization of plant samples (Milestone Ethos Up); determining the content of elements in soils in order to monitor fertility;
- Laboratory of Explant Cultures - specialization: quantification of basic physiological processes, growth-developmental changes at the level of cells, tissues and organs of explant cultures of plants and trees; identification and localization of anatomical-morphological changes of organs from differentiation in vitro to adaptation of regenerants to changed cultivation conditions; comprehensive study of medicinal plants and natural drug sources (taxonomic studies, plant biotechnology, secondary metabolites), finding the connection between the function of secondary products and primary metabolism, the impact of environmental factors on these processes;
- Laboratory of Special Seed Methods - specialization: field research - seeds from the original populations of Melilotus alba (two populations), Lathyrus tuberosum (one population), Rumex spp. (two subpopulations), seed collection was carried out in 2017 in order to pool new gene samples; in the genus Rumex, three populations of two species have been multiplied and the experimental material will be evaluated for production traits - phytomass production and the dynamics of its formation during vegetation;
- Laboratory of Agrobiodiversity and Genetic Technologies - specialization: application of DNA markers - study of population molecular characteristics of Hedera helix L., identification of expression level of Hedera helix L. genes by qRT-PCR, transcriptomics of allergens, application of DNA markers based on retrotransposons - description of hazel genome variability, genomic analyses of in vitro cultures of medicinal plants, etc. ;
- Laboratory of Experimental Botany - specialization: research of taxonomy of the genus Prunus (plum) in biocorridors of agricultural land; research of taxonomy of the genus Cotoneaster in Slovakia using methods of obser-

Experimental brewery, technological line for the production of beer

vational botany, molecular biology, cytometry and cytoembryology; identification of the obscure taxonomic complex Cotoneaster, clarification of methods of reproduction.

- Human Nutrition Laboratory - specialization: preparation and development of new food, especially functional foods and value-added foods in cooperation with other laboratories within the ABT RC and businesses (food producers), finding and identifying new bioactive substances with direct impact on health; studying effects of newly developed foods on human health, etc..

applied ecology and bioenergy:

- Laboratory of Applied Ecology - specialization: research of ecophysiological properties of genotypes and production potential of fast-growing herbs and woody plants with energy-replenishing potential in the conditions of southwestern Slovakia; analysing the growth dynamics and biomass production of fast-growing herbs and woody plants grown on degraded and unused land;
- Biomass Gasification Laboratory - focus: e.g. monitoring the energy intensity of biomass preparation and thermochemical conversion; verification of the influence of the input biomass composition on the quantity and quality of produced gaseous, liquid and solid components of biofuels.

bioeconomics:

- Economic Studies Laboratory – specialization: research focused on the analysis of prices, production, consumption and trade of crops used in power industry; analysis of agricultural and power industry policies; business analysis; econometric modelling of agricultural market developments and the impact of agricultural policies;
- Laboratory of Neuroeconomics and Consumer Decision Making - specialization: implementation of basic and applied interdisciplinary research in the field of consumer choice, decision making and consumer behavior; study of rational and emotional aspects of consumer decision-making, study of brain correlations when making consumer decisions, examination of somatic and autonomous physiological reactions of consumers under the influence of economic stimuli, etc.

biosystem engineering:

- Biomass Analysis Laboratory for Bioenergy - specialization: study of the influence of biological, technical and production factors on the final quality of produced solid biofuels; research into the relationships between the properties of the biomass used in the production of solid biofuels and the physical-mechanical and energy properties of the products obtained; research into hemp compaction for energy purposes;
- Bioenergy Resources Laboratory - specialization: monitoring the adverse effects of fuels on the environment and the parameters of energy resources; study of using biolubricants, biofuels of the 1st and 2nd generation in laboratory conditions and real practice; measuring the amount of emissions produced during the conversion of chemical energy contained in the fuel into mechanical work and comparing the measured results with applicable legislation;
- Laboratory of Innovative Technologies in Crop Production - specialization: research in the field of abiotic stress of plants; influences of technogenic factors arising from the movement of machines on the ground (soil compaction); the effect of variable plant nitrogen-based nutrition using remote sensing methods;

- Laboratory of Physical Properties of Raw Materials and Food - specialization: studying the effect of heat stress in the drying process on macro / micro grain damage, examining the thermal behavior of materials, examining the dependence of physical properties on temperature, examining weather and strength of materials to measure grain purity, sorting of granular materials to determine the effect of their physical-mechanical properties on threshing quality.

biotechnology and landscape modelling:

- Laboratory of Urban Environment and Landscape Modelling - specialization: e.g. research in of growth of the root system of trees in places with scarce water, analysis of root architecture and mass parameters of the root system of trees, study of interspecific differences of underground tree organs; the influence of growth regulators on plant germination and regeneration in vitro, use of methods and progressive digital-graphic technologies in the evaluation of visual and spatial features of urban and landscape structures;
- Laboratory of Beverages "B" - specialization: research in the field of wine production / ongoing analysis of musts and wine (vinification and archiving); obtaining polyphenolic extracts from Slovak vine nobles; assessment of the varietal assortment of apples in terms of suitability for the production of apple cider; research into the determination of chlorophyll, lycopene and selected nutritional properties of tomatoes, peas, celery, beetroot, sweet potatoes and medicinal and aromatic plants.
- food technology and biotechnology: a total of 11 laboratories specializing in:
- analyses of primary (fat, protein, carbohydrate, fiber) and secondary metabolites (antioxidant activity, polyphenols, vitamins) of traditional and lesser-known plant species,
- oil production using modern pressing technologies to evaluate the quality of barley and malt in order to determine quality malting varieties,
- experimental production of beer and malt beverages,
- acquisition, cultivation, micromanipulation, identification, differentiation, description and functional diversity of cereals, pseudo-cereals and legumes based on DNA analyses using microsatellites, retrotransposomes, QTL markers,
- isolation, identification of microorganisms and testing of their properties,
- determining the effects of biologically active substances and environmental risk factors,
- determining the hematological, biochemical parameters, oxidative and antioxidant status, monitoring the hormonal status affected by nutrition/ toxic disruptors.

Research Centre of the University of Žilina in Žilina

Coordinator: University of Žilina in Žilina
Project partner: Výskumný ústav dopravný, a. s. Žilina

ITMS project code: 26220220183
Call code: OPVaV-2012/2.2/08-RO

Eligible project costs: 25 505 982,60 EUR
Project implementation: 05/2013 to 12/2015

Scientific fields: materials research and nanotechnology, sustainable energy and energy, ICT
Domains of smart specialization: Industry for the 21st Century, Public Health and Medical Technology, Healthy Food and Environment, Digital Slovakia and Creative Industries, Vehicles for the 21st Century
ESFRI: environment, physical sciences and engineering
Project implementation location: Žilina region

Main goal: Construction of the Research Centre and improvement of the infrastructure of the University of Žilina in order to increase the competitiveness of Slovakia by transferring the results of research and innovation into practice.

SPECIFIC GOALS

1. Completion of the research infrastructure of R&D workplaces, construction of a multi-purpose building of the Research Centre of the University of Žilina as a regional centre of applied R&D
2. Increasing the potential of R&D and innovation culture at the University of Žilina in cooperation with an incubator
3. Implementation of top R&D in selected areas, expansion of innovative activities, transfer of knowledge and development of activities

The Research Centre of the University of Žilina in Žilina operates as a regional centre of applied research in three main fields: research and development in the field of monitoring and evaluation of the state of transport infrastructure; research and development in the field of advanced materials for the construction of roads and the manufacture of vehicles; research and development in the field of design, construction and management of intelligent buildings and renewable energy sources.

LABORATORIES BUILT

- Laboratory of diagnostic infrastructure and methodologies for automated collection and objective evaluation of variable and non-variable parameters of the transport route and research and development of comprehensive tools for evaluating the economic efficiency of investments in transport infrastructure
- Laboratory for research into minimizing the damage done by heavy freight traffic to roads
- Transport Infrastructure Laboratory for study of new diagnostics and monitoring methods

SELECTED TOP INFRASTRUCTURE

- **XPS / ESCA systems.** Compact high-resolution spectrometer including complex vacuum system, cooling system, monochromatized X-ray source, detection system with analyser, electronic system, control and evaluation data station with OS and basic office software, OS, with control SW. The XPS / ESCA system must be able to perform

high-resolution XPS measurements, small-area XPS analysis, lines, chemical mapping, depth profiling by tilting the sample and dedusting electrically conductive and insulating materials. The system must be equipped for bake out without the need to perform preliminary HW adjustments to the system

- **Scanning Electrochemical Microscope System (SECM).** Localized electrochemical impedance spectroscopy (LEIS), scanning Kelvin probe (SKP), Scanning Vibrating Electrode Technique (SVET), Scanning Droplet System (SDS), Optical Surface Profiling (OSP) (Noncontact Surface Profiling)
- **System for measuring dioxins and furans (continuous).** Device for continuous measurement of dioxins and furans from the fuel combustion process
- **Gas chromatograph - Thermostat.** Device enabling dosing of liquid and head space samples into any injection port. Inject gas and liquid with a syringe
- **System tomograph.** The tomograph allows to measure the concentration of components in two-phase and three-phase systems (e.g water-bubbles, water-steam, water-solids, water-oil, water-air-oil), when mixing liquids (water-salted water) and / or for measuring mass distribution, measurement of the course of chemical reactions, measurement of the course of solidification or crystallization.

DEVELOPMENT TRENDS

The RC UNIZA does research in the following areas:

- Monitoring and evaluation of the condition of transport infrastructure (hereinafter "TI") - research and development of new methods of diagnostics and monitoring of the condition of TI. SW and HW for testing new methods and tools for diagnostics and monitoring of variable and non-variable parameters of the transport route (3D scanning for monitoring and evaluation of TI's condition/ the spread of emissions from road transport to the environment, use of georadar technology in detecting residues in samples, development of recognition software for automatic monitoring and evalu-

ation of road surface condition, assessment of TI damage due to natural disasters or accidents, use of TDR method in monitoring and assessing the stability of road structures, design, development and verification of efficiency of new methods aimed at maintaining roads.

- Progressive materials for roads and means of transport - assessment of metallic and non-metallic materials intended primarily for applications in transport - road construction and means of transport. The research focuses on the assessment of mechanical properties of material, its wear at high transport load and residual mechanical stress using X-ray diffractometry. Furthermore, the research focuses on the assessment of degradation of materials in environment showing with different pollution, under the action of UV radiation and different relative humidity, assessment of surface properties of materials, especially their chemical and electrochemical changes after various mechanical, physical and chemical surface treatments.
- Design and management of smart buildings and renewable energy sources - research into the management of smart buildings in terms of power usage, safety, well-being and the use of a variety of heat, cold and energy sources. The research focuses on the independent management of individual rooms within the building, research and development of new measurement systems and efficient management systems (with open connection to the building system). From the structural point of view of buildings, the research is focused on the building envelope structures in real climatic conditions, thermal characteristics in simulated environments, setting up the boundary working conditions, diversification of heat sources, efficient use of primary energies, in particular the ecological aspect regarding the use of power and power storage for further use.

Martin Centre for Biomedicine (BioMed Martin)

Coordinator: Comenius University in Bratislava, Jessenius School of Medicine in Martin
Project partners: -

ITMS project code: 26220220187
Call code: OPVaV-2013/2.2/09-RO

Eligible project costs: 24,998,953.75 EUR
Project implementation: 11/2013 to 12/2015 Scientific fields: biotechnology and biomedicine

Domains of smart specialization: Public Health and Medical Technologies, Digital Slovakia and the Creative Industries, Industry for the 21st Century
ESFRI: health and food
Project implementation location: Žilina region

Main goal: Construction of a prestigious research institute specializing on strategic areas of research and development in medicine.

SPECIFIC GOALS

1. Establishment of BioMed Martin and improvement of management, in particular in the field of technology transfer and protection of intellectual property
2. Support in research and development
3. Implementation of research activities as a basic element of scientifically based decision-making

BioMed Martin is a research centre of the Jessenius Faculty of Medicine in Martin at Comenius University in Bratislava (JLF UK). It specializes in research and development in biomedicine. Innovative scientific research in selected scientific fields, such as neuroscience, oncology, molecular medicine and respirology, leading to new methods and procedures applicable in clinical medical practice.

LABORATORIES BUILT

- Visceral Pain Laboratory
- Chronic Cough Laboratory
- Experimental Physiology Laboratory,
- Psychophysiological laboratory
- Autonomic Nervous System Research Laboratory
- Clinical Pharmacology and Toxicology Laboratory
- Laboratory of Genomics and Laboratory of Cells and Tissues
- Proteomics and Metabolomics Laboratory

SELECTED TOP INFRASTRUCTURE

- **Imaging mass spectrometer.** The device enables mass analysis of biomarkers, lipids and metabolites, microscopic ultrastructural study of pathologically altered tissue, in pharmacological and pharmacokinetic analyses the device must be able to monitor the metabo-

lized drug in all organs of the animal, in toxicological analyses the device must be able to display the monitored toxins in all organs of the animal, as well as quantify and show the course of their action, in food analyses, the device must allow the presence of contaminants to be monitored (in terms of their display as well as quantification).

- **Sequencing kit.** Device enabling massive parallel sequencing for genetic analysis and functional genomics. It allows work in data output mode and fast mode and is thus flexible for all applications in the field of massive parallel sequencing. The system uses sequencing by synthesis with fluorescently labeled reversible terminators which are removed after each synthesis cycle.
- **Instrument set for pharmacokinetic and toxicological analyses.** The device enables detection and quantification of metabolites and drugs in plasma, secretions and tissues, even in trace concentrations, analysis of complex biological matrices and rapid injection, which is the optimal solution for maximum productivity, performance and flexibility of the gas chromatograph.
- **Laser microdissector.** Non-contaminating and non-contact technology, laser cutting accuracy, microscope with motorized sample table and motorized sample table container, remote control of all motorized computer parts, automated switching between sample cutting and sample container containers, digital colour camera, powerful UV laser, accessories. The device serves to remove predetermined parts of the tissue with the required cells, ensuring aseptic manipulation.
- **Instrument set for next-generation on the principle of semiconductors for molecular diagnostics of gene panels exoma sequencing.** The device will allow sequencing of several dozen genes in the selected gene panel that are associated with a given disease and will also allow sequencing of the entire exoma (all protein-encoding genes), thus identifying new genes associated with the disease.

DEVELOPMENT TRENDS

BioMedu Martin focuses on the following research:

- **neurosciences** - multidisciplinary applied research in the field of central nervous system diseases, visceral pain, autonomic nervous system disorders and a comprehensive study of the stress response;

- **oncology** - population genotyping, selection of individuals with higher genetic predisposition to cancer, new predictive markers for early diagnosis of the disease and optimization of treatment, monitoring the effect of various cell death inducers on cell death induction and cell chemosensitivity of various cell lines derived from tumors of the brain, colon, breast, endometrium and leukemia cells, development of new proteome technologies used in the identification of tumor biomarkers, expansion of tumor diagnosis possibilities by specialized quantification methods;
- **molecular medicine** - is based on perinatal diagnostics, prenatal genetic testing, identification and diagnosis of genetically heterogeneous diseases and on new methods and procedures in the field of regenerative medicine;
- **respirology** - is based on the current need to address especially inflammatory diseases of the respiratory tract; focuses on the pharmacodynamic and pharmacokinetic properties of new potential drugs, assessment of these properties in drugs used to treat respiratory diseases, assessment of the role of pulmonary surfactant, search for new treatment options for respiratory diseases and research into the role of nitric oxide in the respiratory tract.

Centre for Research and Development of Immunologically Active Substances

Coordinator: Slovak Academy of Science
Project partners: Institute of Virology SAS

ITMS project code: 26220220188
Call code: OPVaV-2013/2.2/09-RO

Eligible project costs: 24,995,713.48 EUR
Project implementation: 03/2014 to 09/2015
Scientific fields: biotechnology and biomedicine
Domains of smart specialization: Public Health and Medical Technologies, Industry for the 21st Century
ESFRI: health and food
Project implementation location: Prešov region

Main goal: Establishment of a Centre for Research and Development of Immunologically Active Substances

SPECIFIC GOALS

1. Support the creation of regional research and development centres.
2. Applied research in immunologically active substances.
3. Ensure the effective transfer of knowledge of results of applied research into practice.

The Centre for Research and Development of Immunologically Active Substances carries out top applied research in: technologies and services supporting health, active life, health care, diagnostics, treatment and healthy life of the population; employment opportunities for young people in a changing environment; promoting the health and quality of life of an aging population; research, development and implementation of new technologies and their use in practice; transfer of the most modern technologies and know - how from abroad to Slovakia; intelligent technologies.

LABORATORIES BUILT

- Analytical laboratories for testing of biopharmaceuticals and for the development of new methods of qualitative and quantitative analysis, replacing the existing obsolete methods of analysis. The analytical laboratories will consist of the following laboratories:
  a. Physical-Chemical Laboratory,
  b. Virology Laboratory,
  c. Biological Laboratory (serology, molecular biology, microbiology).

SELECTED TOP INFRASTRUCTURE

- **Bioreactor with perfusion culture of eukaryotic cells.** Autoclavable exchangeable culture vessels with volumes of 2.5 - 14 l, min. 20 parameters. Built-in cip-sip decontamination.
- **Fermentor.** Working volume range 6.3 - 30 l, duplicator vessel, speed control 50 – 1,200 rpm, IN SITU sterilization, control and monitoring of parameters - touch screen, measurement and control of parameters pH, O2 OD, temperature, speed.
- **Steam sterilizer.** Chamber volume: min. 400 l, two-door folding version - left. Power supply from own steam generator, built-in printer.
- **Preparative chromatographic purification system.** Possibility of connecting several columns with different carriers,

flow rate min. 100 ml / min., can be used under aseptic conditions, 2 sets of columns.
- **Atomic absorption spectrophotometer - AAS.** AAS - with automatic dispenser for electrothermal atomization and background correction.

DEVELOPMENT TRENDS

The Centre for Research and Development of Immunologically Active Substances specializes on the following activities:
- development and introduction of new methods for the preparation, purification and formulation of biologically active macromolecules and multi-constituent substances of biological origin for therapeutic and preventive purposes,
- development and preparation of biopharmaceuticals in eukaryotic systems,
- research and development of more effective and safer viral vaccines,
- production of therapeutic and diagnostic preparations of bacterial origin,
- production of bio-pharmaceuticals with better stability and efficacy
- development and validation of methods for determining the efficacy, composition, safety and purity of biologically active substances.

Research Centre of Advanced Materials and Technologies for Current and Future Applications "PROMATECH "

Coordinator: Slovak Academy of Science
Project partners: Technical University of Košice, Pavel Jozef Šafárik University in Košice Institute of Experimental Physics SAS, Institute of Geotechnics SAS, Institute of Materials and Machine Mechanics SAS Institute of Materials Research SAS

Call code: OPVaV-2013/2.2/09-RO
ITMS project code: 26220220186

Eligible project costs: 22,238,024.37 EUR
Project implementation: 04/2013 to 07/2015

Scientific fields: materials research and nanotechnologies, biotechnologies and biomedicine, ICT
Domains of smart specialization: Public Health and Medical Technologies, Industry for the 21st Century
ESFRI: health and diet, physical sciences and engineering
Project implementation location: Košice region

Main goal: Establishment of a national Research Centre for Advanced Materials and Technologies for Current and Future Applications

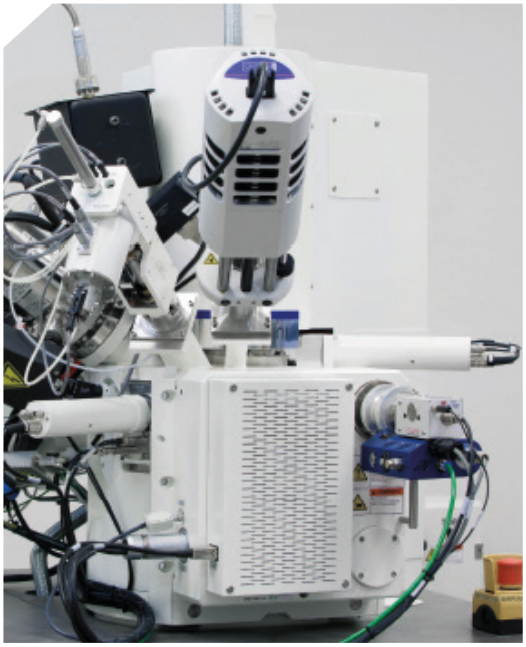
SPECIFIC GOALS

1. Support for research and development institutions and their scientific and technical infrastructure
2. Cooperation in the implementation of applied research and development
3. Ensure the effective transfer of knowledge of results of applied research into practice

The PROMATECH research centre focuses on research and development in the following areas: progressive steels and alloys, powder metallurgy products, ceramic materials and hard coatings; biomedical and environmental technology materials; materials for ICT technology and cryotechnology; new magnetic materials.

LABORATORIES BUILT

- Magnetically Shielded Laboratory
- REM Environmental Laboratory
- Nanotechnology Laboratory
- Laboratory for Treatment of Powder Materials
- Laboratory of Tribotechnology
- Corrosion Testing Laboratory
- Mechanochemistry Laboratory



- Laboratory of Thermal Analysis of Materials
- Laboratory of Thermal Analysis
- Powder Materials Laboratory
- Light Microscopy Laboratory
- Chemical Surface Analyses Laboratory
- Magnetometry and Sensors Laboratory
- Sample Preparation and Heat Treatment Laboratory
- Laboratory of Optical Microscopy
- Ceramography Laboratory-
- Solid Phase Aerosols and Sediments Laboratory
- Laboratory of Mineral Biotechnology
- Physical and Chemical Laboratory
- Laser Laboratory
- Hypertension Laboratory
- Microscopy Laboratory
- Spectroscopy Laboratory
- Laboratory of Dielectric Measurements
- Light Microscopy Laboratory
- Mechanical Testing Laboratory
- Laboratory of Coating Technologies
- Laboratory of Progressive Alloys
- Laboratory of Sintering and Heat Treatment
- Metalworking Laboratory
- Laboratory of Polymeric Materials
- Laboratory of Preparation of Powder and Pressed Samples
- Laboratory of Magnetic Properties
- Laboratory of Growth Probe Microscopy STM and AFM
- Low-Temperature Nanolaboratory of Magnetic Properties of Materials
- and others.

SELECTED TOP INFRASTRUCTURE

- Environmental scanning electron microscope. Microscope capable of electron microscopic observations of microstructure and topography of modern composite and nanocomposite materials with submicrometric dimensions of microstructure units offering a wide range of magnifications and working pressures to such an extent

that plating of non-conductive materials is not necessary, determination of the local chemical composition thanks to the incorporation of basic analytical methods based on EDX and WDX and others, such as XRF and cathodoluminescence.

- Glow discharge optical emission spectroscope (GDOES). GDOES is a universal device for rapid chemical analysis of electrically conductive and non-conductive solid materials, corrosion layers, coatings and determination of depth concentration profiles of a sufficiently wide range of elements from light to heavy, with high accuracy in a wide range of concentrations, in surface and thin subsurface areas from concentrations at several ppm.
- Apparatus for observing and simultaneously processing materials, so-called Dual beam "Focused Ion Beam". Equipment for observation of microstructure and fracture surfaces of materials, for preparation of thin films for transmission electron microscopy for preparation of nanostructures and for gradual polishing of samples and simultaneous chemical analysis.
- HiTUS technology for sputtering thin layers and coatings. Stainless steel vacuum chamber with a capacity of up to 50 l and replaceable inner wall shielding and a clean vacuum (turbomolecular pump); a high-density plasma source up to 1,013 cm-3 near the target and the control magnet, together with the corresponding force sources; 2.5 kW, target preload in RF mode up to min. 2.5 kW, preload on the substrate in RF mode up to min. 0.5 kW, system for filling and control of at least 2 reaction gases; system for exchange of min. three targets with a diameter of 76 mm and a thickness of up to 6 mm without vacuum interruption with the possibility of using smaller targets with a rotating holder
- Electric sintering device. Technological device, where the material in the die is heated by short high-intensity pulses of direct current during which microscopic electric discharges associated with the production of Joule heat occur between adjacent powder particles.

DEVELOPMENT TRENDS:

PROMATECH research centre focuses on the following:

Progressive steels and alloys, powder metallurgy products, ceramic and hard materials coatings - research focuses on:

- research and development of ceramic composites and PVD coatings with increased hardness and reduced coefficient of friction for power transmission in bearing and transmission mechanisms,
- research and development of technology for the production of electrocontact materials using powder metallurgy technology,
- research and development of grain-oriented electrical steels with lower watt losses,
- research into light structural components using aluminium composites and foams,
- corrosion monitoring and service life of gas pipelines.

Materials for biomedicine and environmental technologies - topics addressed:

- magnetic functionalized nanoparticles for biomedical purposes, drugs, polymers and surfactants and their use in the treatment of major diseases such as cancer, cardiovascular and amyloid diseases,
- design of biocomposite cement systems for biomedical use,
- research into the processability of carbonate and silicate raw materials contaminated with reactive and harmful mineral impurities in order to prepare monomineral concentrates for commercial use;
- synthesis and design of sulfide minerals for applications in power industry and medicine,
- research and development of materials and technologies for decontamination of industrial areas after mining and metallurgical activities ended

Materials for ICT technologies and cryotechnologies - research projects:

- research and development of a new technology for the preparation of massive monocrystalline superconductors for high-current applications - superconducting permanent magnets,
- research into nanostructured semiconductors for memory elements of ICT technologies

New magnetic materials - research projects:

- new materials for sensor systems with increased sensitivity and improved noise features
- microwires with increased sensitivity to external parameters such as temperature, mechanical stress and magnetic fields for use in microsensors,
- pressed magnetic soft composite materials for medium frequency use.

SLOVAK INFRASTRUCTURE FOR HIGH-PERFORMANCE COMPUTING

Supercomputing centres began to be built in the 1990s in economically developed countries, including neighbouring countries - Poland, Austria, Hungary and the Czech Republic, where the beginnings of supercomputing centres date back to 1995 - 1996. In Slovakia we recorded several attempts to create such centres (2001 - 2007). All attempts encountered a lack of funds and poor infrastructure.

As part of the preparation of the NSRF and the OP R&D, preconditions were created for the establishment of supercomputing centres in the Slovak Republic.

On 28 May 2009, the Managing Authority for the OP R&D announced a closed call entitled "Slovak Infrastructure for High-Performance Computing". The aim of this call was to build a unique computer infrastructure in Slovakia through its national project. The aim was to built an infrastructure which would be able to carry out very complex numerical calculations and would support the development of science and technology.

The computer infrastructure was implemented on the basis of supercomputers and grids. This computing infrastructure consisted of a parallel high-performance MPP computer (massive parallel processing) and an SMP supercomputer (symmetric multiprocessing), which are used for very complex calculations and modelling, and high-performance computers connected (parallel computing flows). It is also possible to combine these technologies in a superstructure built on the high-performance computers.

The technological base based on massively-parallel and grid computing systems will be easily accessible from all universities and research institutions in Slovakia.

The national project was implemented in cooperation with three SAS organizations and four universities and represented a helped develop computer culture at Slovak universities and at the SAS. The project provided opportunities not only to involved parties, but also to all universities and scientific institutes at the Slovak Academy of Sciences, as well as other research institutions and business entities.

The aim of the national project "Slovak Infrastructure for High-Performance Computing" was to create a centre in selected universities and workplaces of the Slovak Academy of Sciences equipped with a high-performance system with performance comparable to the computing capacities of similar centres in developed countries. These computing systems were connected to the SANET academic network. The national project helped the Slovak Republic to catch up to the neighbouring countries in this regard.

[1] Background for international strategic audit of research institutions, 2019.

Centre of Excellence for Contaminants and Microorganisms in Food - Acrylamide Elimination Strategy in the Food Manufacturing Process

Coordinator: National Agricultural and Food Centre
Partners: CEx3: Slovak Association of Bakers, Confectioners and Pasta Makers, Pečivárne Liptovský Hrádok, s.r.o., Mäspomix, s.r.o., Zvolen.

ITMS project code: CEX1 ITMS 26240120013 (original) / 26240120041 (new) CEX 2 ITMS 26240120024 (original) / 26240120042 (new) CEX 3 ITMS 26240220050 (original) / 26240220091 (new)
Call code: CEX1: OPVaV-2008/4.1/01-SORO CEx2: OPVaV-2009/4.1/02-SORO CSx3: OPVaV- 2009/4.2/04-SORO

Eligible project costs: CEx1: 736 451,84 € CEx2: 2 649 854,76 € CEx3: 939 347,90 €
Project implementation: CEx1: 05/2009 – 02/2012 CEx2: 04/2010 – 09/2014 CEx3: 10/2010 – 03/2015

Scientific fields: agricultural, natural and technical sciences
Domains of smart specialization: Healthy food and environment,
ESFRI: Health and Food
Project implementation location: NPPC VÚP Bratislava

Pursued goal:
CEx1: Construction of a unique workplace dealing with procedures for studying the formation, presence and elimination of contaminants in food
CEx2: Modernization of laboratories and instrumentation to support research and development at the centre of excellence
CEx3: Increasing the safety, quality and functionality of cereal products by eliminating acrylamide in the technological process of their production

SPECIFIC GOALS

CEx1: Support for excellent research in the Bratislava region. Improving the quality of research institutes. Positive impact on the health of the population of the Slovak Republic through healthy foods without contaminants. Creating conditions for more effective international cooperation.

CEx2: Scientific activities at the centre of excellence aimed at improving the research and development (works under scientific projects).

CEx3: Quality and safety of cereal products, quantification of parameters in terms of acrylamide content, physical-chemical and sensory properties. Increasing the safety of selected cereal products by eliminating acrylamide content, impact on physical-chemical and sensory properties.

LABORATORIES BUILT

Cex1 a Cex2: Specialized chromatographic laboratory for performing specific analyses aimed at identifying and quantifying trace amounts of chemical contaminants (HPLC / Q / TOF with autosampler, HPLC / QQQ with autosampler, nano HPLC with on-chip detection, HPLC for preparative purposes, GC / MS / MS). Spectrophotometric laboratory (UV / VIS / NIR and

EPR) allows the implementation of kinetic measurements and quantitative analysis of spectral data to study antioxidant properties of food. Laboratory of electrophoretic methods (capillary electrophoresis, pulse electrophoresis, temperature gradient electrophoresis, denaturing gradient gel electrophoresis, column gel electrophoresis, horizontal electrophoresis) studies DNA of microorganisms. Laboratory of biomolecular methods (PCR cycler, laser particle analyser, hybridization analyser, analytical system for biomacromolecules) studies proteins, peptides and nucleic acids.

CEx3: Specialized workplace of cereals-oriented technologies consisting of:

1. Cereals-oriented Technologies Laboratory:
   It carries out activities related to the preparation and analysis of cereal samples:
   - Sample preparation in the laboratory oven
   - Storage of samples in the climate chamber and freezer boxes
   - Study of flour and rheological properties of dough using the Mixolab Chopin
   - Study of water activity
   - Study of dry matter
   - Study of colour
   - Study of textural properties
   - Study of crude fibre
   - Photo documentation
2. Analytical chromatographic laboratory (HPLC / QQQ with autosampler):
   It carries out activities related to the analysis of contaminants, their precursors and volatile substances from cereal samples:
   - Analysis of acrylamide and hydroxymethylfurfural
   - Amino acid analysis
   - Volatile substance profile
3. Sensory laboratory with IT equipment: The laboratory meets the requirements of STN ISO 8589.
   The laboratory carries out sensory analyses of product properties. The laboratory also offers sensory training. The sensory laboratory also carries out instrumental sensory analysis using GC-olfactometry.

NPPC's Centre of Excellence for Genetic Resources Research

Coordinator: NPPC – National Agricultural and Food Centre
Partners: Constantine the Philosopher University in Nitra

ITMS project code: 26220120073 / 26220120070
Call code: OPVaV-2009/2.1/02-SORO / superstructure OPVaV-2008/2.1/01-SORO

Eligible project expenditures: 3,854,348.96 Eur
Project implementation: 06/2009 – 02/2015

Scientific fields: agricultural, natural and technical sciences
Domains of smart specialization: Healthy food and environment
ESFRI: Health and food
Project implementation location: Nitra region, Lužianky, Nitra

Goal pursued: To complete the infrastructure of the following laboratories: breeding, computational genetics and research of genetic animal resources with emphasis on product quality and animal welfare and with the perspective of building a national livestock gene bank

SPECIFIC GOALS

To complete the infrastructure of the computational genetics laboratory with emphasis on the use of advanced information technologies in research and education. Integration of research capacities in the field of breeding to improve the quality of animal products, including genetic markers, while taking into account animal welfare. Build an integrated laboratory for research on animal genetic resources. Modernization of equipment of laboratories assessing quality of animal products. To complete the research base for development of methods for assessment of animal welfare. To supply equipment needed to assess animal genetic resources.

LABORATORIES BUILT

- Laboratory of Computational Genetics
- Laboratory for Research and Preservation of Animal Genetic Resources
- Laboratory of Meat Quality Assessment
- Mobile Laboratory of Carcass Evaluation in Vivo
- Milk Quality Laboratory
- Integrated Laboratory for Animal Genetic Resources
- Somatic and Generative Cell Laboratory

This research infrastructure will be used in a long-term strategic research project Code: 313011W112 Name: SMARTFARM Sustainable smart farming systems taking into account the challenges of the future. Sum: 11,570,579.08 EUR. Project implementation period: 07/2017 - 03/2023. 10 partners from the public and academic (4) and private sectors (6) work on the project.

National Gene Bank of the Slovak Republic

Coordinator: National Agricultural and Food Centre, Department of the National Agricultural and Food Centre, Research Institute of Crop Production, Piešťany. It is a workplace of national importance that ensures the management of genetic plant resources at the national level in accordance with international conventions (Regulation No. 511/2014 of the European Parliament and of the Council of 16 April 2014 Nagoya Protocol on Access to Genetic Resources and Equitable and Equitable Sharing benefits arising from their use adopted by the European Union (published in the Official Journal of the EU L 150/237 of 20 May 2014), the basic objectives of the Convention on Biological Diversity published in the Collection of Laws of the Slovak Republic No. 34/1996 and the International Treaty on Plant Genetics Resources for Food and Agriculture and the Agreement on the Establishment of the World Trust Fund for Crop Diversity (Collection of Laws No. 446/2010 and 449/2010) and national legislation (Act of the National Council of the Slovak Republic No. 215/2001 Coll. on the Protection of Plant Genetic Resources for Food and Agriculture) in the field of protection of plant genetic resources for food and agriculture. The activities of the workplace are related to the following implemented OPVAI research projects and currently implemented H2020 projects. Title: Research of plant genetic resources and its place in the sustainable development of the Slovak economy.
Partners: Institute of Plant Genetics and Biotechnology, Slovak Academy of Sciences, Akademická 2, 950 07 Nitra

ITMS project code: 26220220192
Call code:

Eligible project costs: 862,222 EUR
Scientific fields: agricultural, natural and technical sciences
Domains of smart specialization: Health food and environment,
ESFRI: Health and Food
Project implementation location: Piešťany district, Piešťany

Gene Bank of SR is a special technical facility, the only one of its kind in Slovakia and has many years of experience with long-term preservation of plant genetic resources. In terms of domestic and foreign ties, Gene Bank SR ranks among unique workplaces focusing on the support of basic and applied plant research and the creation of better conditions for the protection of biological resources in the Slovak Republic. At the international level, Gene Bank SR cooperates with other gene banks in the world, especially in the field of mutual exchange of seeds for the purposes of research and cultivating. The Slovak Republic is a member of Biodiversity International in Rome and participates in the European Cooperative Program for Plant Genetic Resources (ECPGR). The main activities of Gene Bank are carried out within ECPGR working groups and networks (https://www.vurv.sk/pracoviska/vyskumny-ustav-rastlinnej-vyroby-vurv-piestany/genova-banka-slovenskej-republiky).

Significant international projects **H2020: AGENT** ('Activated GEnebank NeTwork') are follow up to the GB's activities. ID: 862613 https://cordis.europa.eu/project/id/862613

H2020: ECOBREED Increasing the efficiency and competitiveness of organic crop breeding ID: 771367 https://cordis.europa.eu/project/id/771367

GOAL PURSUED

- Innovate and improve the infrastructure of the National Plant Gene Bank to make the transfer of newly acquired knowledge into practice easier (an emphasis is placed on the use of plant genetic resources).
- Ensuring the functionality of the information database system of plant genetic resources and its compatibility with international databases (https://griss.vurv.sk/).
- Building system capacities for monitoring old and regional varieties of fruit trees and preserving plant genetic resources.
- Modernization of technical infrastructure for protection, evaluation and regeneration of preserved collections of plant genetic resources.
- Building an ex-situ field collection of genetic resources of grapevine, apricots, peaches, cherries and other types of fruit trees, maintaining collections of species in the in vitro system and on farms.
- Long-term conservation and research of plant genetic resources for food and agriculture, resulting from the need to preserve the diversity of domestic genetic resources as part of the nation's cultural heritage. Research focused on specific properties related to climate change (adaptability, plasticity of genotypes, identification of disease resistance genes, interaction of genotype x environment.)

LABORATORIES BUILT

a) Laboratory for the Collection and Provision of Plant Genetic Resources;
b) Laboratory of Genetic Resource Collection (Study and Evaluation);
c) Laboratory for Keeping Seeds Stored in a Gene Bank in a Viable State;
d) Laboratory of Plant Genetic Resources Documentation;
e) In Vitro Collection Laboratory
f) expanding the domestic and foreign gene pool for further use in research and breeding;
g) preservation of seed species in the gene bank in ex situ collections, in vitro and in field collections in a viable state;
h) generation of passport and descriptive databases for the purpose of processing the information system of plant genetic resources;
i) international cooperation, in particular within the ECPGR (European Cooperative Program for Plant Genetic Resources) and its implementation in ECPGR working groups and networks (Avena, Barley, Forages, Grain Legumes, Malus / Pyrus, MAP, Potato, Prunus, Wheat, Vitis);
j) the provision of biological material for breeding, research, study and exchange with other gene banks

The mentioned research infrastructure will be used within the long-term strategic research project.

LignoSilva – the Centre of Excellence of Forest-based Industry

Coordinator: National Forestry Centre
Partners: Paper and Pulp Research Institute ITMS project code: 313011S735

Call code: OPVaI-VA/DP/2018/1.1.3-04

Eligible project costs: 10,427,302.82 €
Project implementation: 01/2017 to 06/2023

Scientific fields: agricultural, natural and technical sciences
Domains of smart specialization: Healthy Food and the Environment, Industry for the 21st Century
ESFRI: Environment
Project implementation location: Banská Bystrica region, Bratislava region, Trnava region

Goals pursued: Creation of the Centre of Excellence of Forest-based Industry (CE) focusing on building support infrastructure and support of CE research activities.

SPECIFIC GOALS

- Building a platform for bioeconomics for Central Europe, which integrates the research, development and innovation potential of the forest-based industry (including and pulp and paper) into a rationally interconnected chain of wood production, processing and utilization.
- Transforming the forest-based industry into a sector with higher added value through research and transfer of knowledge into practice, while accepting the current social requirement of the structural transition of society from a fossil to a low-carbon economy based on the use of renewable resources.

LABORATORIES BUILT

- Laboratory of Image Processing, Remote Sensing and GIS
- Forest Dynamics Research, Modelling and Forecasting Laboratory
- Laboratory of Integrated Forest Protection
- Laboratory and Facilities for Research on Growing Trees
- Central Forestry Chemical Laboratory

The laboratory was renovated and received new equipment in the previous programming period 2007-2013, when the volume of invested funds in infrastructure amount to: - Research and Development: EUR 2,257,213 - Centre of Excellence for Forest and Landscape Decision Support - Centre of Biological Excellence Forest Protection Methods - Centre of Excellence for Adaptive Forest Ecosystems - Swiss Financial Mechanism: EUR 1,964,577 - own resources: EUR 696,920. Their further development is planned in detail within CE LignoSilva.

SELECTED TOP INFRASTRUCTURE

Technology for forest dynamics research, modelling and forecasting includes a comprehensive infrastructure for field data collection, databases of long-term time series of various forest development indicators, tools for analysis, modelling

and forecasting of forest development from the National Forest Inventory Network (4 x 4 km, total 1,486 areas), ICP Forests-based monitoring (16 x 16 km, a total of 112 areas) and other research areas in forest ecosystems in Slovakia.

The infrastructure is complemented by the SGI Altix UV2000 supercomputer used to simulate the impacts of climate change on the forest and optimize forest management, field stations for comprehensive dendrometric and climatological data collection, and FieldMap technology for forest inventory. Integrated forest protection research technology.

A set of technical equipment and software, extensive long-term data sources used to research the impact of harmful factors on the state of forest ecosystems, specializing in research of ecological and preferably biological forest protection methods, ethology and ecology of domestic and invasive pests and development progressive forest protection methods. The infrastructure consists of special laboratories for breeding of insect and fungal pests and a genetic laboratory. The infrastructure includes special microscopes, binocular magnifiers with digital image sensors, 8 air conditioning cabinets with temperature, humidity and light settings, 3 sterile environment boxes, 4 air-conditioned rooms for laboratory insects, 2 autoclaves, 2 flowboxes, automated equipment with rain control for field trials containing 12 breeding boxes. The genetic laboratory is equipped with a thermal cycler. Technology for research on growing and producing trees. The basic parts of the infrastructure for breeding and working with reproductive material are located in the genetic and seed laboratory in Zvolen, which is accredited by the ISTA (International Seed Testing Association). Production areas with infrastructure for research in physiology, propagation and breeding of fast-growing trees are located in the research station “Juh” in Gabčíkovo.

Due to the nature of the research, long-term research facilities and areas are located directly in the field: - Veľká stráž biological base near Zvolen with infrastructure for field experiments (breeding and cultivation of trees, Kysihýbel Forest Arboretum with non-native trees monitors their growth in terms of their use in forestry, - Kysuce research facility focuses on research renewal of failing spruce stands (joint initiative of NLC - Lesy SR š.p. - Ministry of Agriculture and Rural Development of the Slovak Republic - permanent research areas are being established since 1958 (research, cultivation of forest stands and provenance research).

4.5 MANAGEMENT AND COORDINATION OF THE INVOLVEMENT OF THE SLOVAK REPUBLIC IN ESFRI RESEARCH INFRASTRUCTURES

The implementation of the Roadmap for Research Infrastructures is managed by the ESFRI Research Infrastructures Council. The council will consist of representatives of the Ministry of Education of the Slovak Republic, representatives of the Slovak Republic in the ESFRI Forum, chairmen of commissions for coordination of Slovak activities in ESFRI research infrastructures, Slovak delegate SR in the ERIC Council, representatives of the SR in the strategic working groups (SWG) ESFRI for individual thematic areas, as well as representatives of the scientific and professional community, the business sector and representatives of central state administration bodies.

The main task of the ESFRI Research Infrastructures Council will be to prepare and update the SK Roadmap, coordinate strategies and positions of the Slovak Republic towards the European ESFRI Forum, coordinate four commissions for coordination of activities of the Slovak Republic in ESFRI research infrastructures and assess applications for national platform recognition in terms of administrative readiness and their compliance with SK Roadmap priorities.

Details on the members and powers of the ESFRI Research Infrastructures Council are regulated by the statute of the ESFRI Research Infrastructures Council, which is issued and updated by the Ministry of Education, Youth and Sports of the Slovak Republic.

Four commissions for the coordination of activities of the Slovak Republic in ESFRI research infrastructures have been established to manage research infrastructures, each in charge of own division within the European ESFRI Roadmap. The commissions:

- Commission on Physical Sciences, Materials and Energy Facilities,
- Commission on Health, Food and the Environment,
- Commission on Culture, Social Sciences and Humanities
- Commission on Technical Sciences and Industry.

The aim of these commissions is in particular:

- to create and update the concept of cooperation of the Slovak Republic with ESFRI research infrastructures in individual areas,
- to evaluate applications for recognition of the national platform in each area in terms of scientific and vocational training and readiness,
- continuously assess the results and further intentions of cooperation with ESFRI research infrastructures in individual areas,
- to assess the intentions, goals, time-limited research and development activities and tasks of platforms representing the Slovak Republic in ESFRI research infrastructures in individual areas,
- to compile expert and scientific opinions and recommendations for the cooperation of the Slovak Republic with ESFRI research infrastructures in individual areas,
- to initiate new experiments and evaluate existing experiments of organizations in ESFRI research infrastructures,
- to coordinate the participation of Slovak representatives in conferences, workshops and similar events organized by ESFRI research infrastructures,
- to propose traineeships, researcher mobility and facilitate the transfer of information between ESFRI research infrastructures and bodies at the national level,
- to coordinate activities at the meetings of the working groups in ESFRI research infrastructures and to evaluate the results of those meetings.

Details on the composition and competence of individual commissions are regulated by their statutes. These statutes are issued and updated by the Ministry of Education, Youth and Sports of the Slovak Republic.

The National Platform is a group of key research and development institutions of the Slovak Republic in the relevant field and its complementary branches, which, with the aim of implementing a common coordinated approach towards research and development issues, creates an association with contractually defined goals, competencies and obligations. The National Platform communicates through the national contact point with state administration bodies (inwards) as well as international organizations (outwards).

The cooperation of the Slovak Republic with research infrastructures within the ESFRI will be ensured at the national level by national contact points, which will be established for each research infrastructure and will be within the material competence of the institution representing the national platform for the relevant area. The costs associated with the operation of the national contact point shall be borne by the representative of the national platform for the area concerned.

4.6 PROVISION OF INFORMATION ON ACTIVITIES OF THE SLOVAK REPUBLIC IN THE FIELD OF RESEARCH INFRASTRUCTURES

In order to provide information on the activities of the Slovak Republic in research infrastructures within the ESFRI as well as information on statistics and analyses in the field of research and development, an information provision section will be established in 2021 within the Central Information Portal for Research, Development and Innovation - vedatechnika.sk, which will, among other things, also contain comprehensive information on public and private technical R&D infrastructure in Slovakia.

The above information section will contain all relevant information on:

- significant research infrastructure of the Slovak Republic which was built from public or private sources,
- localization of research infrastructure,
- devices, equipment and staff,
- existing or planned national platforms,
- the results of monitoring activities of individual research infrastructures and their evaluation,
- top scientific teams identified by the Accreditation Commission,
- dynamic research teams,
- the offer of research and development services (the infrastructure could be used in research and development carried out by the business sector),
- national contact points,
- offers for international R&D cooperation.

In connection with the prepared I. Action Plan for the Implementation of the Roadmap of Research Infrastructures for the period 2021 - 2025, an online catalogue of research infrastructures of the Slovak Republic will be prepared and published within the mentioned information section. The section will contain information on equipment and devices available to research infrastructures, information on the use of equipment and devices together with information on whether the institution has trained staff who can operate a particular device and whether the actual

equipment and devices are used for the purpose in question. It will also provide information whether the research infrastructure is open to be used for remuneration. Data will be intended for the professional public and the private sector which currently do not have information on the research infrastructure.

The manager of the information system in question will be the Ministry of Education, Youth and Sports of the Slovak Republic as the central state administration body for science and technology. The information system administrator will be the Centre for Scientific and Technical Information of the Slovak Republic (CVTI SR).

The on-line catalogue of research infrastructure of the Slovak Republic will contain comprehensive information on R&D infrastructure in the Slovak Republic built from public or private sources. On the basis of I. Action Plan for the Implementation of the Roadmap of Research Infrastructures, the Ministry of Education, Youth and Sports of the Slovak Republic will prepare legally binding rules and obligations under which R&D entities would be obliged to regularly provide information to the online catalogue of research infrastructure of the Slovak Republic, including effective sanctions for non-compliance with this obligation.

4.7 FUNDING OF SLOVAK RESEARCH INFRASTRUCTURES

As already mentioned, the financing of the research infrastructure of the Slovak Republic is based on resources from the state budget (state programs targeting research and development infrastructure, subsidies for scientific and technical services), resources obtained on the basis of own project activity (involvement in programs and general calls of the Research and Development Support Agency) as well as resources of the European Structural and Investment Funds (within the operational programs focused on research, development and innovation) (these funds make an important part of the research funding in the Slovak Republic) and private funding from individual sectors of the economy.

The action plans will include an analysis of the necessary financial resources for the continuous systematic innovation of the technical R&D infrastructure (R&D) from public and private sector resources. These include the operation, maintenance and repairs of TI R&D and personnel costs. The action plans will also include proposals for incentives and measures to support the cooperation of the owners / users of the established research infrastructure with state administration bodies, local governments and the business sector.

At present, the Slovak Republic's membership fees in international research and development organizations are financed from the budget of the Ministry of Education, Science, Research and Sports of the Slovak Republic on the basis of prior membership approval given by the Government of the Slovak Republic which allocates funds for this purpose.

A specific grant scheme will be established to fund national platforms and project activities with links to international research and development organizations in the territory of the Slovak Republic within the ESFRI. These will be covered by the relevant commission presiding over each area.

Each commission will manage the relevant part of the grant scheme as per its area under the SK Roadmap. Under the scheme, the individual national platforms - SK Roadmap projects and SK Roadmap infrastructure will compete for funds to support their activities. At the same time, the Ministry of Education, Youth and Sports of the Slovak Republic will fund membership fees in individual European ESFRI infrastructures and projects from the allocated funds.

In addition to resources from the Structural Funds, government should allocate a portion of its budget to fund science and research. A good example is the Czech Republic: Targeted support for the National Sustainability Program I and II (42 centres in NPU I and 6 centres in NPU II), under within which R&D will be supported until 2020. In the case of three quarters of centres, targeted support covers over 45% of total revenues and in the case of half of the centres more than 59%. Thus, most centres are funded by the NPU, national funds and ESIF programs.

European and national state aid rules must be taken into account when setting support measures, and in the event of state aid as such, compatibility with the rules in question must be ensured. In the event that any of the measures does not constitute State aid, it is necessary for the provider to be able to apply the relevant exception to the rules in question (eg de minimis).

4.8 4.8 VISION, GOAL, PRIORITIES AND PRINCIPLES

Vision: In 2030, the Slovak Republic will be an internationally recognized country for its high-quality and competitive research infrastructures which have a direct impact on education, society, the economy and the business sector.

The target state of the Slovak research infrastructure can be defined as the state which allows us to do top research in areas in which Slovak science specializes in and also allows Slovak researchers to participate in international research as equal partners. Related to this is a stable and predictable environment for building research infrastructure at national level, the existence of a long-term program and procedures to support the development of research infrastructures and related research.

The presented Roadmap VI represents the beginning of the journey, a conceptual document aimed at achieving the state described in the vision. The Roadmap aims to define the principles, procedures, management system and funding for the development of national research infrastructure in the long term. The concrete steps to achieve this vision will be elaborated in detail in the Action Plan for the Implementation of the Roadmap for Research Infrastructures. The Ministry of Education, Science, Research and Sports

of the Slovak Republic, together with other central state administration bodies and the Slovak Academy of Sciences, will participate in the preparation of the Action Plan.

Road Map VI will be updated regularly. The periodicity of its update will be adapted to the periodicity of the update of the European ESFRI Roadmap, with the update taking place at the latest every four years. The idea is to update the National Roadmap one year after the European ESFRI Roadmap is updated, which will allow us one year during which we would be able to identify new opportunities for the Slovak scientific and professional community in terms of involvement in ESFRI European research infrastructures and to shape the national environment accordingly. In this context, the first update of the National Roadmap VI will follow the update of the European ESFRI Roadmap, which is being prepared for 2021. This first update of the National Roadmap VI will already contain the essential elements of the Action Plan and the specification of research management rules, procedures and steps.

One of the tasks of Roadmap VI is to define the main priorities in the field of research infrastructures in Slovakia and the way they are connected to ESFRI. Defining priorities should be understood as a process. At this stage of creating the national Roadmap, we will limit ourselves to large international infrastructures in which the Slovak Republic is a long-term member, in which considerable funds and human potential have already been invested and to which ongoing research programs and, in most cases, the education and training of the young generation of scientists are linked. It is mainly these infrastructures:

- CERN – European Organization for Nuclear Research
- JINR - Joint Institute for Nuclear Research
- EMBL - European Molecular Biology Laboratories
- ICGEB - International Centre for Genetic Engineering and Biotechnology
- European XFEL - European X-ray laser based on free electrons

It is an unquestionable priority to continue our participation in these infrastructures and to enhance the resources and experience gained so far. Of the above infrastructures, European XFEL is part of ESFRI, as is the CERN's High-Luminosity Large Hadron Collider (HL-LHC) project.

Further priorities in the field of research infrastructures will be identified in the process of evaluation of national research infrastructures, where their connection to international structures is an important criterion, especially within the framework of ESFRI. Following the first round of the assessment, these priorities will be added to the updated version of the Roadmap VI.

The principles for building a national research infrastructure.

1. **Long-term development of research infrastructures**

- The development and sustainability of small, medium and large infrastructures in the medium and long term will be included in the strategic development plans of research organizations;
- The Ministry of Education, Youth and Sports of the Slovak Republic will pay more attention to the opportunities offered by research infrastructures in the research and development sector and in the business sector, as well as in strengthening competitiveness and further development of society;
- The Ministry of Education, Youth and Sports of the Slovak Republic will take steps to ensure that the quality of existing national research infrastructures contributes to the activities and optimal use of international research infrastructures.

2. **Improving accessibility and collaborative approach to the use of research infrastructures**

- The Ministry of Education, Youth and Sports of the Slovak Republic will systematically support the cooperation of individual members of research infrastructures also through existing research and development support schemes in order to maximize the use of research infrastructure potential in the development of society and economy of the Slovak Republic;
- The Ministry of Education, Youth and Sports of the Slovak Republic will create conditions for a collaborative approach to the use of research infrastructures by individual members of research infrastructures, universities, research institutions, hospitals and business entities by creating conditions and mechanisms for cooperation and creating an innovative environment;
- The FAIR (Findable, Accessible, Interoperable, Reusable) principle and solutions that support open science within research infrastructures will be applied;
- The Ministry of Education, Youth and Sports of the Slovak Republic will systematically support the use of the existing research infrastructure through the existing research and development support schemes.

3. **Strengthening the funding of research infrastructures**

- Based on the AP, targeted and long-term sustainable funding of research infrastructures will be provided;
- The cooperation of individual stakeholders (ministry, universities, research organizations, companies, etc.) in the funding of research infrastructures will be expanded;
- The funding system will support the cooperation of individual participants;
- The funding plan will be adopted at national and organizational level, taking into account possible life-cycle changes and characteristics of the research infrastructure.

4. **The Roadmap will provide a basic framework and methodology for the development of research infrastructures**

- The most important and priority projects will be included in the Roadmap, thus achieving a high quality of generated knowledge which would be applied in practice. Considerable impact at the national and international level is expected;
- The selected projects will cover all key disciplines and will support the implementation of strategies and policies of the Slovak Republic in the field of research and development.
- The implementation of the strategy in the field of research infrastructures and the progress achieved by individual research infrastructures will be assessed at three-year intervals.
- The impact, uniqueness, significance and collaborative use of research infrastructures will be subject to regular evaluation;

5. **Evaluation of the impact and importance of research infrastructures**

- Decisions on the continued involvement of the Slovak Republic in international research infrastructures will be based on systematic evaluation;
- The evaluation will focus on the direct and indirect benefits of research infrastructures for the society and economy of the Slovak Republic as well as for the development of the research environment. ■

5 CREATING A NATIONAL
Roadmap of Research Infrastructures - SK VI Roadmap

The Slovak Republic engages in ESFRI European research infrastructures through a complementary infrastructure at the national level, which is grouped in the form of national platforms for specific areas of research and development.

The ESFRI National Infrastructure Platform is a national research infrastructure that is compatible with the relevant ESFRI project or ESFRI infrastructure and is able to participate in their construction and operation. The main purpose of the National Platform is to build and operate a national infrastructure that provides services to researchers and society, which is also an integral part of the European Research Infrastructure and participates in its activities.

The creation of these platforms is initiated either from below by individual entities or from above by the Ministry of Education, Youth and Sports of the Slovak Republic, and the process of their establishment is coordinated by the Ministry of Education, Youth and Sports of the Slovak Republic through the Science and Technology Section.

This principle reflects the emergence of European infrastructure, i. e. just as the European infrastructure is a consortium of national infrastructures of several member countries, so national infrastructure should be an association of several entities that operate within the Slovak Republic, are of national importance and can contribute to the activities of the European infrastructure.

5.1 SELECTION PROCESS AND CRITERIA FOR RESEARCH INFRASTRUCTURES

The natural outcome of scientific activities is the emergence of new R&D platforms. The platforms make it possible to organize the national research infrastructure into functional units according to the areas of focus with a view to their future inclusion in the SK Roadmap and the ESFRI.

For implementation into the policy at the national level in relation to the SK Roadmap and the European ESFRI Roadmap, when creating new platforms, the scientific and professional community will proceed as follows:

1. The first step is to create a functional unit - a consortium on the basis of an agreement on cooperation and consortium creation, focusing on the relevant thematic areas corresponding to the activities of the consortium members and the ESFRI. Mutual cooperation of specific partners results either from the existing cooperation in the given area (top-down approach) or, optionally, the Ministry of Education, Youth and Sports of the Slovak Republic will initiate cooperation among several partners whose activities would complement each other (bottom-up approach). The contract must contain, among other things, the name / acronym of the association, the designation of a leader appointed from among the individual members of the consortium and also a condition for declaring the openness of the consortium thus formed in relation to possible later entry of of other partners interested in participation.

2. The consortium created in this way will apply to the Ministry of Education, Youth and Sports of the Slovak Republic for the status of a national platform under the relevant thematic area. Once granted the status, the consortium may apply for inclusion in the SK Roadmap as a SK Roadmap project to be included in the corresponding European research infrastructure ESFRI. **The deadline for submitting applications for national platform status is 31 May (each year).** The applications must be submitted before the state budget is confirmed as applications must be taken into account when proposing the funding scheme.

   Under the application, the consortium will also provide structured data on individual consortium member organizations, participants, professional profiling, completed projects and their outputs to a specialized database maintained by the Ministry of Education, Youth and Sports of the Slovak Republic. The outputs from the database will be used for the purposes of supporting the platform in the given area, in particular the availability of experts for the elaboration of expert opinions and evaluations, checking research capacities for projects and creating dynamic research teams at the domestic and international level. They will also serve the needs of the professional public in relation to the possibility of expanding existing and creating new consortia, as well as the needs of the Ministry of Education, Youth and Sports of the Slovak Republic in relation to the creation of individual professional bodies for research infrastructures within its competencies at the national and international level.

3. The Ministry of Education, Youth and Sports of the Slovak Republic through the established bodies (Commission for Coordination of Activities of the Slovak Republic in ESFRI Research Infrastructures for the relevant thematic area, ESFRI Research Infrastructures Council)[1] will assess this application in terms of scientific and professional readiness, administrative readiness and compliance with SK Roadmap priorities, and, if approved, issue a decree, acceptance letter, to the relevant consortium recognizing it as a national platform for the relevant thematic area. The consortium in the form of a national platform will thus be included in the SK Roadmap as a SK Roadmap project eligible to be funded through a specific grant scheme. This is a preparatory phase in which the platform must demonstrate its professional and organizational viability and prepare to join the relevant European research consortium ESFRI.

4. Based on the achievement and evaluation of the maturity of the platform and the availability of mandatory funds for membership financing, the Ministry of Education, Youth and Sports of the Slovak Republic will take all necessary administrative steps to confirm Slovakia's membership in the relevant ESFRI European Research Infrastructure through a consortium - a recognized national platform.

   The quality of research and development in Slovakia as well as the quality of research and development infrastructure is ensured at several levels of project preparation or project life cycle:

[1] *See the definition of the authorities below.*

- When evaluating and selecting project proposals for the Roadmap, increased attention is paid to the quality of research and the applicant as well as the quality of the project plan, which must meet the set criteria. The assessment of proposals will be carried out through a panel of foreign experts;
- At the same time, emphasis is placed on international research cooperation and partnerships in order to maximize know-how and the use of available research infrastructure;
- A key condition for existing cooperation is the quality of research and development, global competitiveness, knowledge exchange potential, instrumentation sharing and redistribution of competencies.
- Existing as well as emerging research infrastructures are based on long-term strategic visions, which set achievable and verifiable goals (in the medium and long term). The long-term strategic vision of the research infrastructure should also include a plan to transform the in-house research into open user access within a clearly defined time horizon.

SUBMISSION OF PROPOSALS FOR NEW ESFRI INFRASTRUCTURES

Within the created environment of the SK Roadmap and in relation to the European ESFRI Roadmap, it is possible for the Slovak scientific and professional community to draw up new European research infrastructures proposals. These proposals must be drawn up in coordination with the Slovak Republic or another ESFRI member country to be included in the European ESFRI Roadmap. For the Slovak Republic, such proposals are prepared by national platforms, which were created in accordance with the above procedure and approved for inclusion in the SK Roadmap. The deadline for submitting an application for national support for a new research infrastructure project proposal (the European ESFRI Roadmap) is no later than 8 months before the deadline set for the submission of research infrastructure project proposals (the update of the European ESFRI Roadmap).

Based on the submission of an application for the inclusion of a new research infrastructure in the European ESFRI Roadmap within the specified deadline, the Ministry of Education, Youth and Sports of the Slovak Republic will ensure all necessary steps to finalize the application through established bodies (Commission for Coordination of Activities of the Slovak Republic in Research Infrastructures ESFRI for the relevant thematic area, Council for Research Infrastructures ESFRI) all necessary steps to finalize the application, obtain the necessary political support and ensure the obligatory funding to ensure Slovak membership in case European ESFRI Roadmap.

Political support is a manifestation of the political interest of the Government of the Slovak Republic through the Ministry of Education, Youth and Sports of the Slovak Republic to support the development of activities and cooperation at the European level within the European Research Area in the relevant field of research and development. In this case, the expression of political support from the Slovak Republic, as well as from other countries establishing the proposed research infrastructure, is a necessary condition for submitting a joint application of the proposed research infrastructure to the ESFRI Roadmap.

The mere expression of political support does not create any obligations in relation to the financing of Slovakia‘s mem-

bership in the given research infrastructure, as it is not clear at the time of the political support whether the ESFRI Forum will approve and include the relevant research infrastructure proposal in the ESFRI Roadmap. However, political support is a prerequisite for creating these commitments.

Ensuring the obligatory funding for securing the membership of the Slovak Republic is a follow-up logical step in the process of implementing the design of a new research infrastructure into the European ESFRI Roadmap and its transfer to the national level. On the basis of the expressed political support, the intended design of a new research infrastructure will be included in the prepared/ running ESFRI projects as part of the SK VI Roadmap update. VI projects that were included in the ESFRI Roadmap update are expected to be funded from the state budget under the next budget period.

5.2 EVALUATION OF NATIONAL RESEARCH INFRASTRUCTURES AND THEIR INCLUSION IN THE SK ROADMAP AND ESFRI ROADMAP

As part of the process of creating consortia at the national level, their approval and inclusion in the SK Roadmap and subsequent implementation, three levels of evaluation will take place.

1. At the first level, the application of the consortium recognized as a national platform will be assessed in terms of scientific and professional readiness, administrative readiness and compliance with the priorities of the SK Roadmap. The intended activities and prospects of the involvement of the Slovak Republic in European research infrastructures will be evaluated. This evaluation will be carried out by individual commissions for the coordination of activities of the Slovak Republic in ESFRI research infrastructures. The organizational potential and sustainability of the consortium in relation to the implementation of the project will also be assessed by the ESFRI Research Infrastructures Council.

2. After approval of the intention and recognition of the consortium as a national platform for the relevant thematic area, the maturity and viability of the platform in relation to the readiness to represent the Slovak Republic in the corresponding European consortium ESFRI will be assessed at the second level. The assessment will be implemented by the Ministry of Education, Youth and Sports of the Slovak Republic and the ESFRI Research Infrastructures Council. After the assessment (positive result is required), the Ministry of Education, Youth and Sports of the Slovak Republic will take all necessary administrative steps to confirm the membership of the Slovak Republic in the relevant European research infrastructure ESFRI through the given recognized national platform.

3. The third level of evaluation includes regular annual monitoring of objectives set by the platforms and the benefits of their membership in the ESFRI European Research Infrastructures. The assessment will be implemented by the Ministry of Education, Youth and Sports of the Slovak Republic and the ESFRI Research Infrastructures Council. The outputs from the monitoring will also serve as inputs for annual analytical reports on the state of research and development in the Slovak Republic.

5.3 OPPORTUNITIES AND CHALLENGES OF RESEARCH INFRASTRUCTURES IN THE SLOVAK REPUBLIC

Based on previous experience in the field of research infrastructure support, it is necessary to identify national infrastructures under SK VI Roadmap using the horizontal approach as follows:

1) If we start from the research infrastructures that the Slovak Republic already has and which were financed from the EU structural funds, it is necessary to take into account all university science parks, research centres, the Slovak infrastructure for high-performance computing and selected national CVTI projects (especially the Data Centre). These are not ESFRI-type infrastructures, but represent the basis on which the subsequent definition of national infrastructures for the SK VI Roadmap can be built, and which can also have the potential to become a national platform of the ESFRI research infrastructures. These existing infrastructures existing in Slovakia could be transformed into national centres of distributed public research infrastructure (a great example is the Czech Republic and its network of research centres across the country - „National Centre for Medical Genomics" (https://ncmg.cz). Research infrastructure organized in this way is still lacking in Slovakia. However, it could be created in various priority areas on the basis of networking across the mentioned infrastructures / institutions.

2) The second group of infrastructures should be the one that is currently absent in Slovakia (it should be created and financed). A great example is the call of the Research Agency for the Support of Systemic Research Infrastructure in the field of Public Health - two complementary biobanking projects were g submitted and, if approved, may become the basis for a national biobanking infrastructure, which may subsequently become part of the pan-European ESFRI biobanking infrastructure.

To implement these two steps, we propose close cooperation with the Centre for Scientific and Technical Information, which should identify a list of such infrastructures. The research agency will then provide for each such infrastructure information on its current state of funding/other data. Such list of infrastructures could form the SK VI Roadmap and also define priorities in building research infrastructures in Slovakia.

A comparative analysis of the construction of science parks in the environment of academic institutions in the V4 countries has also yielded several findings. These findings might help identify future development opportunities.

In all V4 countries, the field of science and research is primarily publicly funded. Compared to Slovakia, the Czech Republic has used several instruments to fund the operation and sustainable use of R & D & I, which is mainly funded by the EU. On the other hand, Slovakia leaves many R & D capacities unused because it cannot secure funding for their operations and researchers. A significant obstacle is the lengthy approval process, lack of motivation and inexperience of academic institutions and ministries to seek other sources of funding for R & D activities (multi-source R & D funding). The sustainability of basic research, which brings general knowledge and discoveries with unclear potential for practical application, should be funded primarily by the state. All V4 countries are more or less striving for this.

In addition to centres funded from by the state budget, the Czech Republic invests in research centres through the activities of the Ministry of Education, Youth and Sports of the Czech Republic. Unlike the centres established within the OP RDI (Operational Program Research and Development for Innovation), their integration into macro-regional entities created according to various legal frameworks is an integral part of the support of research infrastructures. The term Research Infrastructure is defined by Act no. 130/2002 Coll. as „research infrastructure which is a research facility necessary for comprehensive research and development activities with high financial and technological demands approved by the government and established for use by other research organizations." This results in the accumulation of research capacities that are funded from various sources and often function under the same founding research institution. For large research infrastructures, operating costs will be covered from targeted support from the state budget of the Czech Republic allocated on research, development and innovation. Investment costs will be financed in a complementary way using the resources of the European Structural and Investment Funds drawn from the Operational Programs focused on research, development and innovation.

Experience from abroad has shown that university science parks and research centres should not only be used by state research institutions and universities, but also by broader public to validate, test and introduce new ideas and improvements that are of interest to people as end users and which are able to improve existing complex systems and improve quality of life.

The basic goals set by the Czech Republic include strengthening R&D funding (measured as % of GDP), spending more public resources as well as business resources on R & D & I, increasing the institutional component of R&D and innovation funding as well as targeted institutional support, focusing on Horizon Europe programs etc. The key disciplines include:

- biotechnology and nanotechnology,
- digital economy,
- automotive, aerospace and rail transport,
- traditional industries: mechanical engineering, electrical engineering, steel, foundry and energy,
- and last but not least, the cultural and creative industries.

A great opportunity for research infrastructures in the Slovak Republic is the effective fulfilment of the planned objectives of the EU „*MORE INTELLIGENT EUROPE - Innovative and Intelligent Transformation of the Economy,*" which are the subject of the forthcoming Partnership Agreement of the Horizon Europe programming period 2021-2027. In order to ensure the coherence of the systemic framework of policies and activities of research infrastructures at the national and international level, the set objectives will be reflected in the I. and II. Action plan for the implementation of the Roadmap of Research Infrastructures for the period 2021 - 2025 (2026 - 2030), including financial support for the development of research infrastructures in the Slovak Republic. ■

6 MEASURES AND SPECIFIC

recommendations for the development of research infrastructures

However, in order for research infrastructures to be justified for their continued functioning (sustainability), they must bring short-term and long-term benefits in several areas and secure a way to acquire new scientific capacity and involve sponsors in their funding (owner and administrator of land and leased infrastructure, responsible scientific research institutions, private companies leasing their equipment), relationships with important stakeholders and sponsors must be established.

Experts found that there is a lack of incentives for owners and users of the R&D infrastructure to motivate them to find ways to use research infrastructure more efficiently and prevent the risk of technological obsolescence. There are also no penalties (loss of public funding) regarding lack of use of procured research infrastructure.

The attractiveness of the research infrastructure for young innovators and its interaction with practice are basic prerequisites for sustainable progress, where experienced researchers open up opportunities for the involvement of young researchers and the transfer of research results into practice.

A key aspect will be the elaboration of the **I. Action Plan for the Implementation of the Roadmap of Research Infrastructures for the period 2021 - 2025, and II. Action Plan for the Implementation of the Roadmap of Research Infrastructures for the period 2026 - 2030**, including financial support for the development of research infrastructures in the Slovak Republic for the year 2021-2030, which will aim (among other things) to specify:

- incentives and measures that direct the owners / users of the research infrastructure to seek cooperation with local governments and business sector,
- systemic and financial incentive mechanisms for owners and users of research infrastructure to become real centres of innovation and to create opportunities for improving the quality of life of the population,
- a system service support and development targeting the operation of science parks in order to make science parks more attractive for prospective users and increase their efficiency, while ensuring a higher income (R&D funds) (a good are Poland and the Czech Republic),
- a framework enabling the use of research infrastructure by the business sector for remuneration (once again, Poland is a great example).

Research infrastructures that do not produce results that can be used in real life/ in practice and do not appeal to the professional public and entrepreneurs (they fail to bring real results) are uninteresting for society and their further maintenance and funding becomes inefficient (topic of choice / innovation potential).

Therefore, research infrastructures should remain interesting and attractive for international experts and entities, for the private sector, and generate new scientific results in cooperation with renowned

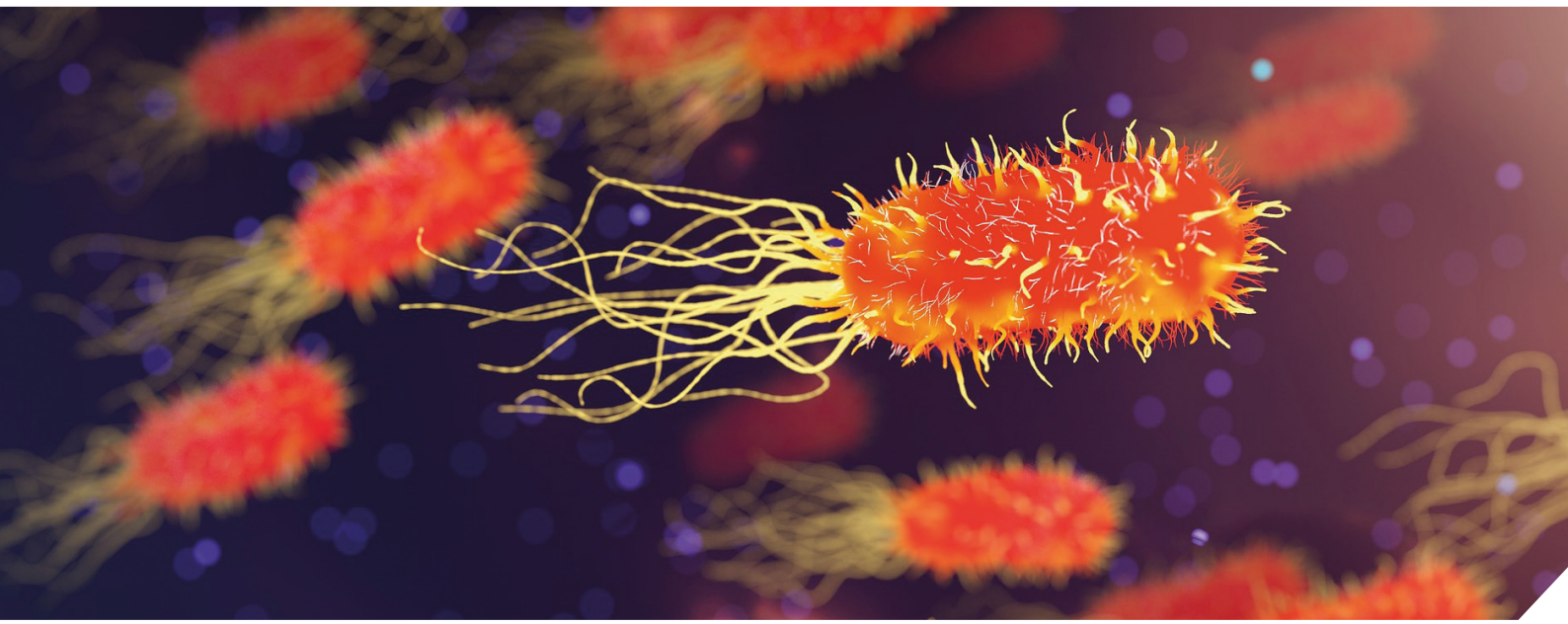
scientists, prompt research participants to seek independence and thus create new business entities (and thus jobs).

A stable environment and an effective system of (competitive) funding of research infrastructures with an emphasis on quality can help build high-quality, viable and sustainable research infrastructures that will contribute to the development of science and research in the Slovak Republic with an international reach.

A specific grant scheme, which will be covered by the relevant commission in each area, will represent an effective system of (competitive) funding. Based on the recommendations of individual commissions, calls will be announced for the submission of research projects funded from the state budget through the Ministry of Education, Science, Research and Sports of the Slovak Republic.

Each commission will manage the relevant part of the grant scheme per its area under the SK Roadmap. Under the scheme, individual national platforms - SK Roadmap projects and SK Roadmap infrastructure will compete for funds to support their research activities. This competitive funding scheme will be complementary to existing schemes aimed at supporting research and development from the ESI Funds and the state budget through the APVV programs and state programs for the development of research and development infrastructure.

Specific measures will be specified in more detail in the I. Action Plan for the Implementation of the Road Map of Research Infrastructures for the period 2021 - 2025, and in the II. Action Plan for the Implementation of the Roadmap for Research Infrastructures for the period 2026-2030. ■



ANNEXES

ANNEX NO. 1: RESEARCH INFRASTRUCTURES COUNCIL AND ITS MEMBERS

The Chairman, Vice-Chairman and members of the Council for Research Infrastructures are appointed by the Minister of Education, Science, Research and Sports of the Slovak Republic.

The Council consists of:

- Chairman - elected by the members of the Research Infrastructures Council;
- Vice-chairman - (representative of the Ministry of Education, Youth and Sports of the Slovak Republic);
- Secretary - (representative of the Ministry of Education, Youth and Sports of the Slovak Republic);
- Chairman of the Commission for Coordination of Activities of the Slovak Republic in Research Infrastructures in the Area Social Sciences and Humanities;
- Chairman of the Commission for Coordination of Activities of the Slovak Republic in Research Infrastructures in the Area of Health, Food and the environment;
- Chairman of the Commission for the Coordination of Activities of the Slovak Republic in Research Infrastructures in the Area of Materials and Physical Sciences with Application Potential in Biological and Medical Sciences, Chemical Sciences and IT;
- Chairman of the Commission for Technical Sciences and Industry;
- Delegate of the Slovak Republic in ESFRI for the central body of state administration;
- Delegate of the Slovak Republic in ESFRI for the scientific community;
- Delegate of the Slovak Republic in the Horizon Europe Program Committee for Research Infrastructures;
- Delegate of the Slovak Republic in the ERIC Council;
- Representatives of the Slovak Republic in ESFRI working groups;
- Representative of the Ministry of Health of the Slovak Republic;
- Representative of the Ministry of Economy of the Slovak Republic;
- Representative of the Ministry of Agriculture and Rural Development of the Slovak Republic;
- Representative of the Ministry of the Environment of the Slovak Republic;
- Representative of the Ministry of Culture of the Slovak Republic
- Representative of the Ministry of Investment, Regional Development and Informatization of the Slovak Republic;
- Representative of the Slovak Academy of Sciences;
- Three representatives of the higher education sector;
- Representative of the business sector / employers for the area of Healthy Food and the Environment;
- Representative of the business sector / employers for the area of Public Health and Medical Technologies;
- Representative of the business sector / employers for the area of Industry for 21. century;
- Representative of the business sector / employers for the area of Transport for 21. century;
- Representative of the business sector / employers for the area of Digital Slovakia and the creative industry

ANNEX NO. 2: GENERAL EVALUATION AND SELECTION CRITERIA FOR PROJECT PROPOSALS SUBMITTED TO THE ROADMAP RESEARCH INFRASTRUCTURES

The Roadmap of Research Infrastructures - SK VI Roadmap 2020 - 2030 in the area of evaluation and selection criteria regarding project proposals to be included in the Roadmap of Research Infrastructures outlines only key evaluated areas and not qualitative or quantitative evaluation indicators, these will be developed within the I. Action Plan. The Roadmap of Research Infrastructures - SK VI Roadmap 2020 - 2030 mainly monitors the existing R&D infrastructure built from public sources, while the construction of other necessary technical R&D infrastructure focused on industrial research and experimental development with the active participation of the private sector is one of the key steps to introduce results and outputs of the basic research into practice.

One of the tasks of the I. and II. Action Plan under the Roadmap of Research Infrastructures is to compile a methodology for evaluating submitted project proposals, which will include relevant qualitative and quantitative evaluation indicators. This should be done in cooperation with the Council for Research Infrastructures and members of individual commissions for coordination of activities. Representatives of all sectors will be involved in the evaluation itself.

In order for research infrastructures to be competitive and sustainable in the long-term, they must:

- create the conditions for world-class research;
- be in the broad national interest and increase the international reach of research;
- have a long-term plan for scientific goals, sustainability, funding and exploitation;
- be used by several research groups / users for quality research;
- be open and accessible to all scientists;
- have a plan for accessing and storing the collected data and / or materials in an Open Science spirit and in accordance with the FAIR principle;
- Introduce new cutting-edge technologies (if relevant).

The research infrastructure can be national or international and can be geographically located in one place, distributed or virtual.

The development of research infrastructures involves several phases. From concept through development and planning, construction, operation, occasional modernization to completion and decommissioning. Different types of support and funding are needed to meet the different phases and long-term needs of the research infrastructure. In terms of research infrastructure, the relevant funding instruments are:

- those used for project studies and construction or cooperation planning;
- investments in technical infrastructure, equipment or databases used to build national or international research infrastructures;
- research capacity building: staff capacity, education and training;
- operating costs from a long-term sustainability perspective;
- to phase out the research infrastructure (if relevant).

A well-designed funding plan is important for the long-term sustainability of the research infrastructure. The design phase, especially in the case of central-

ized research infrastructures, envisages the purchase of equipment and other large investment costs. The balance of costs between construction and operation may be reversed in the case of distributed research infrastructures, where the greatest costs are rarely investment costs, but rather the costs of ongoing work on standardization, harmonization and quality assurance of procedures and data. Research infrastructures usually need to be upgraded in order to remain competitive and require further investment to operate. Most research infrastructures will eventually cease to operate - this is associated with significant costs for the dismantling of technical equipment and phasing out (equipment, staff, etc). For this reason, the decision to build the research infrastructure should be preceded by a decommissioning plan.

SPECIFIC EVALUATION CRITERIA FOR RESEARCH INFRASTRUCTURES

Research infrastructure projects and research infrastructures themselves can be evaluated at different stages of the life cycle. Some are in the planning and preparation stages, while others may already be in place. For research infrastructures that are in the planning phase, the evaluation is mainly based on expected future impacts rather than actual results. For existing research infrastructures, their actual results are evaluated.

The criteria used should be fair and should reflect the current state and level of R&D within the relevant area in an international comparison. Significant development of existing research infrastructures will be achieved by completing or changing the focus of research infrastructures on the basis of a reassessment of the fulfilment of all criteria, both general and specific. The evaluation of research infrastructures is based on five dimensions. Each research infrastructure is evaluated individually and is also compared with other infrastructures in other areas of science.

Dimensions are as follows:

1. Scientific quality and potential;
2. Open access and usability;
3. Relevance of the strategies of the host institutions;
4. National and international significance;
5. Feasibility and sustainability

1. Scientific quality and potential;

The main principle of evaluation is to enhance the scientific excellence of the research infrastructure. Specifically, it is necessary to focus on the following areas:

1. Research infrastructure is of key scientific importance, enabling cutting-edge frontier research and provides added value at national and international level;
2. The research infrastructure is continuously used by excellent researchers and research teams at national and international level;
3. Existing research infrastructures deduct their activities, utilization rates and impacts, for example in the form of publications and data;

4. The research infrastructure shall participate in the training of researchers and students or be used directly for these purposes.

2. Open access and usability;
Research infrastructures have evolved in different ways. The use of research infrastructure has grown organically over time and has partially adapted to the specific needs of research and development. In many cases, new research infrastructures attract excellent research teams from other disciplines as well as researchers from abroad.

1. There is a need for transnational open access to research infrastructures. Access may be subject to the approval of a research plan, reasonable user fees for maintenance, user support and other related services;
2. Research infrastructures should have a data management policy that supports the concept of open science, in which research methods, data and results are well documented and publicly available. In this context, the research infrastructure must have a data management plan that includes information on data acquisition and processing, data storage and data ownership;
3. The research infrastructure must have clearly defined management and administrative structures, adequate staff for maintenance, services and user support;
4. The research infrastructure should monitor the utilization rate;
5. The research infrastructure should demonstrate its contribution to training, e.g. in the form of courses, professional advice and training.

3. Relevance of the strategies of the host institutions;
Building and operating a research infrastructure requires a long-term commitment from the research infrastructure itself and the host institutions, as well as other institutions involved. The strategies and priorities of the host institution are therefore also included in the evaluation.

4. National and international significance;
This dimension of evaluation concerns the added value that the research infrastructure brings to the national and international research community and how it contributes to the country's visibility, global attractiveness and future development of the Slovak research environment.

a) Strategic importance of research infrastructure for the Slovak Republic
b) b) Added value of research infrastructure:
   i. for society as a whole;
   ii. for innovation, trade and the economy;
   iii. through international cooperation of the Slovak scientific community (e.g. mobility of highly qualified employees).

5. Feasibility and sustainability
The feasibility and sustainability of a project is assessed on the basis of technical, institutional (e.g. form of ownership, conditions of use or membership) and staffing needs throughout the life cycle of the research infrastructure. Costs throughout the life of the research infrastructure consists of planning, investment and operating costs, as well as decommissioning costs.

PLANNING COSTS

Investments costs

1. Construction and infrastructure costs;
2. Costs of acquiring real estate;
3. Costs of special technical equipment;
4. Costs of delivery and installation of equipment and facilities.

OPERATING COSTS

1. Personnel costs (eg operation, maintenance, user support);
2. Material and organizational costs (including membership fees or other payments of contributions to organizations);
3. Flat-rate operating costs (rent, energy);
4. Additional costs necessary to maintain the research infrastructure and its equipment at an appropriate level, reflecting state-of-the-art technologies.

DECOMMISSIONING COSTS

Costs of decommissioning and maintaining created resources

Ensuring sustainable funding throughout the life cycle of the research infrastructure is essential not only for the research infrastructure itself, but also for the whole user community. The financial plan should clearly indicate the investment and operating costs as well as the related resources. A flexible business model is essential for the long-term sustainability of the research infrastructure.

ANNEX NO. 3: ABBREVIATIONS USED

AL	Albania
AP	Action plan
APVV	Research and Development Support Agency
AT	Austria
BE	Belgium
BG	Bulgaria
CE	Centre of Excellence
CERN	Conseil Européen pour la Recherche Nucléaire – European Council for Nuclear Research
CVTI SR	Centre of Scientific and Technical Information of the Slovak Republic
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
EIRENE	European Environmental Exposure Assessment Network
EL	Greece
EMBL	European Molecular Biology Laboratory
ES	Spain
ESFRI	European Strategy Forum on Research Infrastructures
ERIC	European Research Infrastructure Consortium
FI	Finland
FNH-RI	Food, Nutrition and Health Research Infrastructure
FR	France
GR	Greece
HR	Croatia

HU	Hungary
CH	Switzerland
ICGEB	International Centre for Genetic Engineering and Biotechnology
IP RIS3 SR	Research and Innovation Strategy Implementation Plan for Smart Specialization of SR
IE	Ireland
IL	Israel
IN	India
IS	Island
IT	Italy
LT	Lithuania
LU	Luxembourg
LV	Latvia
ME	Montenegro
MEDem	Monitoring Electoral Democracy
MK	North Macedonia
MT	Malta
MESRS SR	Ministry of Education, Science, Research and Sports of the Slovak Republic
NL	Netherlands
NO	Norway (Kingdom of Norway)
NPPC	National Agricultural and Food Center
PK	Pakistan
PL	Poland
PT	Portugal
RIS3 SK	Through knowledge towards prosperity – Research and innovation strategy for smart specialization of the Slovak Republic
RO	Romania
RS	Serbia

RU	Russia (Russian Federation)
SAV	Slovak Academy Of Science
SE	Sweden (Kingdom of Sweden)
SI	Slovenia
SIVVP	Slovak infrastructure for high performance computing
SK	Slovakia
SK VI Roadmap	Roadmap of research infrastructures
STU	Slovak University of Technology
SÚJV	Joint Institute for Nuclear Research
SWG	Strategic working group
SF	EU Structural Funds
TR	Turkey
UA	Ukraine
UK	United Kingdom (United Kingdom of Great Britain and Northern Ireland)
UVP	University Science Park
VA	Research agency
VaI	Research and innovation
VaV	Research & Development
VC	Research center - Research center
UKF	Constantine the Philosopher University in Nitra

ANNEX NO. 4: REFERENCES

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SLOVENSKEJ REPUBLIKY

ROADMAP OF RESEARCH INFRASTRUCTURES
SK VI ROADMAP 2020 – 2030