



Ministry of  
Education, Science  
and Innovation

# **MONTENEGRO RESEARCH INFRASTRUCTURES ROADMAP 2024-2028**

SEPTEMBER 2024



# TABLE OF CONTENTS

<b>LIST OF ABBREVIATIONS</b>	<b>4</b>
<b>1 INTRODUCTION</b>	<b>7</b>
Research Infrastructures	<b>7</b>
Purpose and Objectives of the Montenegro Research Infrastructures Roadmap 2024-2028	<b>9</b>
Positioning the Research Infrastructures Roadmap within the Strategic Framework of Montenegro	<b>10</b>
Compliance with International Obligations	<b>14</b>
Strategic Environmental Impact Assessment	<b>15</b>
<b>2 CURRENT STATUS REVIEW AND RESEARCH INFRASTRUCTURE MAPPING PROCESS</b>	<b>17</b>
2.1 Research Infrastructure Mapping Process	<b>17</b>
2.2 EU Strategic Framework for Research Infrastructure	<b>20</b>
2.3 Current Status Review	<b>20</b>
2.4 SWOT Analysis	<b>24</b>
<b>3 OVERVIEW OF RESEARCH INFRASTRUCTURES IN MONTENEGRO AND MEMBERSHIP IN PAN-EUROPEAN RESEARCH INFRASTRUCTURES AND INTERNATIONAL BODIES</b>	<b>27</b>
3.1 Overview of Minor National Research Infrastructures	<b>27</b>
3.1.1 National Research Infrastructures within the Priority Area of Science, Education, and Culture	<b>27</b>
3.1.2 National Research Infrastructures within the Priority Area of Sustainable Agriculture and Food Value Chains	<b>34</b>
3.1.3 National Research Infrastructures within the Priority Area of Medicine and Health	<b>38</b>
3.1.4 National Research Infrastructures within the Priority Area of Information and Communication Technologies	<b>42</b>
3.1.5 National Research Infrastructures within the Priority Area of New Materials, Technologies, Products, and Services	<b>44</b>
3.2 Innovation and Entrepreneurship Center “Tehnopolis” Nikšić	<b>45</b>
3.3 Science and Technology Park of Montenegro (NTP CG)	<b>47</b>
3.4 Regional Project for the Establishment of the South East European International Institute for Sustainable Technologies (SEEIIST)	<b>48</b>
3.5 Access and Membership in Pan-European Research Infrastructures and International Bodies	<b>49</b>
<b>4 RESEARCH INFRASTRUCTURES DEVELOPMENT VISION</b>	<b>53</b>

# LIST OF ABBREVIATIONS

<b>CERN</b>	European Organization for Nuclear Research
<b>CESSDA ERIC</b>	Consortium of European Social Science Data Archives
<b>CMS</b>	Compact Muon Solenoid Detector
<b>EMBC</b>	European Molecular Biology Conference
<b>EMBL</b>	European Molecular Biology Laboratory
<b>EMBO</b>	European Molecular Biology Organization
<b>EOSC</b>	European Open Science Cloud
<b>ERA</b>	European Research Area
<b>ESA</b>	European Space Agency
<b>ESFRI</b>	European Strategy Forum on Research Infrastructures
<b>ESIF</b>	European Structural and Investment Funds
<b>ESS ERIC</b>	European Social Survey European Research Infrastructure Consortium
<b>ERIC</b>	European Research Infrastructure Consortium
<b>EU</b>	European Union
<b>FoodHab</b>	University of Donja Gorica - Centre of excellence for digitalization of microbial food safety risk assessment and quality parameters for accurate food authenticity certification
<b>FP7</b>	Seventh Framework Program for Research, Technological Development and Demonstration Activities 2007-2013
<b>GII</b>	Global Innovation Index
<b>HORIZONT EUROPE</b>	Framework Program for Research and Innovation 2021-2027
<b>ICGEB</b>	International Centre for Genetic Engineering and Biotechnology
<b>IPA</b>	Instrument for Pre-accession Assistance
<b>IPC Tehnopolis</b>	Innovation and Entrepreneurship Center Tehnopolis, Nikšić
<b>IRI</b>	Research, Learning, and Evaluation
<b>JRC</b>	Joint Research Centre
<b>LHC</b>	Large Hadron Collider
<b>MPNI</b>	Ministry of Education, Science and Innovation
<b>NCP</b>	National Contact Points

<b>NEIA</b>	New European Innovation Agenda
<b>NTP CG</b>	Science and Technology Park of Montenegro
<b>PER</b>	Economic Reform Program
<b>PPCG</b>	Montenegro's EU Accession Program
<b>RCC</b>	Regional Cooperation Council
<b>S3</b>	Smart Specialization Strategy
<b>SDG</b>	Sustainable Development Goals
<b>UCG</b>	University of Montenegro
<b>UDG</b>	University Donja Gorica
<b>WIPO</b>	World Intellectual Property Organization

*\*The World Bank has provided comments on Montenegro Research Infrastructures Roadmap 2024-2028 as part of the BEST-Public Sector in Montenegro Project (Building an Effective, Sustainable, and Transformational Public Sector), funded by the European Union.*



# 1. INTRODUCTION

## Research Infrastructures

Research infrastructures are essential for scientific advancement and play a vital role in overall economic and social development. They facilitate excellent research, enhance international visibility, promote economic growth, create new jobs, and help tackle global challenges such as climate change and health crises. Furthermore, research infrastructures contribute to the education and skill development of researchers, while also bolstering the innovation ecosystem through various types of innovation infrastructures<sup>1</sup>. High-quality research infrastructure serves as the foundation for sustainable development and global competitiveness.

According to the European Commission's definition<sup>2</sup> 'research infrastructures' means facilities that provide resources and services for the research communities to conduct research and foster innovation in their fields, including:

- major equipment or sets of instruments;
- knowledge-related facilities such as collections, archives or scientific data infrastructures;
- supporting infrastructures based on information and communication technologies, such as GRID infrastructure, computing, programming, and communication infrastructure; and
- any other infrastructure of a unique nature essential for research.

Research infrastructures can be classified in several ways.

Traditional infrastructures are located at a single site, while distributed infrastructures consist of a network of resources spread across multiple locations. Virtual infrastructures provide services electronically.

Based on the geographical area they cover, they can be national, regional, macro-regional, or pan-European.

Research infrastructures can also be classified according to their capacity to support various phases of scientific research. This classification recognizes:

1. Large research infrastructures that enable the execution of all research activities within a given scientific process in a specific field of science (e.g., infrastructure planned by the SEEIIST project).<sup>3</sup>
2. Medium research infrastructures that enable the execution of individual or partial phases of the

<sup>1</sup> Article 10, paragraph 1, item 16) of the Law on Innovation Activity (Official Gazette of Montenegro, no. 82/20) defines the innovation infrastructure as encompassing facilities, technical and technological equipment, software and knowledge networks in support of the implementation of innovation activities, provided by relevant entities with the aim of spreading knowledge and awareness of innovation, supporting the formation and strengthening of innovative businesses, utilizing R&D results, improving innovative capacity of the economy and universities, providing for internationalization of business and scientific activities, and facilitating cooperation between the economic, scientific, academic and public sectors and strengthening the scientific base of society.

<sup>2</sup> Regulation (EU) 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing Horizon Europe – the Framework Program for Research and Innovation, laying down its rules for participation and dissemination, and repealing Regulations (EU) No 1290/2013 and (EU) No 1291/2013 (<https://eur-lex.europa.eu/eli/reg/2021/695/oj>)

<sup>3</sup> <https://seeiist.eu/>

research process (e.g., centers of excellence – such as FoodHub<sup>4</sup>).

### 3. Small research infrastructures that allow the completion of specific tasks within the research process

A key characteristic of research infrastructure is its central role in the quadruple helix model<sup>5</sup>, as it facilitates the creation of knowledge through research, the transfer of that knowledge, and its application through innovations in the economic sector, thereby positively impacting overall social progress.

In the context of research infrastructure, scientific equipment refers to the physical or digital tools and resources of the research infrastructure. It is crucial to distinguish between research infrastructure and scientific research institutions although the term “research infrastructure” may encompass one or more scientific research institutions or their organizational units (e.g., laboratories), as well as actors from the economic sector. For the purpose of this document, innovation infrastructure has also been partially covered. Emphasis has been placed on infrastructure that promotes research activities and enables effective collaboration between science and industry, including technology transfer, to meet the needs of the economic sector in developing new or improved technologies, products, and services.

Taking the above into account, research infrastructure in Montenegro includes:

- Centers of excellence, which are consortia of scientific research institutions and/or actors from the economic sector. These centers enable the formation of interdisciplinary networks of innovative researchers and research teams who, in collaboration with the economic sector and institutions from other sectors, conduct excellent research in key priorities of importance to science and society as a whole.
- Equipment and databases located within various laboratories or licensed scientific research institutions, which are used by specific research groups;
- The Science and Technology Park of Montenegro in Podgorica, which provides appropriate space, equipment, and services to fulfill its purpose as outlined by the Law on Innovation Activity;
- Laboratories of the Innovation and Entrepreneurship Center Tehnopolis in Nikšić; and
- National research partnerships, which consist of groups of researchers who utilize the resources of pan-European research organizations/infrastructures, databases, or participate in joint pan-European initiatives.

***Pan-European research infrastructures exhibit several key characteristics. First, they are often highly specialized in particular fields of research or in the development of specific technologies. Second, they employ cutting-edge technologies and equipment, enabling the execution of complex experiments and analyses. Third, they are designed to be accessible to a broad spectrum of users and research communities, often through national or international projects or memberships. Lastly, they play a vital role in the generation of new knowledge, innovations, and technologies, and are indispensable for research and development, as they facilitate experiments and data collection that would otherwise be challenging or impossible to accomplish. Owing to these features, research infrastructures are intricate systems that demand substantial investment in their design, construction, and implementation stages, and their effective operation hinges on the support of exceptional research teams.***

<sup>4</sup> <https://foodhub.udg.edu.me/>

<sup>5</sup> A model that includes four sectors: government, academic, business, and civil.



## Purpose and Objectives of the Montenegro Research Infrastructures Roadmap 2024-2028

The primary aim of the Montenegro Research Infrastructures Roadmap is to support the long-term, sustainable development of national research infrastructures and to facilitate Montenegro's integration into the European Research Area (ERA) through engagement with international bodies and pan-European research infrastructure networks.

The document's first section offers a comprehensive overview of the current situation, covering the strategic, legislative, and institutional frameworks, as well as the funding mechanisms. It also examines previous initiatives and practices in managing research infrastructures, identifying key challenges. The second section highlights Montenegro's involvement with international institutions and pan-European infrastructure networks. The final section outlines the mission and vision for the future development of research infrastructures, providing recommendations for establishing governance structures, enhancing informational content, and expanding funding opportunities, while fostering synergy among different funding sources. Additionally, the Roadmap provides guidelines for the selection of national research infrastructure projects and memberships in international bodies and pan-European research infrastructure networks.

As the analytical foundation for the preparation of this document, an assessment of the existing capacities of research infrastructures was conducted, considering the value and condition of equipment, funding sources, number and types of users, maintenance costs, and other key factors relevant to infrastructure development. Data was also gathered on the institutional readiness to implement open access policies, the availability of user information, the potential services the infrastructures can offer, and the needs of external users and institutions for participation in international bodies and research infrastructure projects.

The objectives of the Research Infrastructures Roadmap are to:

- Assess the current capacities of research infrastructures, providing a foundation for future strategic development directions, upgrades, and modernization of the national research infrastructure;
- Create a systematic overview of the existing capacities of national infrastructures and provide guidelines on operational principles aimed at promoting collaboration and consolidation of research groups across scientific institutions, as well as strengthening cooperation with the business sector and international partners;
- Provide guidelines for establishing an efficient governance and information framework with the aim of achieving a coordinated and strategic approach to resource management, development, and ensuring the visibility and the long-term sustainability of research infrastructures; and;
- Provide guidelines for establishing a framework for selecting future memberships in international research bodies and pan-European research infrastructures, with the goal of enhancing scientific excellence in Montenegro and strengthening national innovation capacities through knowledge and technology transfer from the world's leading scientific research institutions.

## Positioning the Research Infrastructures Roadmap within the Strategic Framework of Montenegro

### *Alignment with Documents Outlining Key Priorities:*

#### **Exposé of the Prime Minister-designate for the Formation of the 44th Government of Montenegro<sup>6</sup>**

Recognizing the pivotal role of science and innovation in Montenegro's smart and competitive development, this document emphasizes increased investment in science, research, and innovation, thereby advancing toward full integration into the European Research Area (ERA) and positioning Montenegro as a credible partner in the implementation of the New European Innovation Agenda (NEIA). By improving the legal and strategic framework for scientific research activities, the aim is to better position research infrastructures, strengthen internationalization efforts, and enhance participation in the EU Framework Program for Research and Innovation. The exposé places special emphasis on boosting innovation infrastructures—particularly the Innovation and Entrepreneurship Center Tehnopolis in Nikšić and the Science and Technology Park of Montenegro in Podgorica—and stimulating technology transfer. The Montenegro Research Infrastructure Roadmap 2024-2028, through its objectives and guidelines for the further development of research infrastructure, contributes to the priorities outlined in the Prime Minister's exposé in this area.

#### **Mid-Term Work Program of the Government of Montenegro 2024-2027<sup>7</sup>**

Priority 3 of the Government's Mid-Term Work Program focuses on "Healthy and Educated Individuals" as the foundation of a prosperous and inclusive society. Within this priority, Goal 15: "Science and Innovation for a Smart and Competitive Montenegro" has been identified as key to enhancing scientific research activities. One of the main indicators tied to this goal is the Global Innovation Index (GII) of the World Intellectual Property Organization (WIPO), specifically its Infrastructure component. The adoption of the Montenegro Research Infrastructure Roadmap 2024-2028 will improve the positioning of research and innovation infrastructures, directly impacting this key indicator in the Government's Mid-Term Work Program.

#### **2024 Work Program of the Government of Montenegro<sup>8</sup>**

The program outlines the ongoing implementation of the Smart Specialization Strategy, the enhancement and maintenance of a continuous system for monitoring the development of innovation infrastructures, and the continuation of reforms within the scientific research system through the adoption of strategic documents. It also promotes measures aimed at advancing research and innovation. Among the key initiatives is the adoption of the Research Infrastructure Roadmap 2024-2028, which lays a strong foundation for the further development of research infrastructure, a critical component of the scientific research system. The Roadmap's purpose and goals align with the Government's Work Program and contribute to achieving the activities outlined in the **2024 Work Program of the Ministry of Education, Science, and Innovation<sup>9</sup>**.

6 <https://www.gov.me/dokumenta/959151c9-edbe-446e-aabb-4e2e41465a46>

7 <https://www.gov.me/dokumenta/ee885398-748f-48fd-912a-29bbac334bfb>

8 <https://www.gov.me/dokumenta/ee885398-748f-48fd-912a-29bbac334bfb>

9 <https://www.gov.me/dokumenta/977aa3ca-f077-4e88-8a1c-f3d623dc4199>

## Montenegro Reform Agenda 2024-2027 within the Western Balkans Growth Plan<sup>10</sup>

Montenegro is soon set to begin the implementation of the Reform Agenda, which it has been diligently preparing since November 2023 in the context of the Instrument for Reforms and Growth for the Western Balkans<sup>11</sup>, also known as the Western Balkans Growth Plan. The Reform Agenda focuses on four priority areas: 1. Business Environment and Private Sector Development, 2. Digital and Energy/Green Transition, 3. Human Resources Development, and 4. Fundamental Rights/Rule of Law. Within Priority Area 1, specifically Sub-area 1.2 (Business Sector Competitiveness), reform measure 1.2.2 has been identified: Further Strengthening of the Research and Innovation Ecosystem for a Knowledge-Based Economy (in line with the Smart Specialization Strategy). The aim of this reform measure is to strengthen the mechanisms for supporting the development of research and innovation in Montenegro, in order to empower all stakeholders in the national ecosystem, including researchers, innovators, scientific research institutions, companies, clusters, and non-governmental organizations. In this context, it is necessary, inter alia, to strengthen and expand the range of services and the role of innovation infrastructures. One of the indicators mentioned is a 50% increase in the number of users from the economic sector who benefit from these infrastructures. The Montenegro Research Infrastructures Roadmap 2024-2028 is integral to achieving the Reform Agenda's objectives in the areas of science and innovation, as it lays the foundations for a new approach to research and innovation infrastructures by reinforcing their role and impact within the science and research system, with an emphasis on fostering stronger connections between science and the economy.

### *Alignment with Strategic and Planning Documents Defining Montenegro General Development Directions*

#### Montenegro EU Accession Program (PPCG) 2024-2027<sup>12</sup>

Chapter 25: Science and Research was opened and provisionally closed in December 2012, but Montenegro continues to follow EU standards in the field of science and innovation, integrating them consistently into its national research and innovation system. The plans for this period include, inter alia, the adoption of the Research Infrastructures Roadmap 2024-2028, which will contribute to better integration into the European Research Area (ERA).

#### Montenegro Economic Reform Program (ERP) 2024-2026<sup>13</sup>

The Economic Reform Program (ERP) serves as Montenegro's main strategic document for mid-term macroeconomic and fiscal policy programming. Its objectives are to ensure macroeconomic stability, enhance international competitiveness, and foster conditions for sustainable, digitally-driven, greener, and more resilient economic growth and development. Reform Measure 3: Promoting Innovation for the Green Agenda and the Transition to a Circular Economy focuses on assessing policy measures that support science, innovation, and smart specialization in Montenegro. It also includes preparatory steps for defining new key initiatives in science and innovation related to the Green Agenda. Reform Measure 5: Improving Digitalization and Cybersecurity while Strengthening Broadband Internet Infrastructure aims to improve digital services for citizens, with a focus on areas such as science and innovation.

The new strategic framework for research infrastructure will play a critical role in advancing these reform measures by enhancing the services provided by research and innovation infrastructures.

<sup>10</sup> <https://www.gov.me/dokumenta/2cc3baa0-65d6-4d97-a25c-fa171aa559b3>

<sup>11</sup> [https://neighbourhood-enlargement.ec.europa.eu/enlargement-policy/new-growth-plan-western-balkans\\_en](https://neighbourhood-enlargement.ec.europa.eu/enlargement-policy/new-growth-plan-western-balkans_en)

<sup>12</sup> <https://www.gov.me/dokumenta/29349d74-d332-498c-9927-3fac36e454a1>

<sup>13</sup> <https://www.gov.me/dokumenta/4a9dd1c8-6ec6-4838-95bc-5b05e80f6836>

## **National Strategy for Sustainable Development of Montenegro by 2030<sup>14</sup>**

Science policy is integrated across several Sustainable Development Goals, as the successful implementation of the 2030 Agenda requires the engagement of scientific research capacities. In the context of financing sustainable development, the importance of investing in science, technology, innovation, and development is particularly emphasized, as these sectors are essential for driving Montenegro's dynamic economic growth in the coming years. The primary goal is to promote economic growth that respects ecological limits and avoids increasing negative impacts on natural resources. A well-defined framework for the development of research and innovation infrastructure is expected to result in greater support and investment in research and development, which is a key indicator of the advancement of the scientific research system.

At the measure level, Promoting the Educational and Scientific Component in Higher Education (aligned with SDG 4 - 4.3, 4.4, 4.c; SDG 8 - 8.3), a sub-measure is planned to Strengthen Ties with the Economy through the Establishment of Science and Technology Parks, Centers of Excellence, and Participation in International Research and Development Cooperation Programs, which directly relates to research and innovation infrastructures and access to international research infrastructures. Furthermore, in the sub-measure related to Establishing a Favorable Regulatory Framework for Investments in the Green Economy, the role of research infrastructures in contributing more significantly to green development is recognized. By improving research infrastructure in Montenegro, the country aims to increase both the number of researchers and investments in science, which are highlighted as key indicators in the National Strategy for Sustainable Development of Montenegro by 2023.

## **Regional Development Strategy of Montenegro 2023-2027<sup>15</sup>**

This strategic document identifies the need for stronger integration between the economy and the scientific research community, as reflected in Strategic Goal 3, Increasing Regional Competitiveness through Improving Infrastructure, Enhancing the Business Environment, and Developing Priority Sectors with Growth Potential. This alignment is particularly evident in Operational Goal 3.1: Increasing Regional Competitiveness, and the associated activity Increasing Innovation Activity of Enterprises and Smart Specialization, and the indicator Number of Business Centers and Collaboration Centers between the Research Community and Priority Economic Sectors, which is linked to the Montenegro Research Infrastructures Roadmap 2024-2028. This supports programmatic assistance for innovation infrastructures aimed at strengthening connections between science and industry and promoting technology transfer in Montenegro, in collaboration with the University of Montenegro.

## **Smart Specialization Strategy (S3) 2019-2024<sup>16</sup> and Action Plan for the Implementation of the Smart Specialization Strategy (2021-2024)<sup>17</sup>**

Montenegro has committed to the EU innovative approach to strategic planning, which enables the identification and development of the country's comparative advantages by determining priority development areas with a strong concentration of research and innovation capacities and significant economic potential. The S3 strategy identifies four key priority areas: Sustainable Agriculture and Food Value Chain, Energy and Sustainable Environment, Sustainable and Health Tourism, and Information and Communication Technologies as a horizontal priority supporting

<sup>14</sup> <https://www.gov.me/en/documents/67dc487e-097d-41d2-8fd5-7827a19a1f5a>

<sup>15</sup> <https://www.gov.me/clanak/javni-poziv-nacr-strategije-regionalnog-razvoja-crne-gore-za-period-2023-2027-godine-sa-akcionim-planom-za-2023-godinu>

<sup>16</sup> <https://s3.me/wp-content/uploads/2022/06/Strategija-pametne-specijalizacije-Crne-Gore-2019-2024-.pdf>

<sup>17</sup> <https://s3.me/wp-content/uploads/2022/06/Operativni-pogram-za-implementaciju-strategije-pametne-specijalizacije-2021-2024-s-Akcionim-planom-2021-2022.pdf>

the development of the previous three (vertical) priorities. The strategic objectives 1. Improving the Excellence and Relevance of Scientific Research Activities and 3. Enhancing Cooperation within the Innovation System highlight the importance of establishing models to strengthen Montenegro's domestic scientific research infrastructure and ensuring open access to that infrastructure. This is one of the goals of the Montenegro Research Infrastructures Roadmap 2024-2028.

In parallel, the Government of Montenegro has adopted a Roadmap for the Preparation of the New Smart Specialization Strategy (S3)<sup>18</sup>, marking the beginning of a new cycle for this strategy. During the preparation of the new S3 cycle, scientific research policy instruments — emerging from the reformed framework for scientific research activities in Montenegro — will be timely integrated to support the achievement of goals in the identified priority areas of smart specialization. A particular focus will be placed on enhancing infrastructure support for the development of these key areas.

### ***Alignment with Sectoral Strategic Documents***

#### **Scientific Research Strategy (2024-2028)<sup>19</sup>**

The Scientific Research Strategy of Montenegro is the primary sectoral strategic document in the field of science and research. It establishes three strategic objectives: 1. Improving the framework conditions for the functioning of scientific research activities in Montenegro; 2. Strengthening human resources and institutional capacities in the field of science and research; and 3. Enhancing international cooperation in science and research. The strategy also defines 10 operational objectives and outlines 45 activities to be implemented during the period covered by the Action Plan 2024-2025. A situational analysis conducted for the strategy revealed significant gaps in research infrastructure, including a lack of modern equipment, laboratories, and other resources, as well as the absence of up-to-date data on existing research infrastructure. To address these issues, Operational Objective 1.2: Strengthening Research Infrastructure was established under the first strategic objective. This objective includes the process of mapping the current research infrastructure and the adoption of the Montenegro Research Infrastructures Roadmap, with a focus on open access policies and supporting the development of research infrastructures. In this regard, the Montenegro Research Infrastructures Roadmap plays a pivotal role in the reform of Montenegro's scientific research system and contributes to achieving the strategic and operational objectives of the Scientific Research Strategy 2024-2028. The strategy also defines priority areas for scientific research<sup>20</sup>, providing a thematic framework to guide future investments in research infrastructure.

#### **Montenegro Industrial Policy 2024-2028<sup>21</sup>**

This strategic document highlights the need for stronger links between science and industry, noting the low utilization of scientific research to drive innovation in enterprises and the limited investment in research and development. Strategic Objective 3 Fostering Innovation Based on the Principles of Smart and Sustainable Industrial Development recognizes the importance of introducing modern technologies through collaboration with scientific research institutions to

18 <https://www.gov.me/en/documents/ebdcc51c-02f8-496b-9333-e57c9ff76eda>

19 <https://www.gov.me/clanak/strategija-naucnoistrzivacke-djelatnosti-2024-2028>

20 Sustainable Agriculture and Food Value Chain, Energy and Sustainable Environment, Sustainable and Health Tourism, Science, Education, and Culture, Medicine and Health, Socio-political and Socio-economic Challenges of Montenegrin Society, New Materials, Technologies, Products, and Services, Disaster Risk Management, and Information and Communication Technologies.

21 <https://www.gov.me/dokumenta/46dc2fa2-6885-482c-8c59-8179a69c68b6>

support the development of business innovation and modern, competitive industries, with the aim of expanding existing industrial production and creating innovative, knowledge-based products and services. In that regard, the 2024 Action Plan outlines activities designed to foster innovation through the services provided by innovation infrastructures and enhance the excellence of research teams, laying the groundwork for future centers of excellence.

### **Montenegro Digital Transformation Strategy 2022-2026<sup>22</sup>**

This strategy aims to improve public services and user experience, digital skills across society, bridge the digital gap, and facilitate digital transformation and effective governance at the national level. It underscores the need for greater collaboration between scientific research institutions and the business sector and highlights the importance of increased investment in research and development.

Research and innovation infrastructures in the field of Information and Communication Technologies (ICT) are crucial to achieving the strategy's goals. The Montenegro Research Infrastructures Roadmap 2024-2028 outlines the mapping and guidelines necessary for this infrastructure development.

### **Montenegro Intellectual Property Strategy 2023-2026<sup>23</sup>**

*One of the priorities of this strategy to be accomplished by 2026 is the establishment of a mechanism to facilitate interaction between scientific research institutions and industry. It also aims to create a system to connect intellectual property rights holders with users of protected innovations. The strategy further emphasizes the importance of establishing a Technology Transfer Office, which is recognized by the Law on Innovation Activity ("Official Gazette of Montenegro," No. 82/20) as an element of innovation infrastructures.*

### **Compliance with International Obligations**

Montenegro's progress in science and innovation is also shaped by its international obligations, particularly those related to European integration. The country's scientific policies are continuously aligned with its commitments under the EU accession process, particularly in Chapter 25: Science and Research, as outlined in the Montenegro Program of Accession to the European Union 2024-2027). This chapter, opened and provisionally closed in 2012, confirmed Montenegro's alignment of its legal and strategic framework with EU standards. Current obligations under this chapter include finalizing the integration of EU standards, notably through the adoption of the Montenegro Research Infrastructures Roadmap 2024-2028. Additionally, Chapter 20: Enterprise and Industrial Policy focuses on the role of science in enhancing competitiveness and economic growth, with a particular emphasis on innovation infrastructures.

In December 2021, Montenegro joined the EU Framework Program for Research and Innovation "Horizon Europe", under an international agreement, as an associated country. By signing this international agreement, Montenegro's research community, innovation-driven enterprises, civil society, and local/public authorities were given the opportunity to access EU funds for science and innovation on an equal footing with EU member states. A specific portion of this program is dedicated to research infrastructures: one segment is reserved for infrastructures listed on the European Strategy Forum for Research Infrastructures Roadmap (ESFRI), as well as initiatives promoting open and fair access through the European Open Science Cloud (EOSC). Additionally,

<sup>22</sup> <https://wapi.gov.me/download-preview/0c802520-e016-41ee-a6e4-7af6eb66e19d?version=1.0>

<sup>23</sup> <https://www.gov.me/dokumenta/d8e61ee3-f669-41b7-b168-4b1c0846dd8f>

the program provides support for infrastructure projects in areas such as health, green and digital transitions, and also covers networking and education initiatives.

In June 2023, Montenegro signed an International Agreement on Joining the Union Program “Digital Europe,” which aims to accelerate digital transformation, improve e-services, enhance cybersecurity prevention measures, and promote digital education, thereby providing citizens and businesses with modern technologies.

Additionally, since 2017, Montenegro has been a full member of the European Molecular Biology Organization, which grants access to the European Molecular Biology Laboratory (EMBL), one of the leading global research organizations. Montenegro also participates in the CMS experiment, one of the largest experiments conducted by the European Organization for Nuclear Research (CERN).

### **Strategic Environmental Impact Assessment**

While the Montenegro Research Infrastructures Roadmap does not fall directly under the Regulation on the Methodology and Procedure for Developing, Harmonizing, and Monitoring the Implementation of Strategic Documents (“Official Gazette of Montenegro,” No. 54/2018), a self-assessment tool for strategic documents in the context of strategic environmental impact assessment, was used in the preparation of this document. It was determined that the Montenegro Research Infrastructures Roadmap 2024-2028 indirectly contributes to achieving environmental goals and improving environmental indicators within the framework of the National Strategy for Sustainable Development of Montenegro by 2030, as this document serves as the foundation for the further development of research and innovation infrastructures.

Additionally, a self-assessment on general issues confirmed that the Montenegro Research Infrastructures Roadmap 2024-2028 does not have a direct positive or negative impact on the environment. Its guidelines are aimed at creating a cohesive framework for research infrastructures, which can subsequently contribute to their advancements in areas crucial for sustainable development.





## 2. CURRENT STATUS REVIEW AND RESEARCH INFRASTRUCTURE MAPPING PROCESS

### 2.1 Research Infrastructure Mapping Process

The research infrastructure mapping process involves identifying, cataloging, and analyzing existing and planned research resources. This structured collection of information encompasses a variety of research assets, including laboratories, equipment, devices, centers of excellence, and other facilities that support scientific research and development.

At the beginning of 2024<sup>24</sup>, the Ministry of Education, Science, and Innovation conducted an initial analysis of existing research infrastructure capacities and future needs. Questionnaires were distributed to a total of 70 entities listed in the Registry of Licensed Research Institutions and the Registry of Innovation Activities. The recipients included organizational units of Montenegrin universities, independent faculty units, institutions performing public authorizations, private sector entities, public institutions, and non-governmental organizations.

The questionnaire included questions regarding the current equipment, its functionality, procurement value, sources of financing, maintenance costs, frequency of use, and the number of users both within and outside the research unit. It also asked for the institution's stance on open access to research infrastructure. Furthermore, information on plans for acquiring new equipment, potential financing sources, operational costs, and other factors relating to future research needs was collected. The third section of the questionnaire focused on identifying the respondents' needs for access to regional, international, and European research infrastructure. In the first round, 61.2% of respondents provided complete or partial answers to the questionnaire, while 31.5% showed no interest in participating. An additional 7.3% of respondents indicated they lacked adequate research equipment. While the high response rate reflects significant interest and awareness of the importance of research infrastructure and open access to research resources, the lack of participation by some suggests potential gaps in knowledge or understanding regarding open access concepts, as well as limitations in their current research infrastructure capacities.

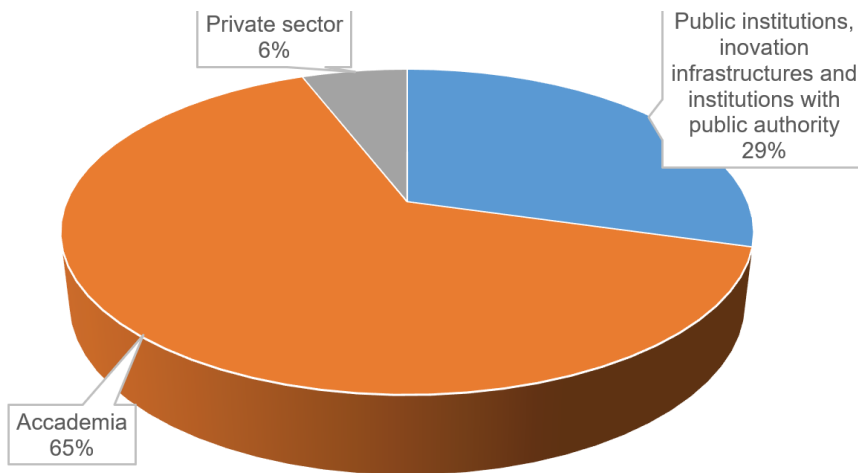
After reviewing the submitted questionnaires, the Ministry of Education, Science, and Innovation identified institutions, along with their respective centers and laboratories, as candidates for inclusion in the list of research infrastructures. This led to a second cycle of mapping, focusing on research centers and laboratories selected based on specific criteria:

1. **Openness to applying open access policies** – Only centers and laboratories that expressed a willingness to adopt open access policies were considered; those that did not were excluded;
2. **Size and capacity of research equipment** – Centers and laboratories with equipment valued at €50,000 or more were included. Additionally, the equipment needed to enable the provision of complex research services, indicating that the laboratories had sufficiently developed infrastructure to support specific research tasks.

The criteria were applied cumulatively, and the second round of analysis encompassed research infrastructures from ten organizational units—faculties and institutes of the University of Montenegro, six faculties from private universities, two public institutions, one institution with public authority, two entities focused on innovation infrastructure, and one private company. Out of these, nine organizational units—faculties and institutes of the University of Montenegro, three faculties from private universities, two public institutions, one institution with public authority, two innovation infrastructure entities, and one private company expressed interest in participating in the second round.

The second round of analysis involved the completion of questionnaires and conducting interviews. Along with general information, the questionnaire included detailed data on research infrastructure, such as the estimated purchase value of equipment, a description of the infrastructure, and an overview of key information and objectives. Data were also collected regarding the services that the infrastructure could provide to users, identifying both current and potential users. Questions addressed the existence of open access policies, including a request for detailed descriptions. Furthermore, data on external users, established partnerships, international agreements, and participation in national, European, or international projects aimed at infrastructure development were collected. This included information on project names, funding sources, duration, and brief descriptions. During the interviews, participants were provided with assistance in completing the questionnaire, along with additional explanations about the open access policy, the challenges institutions and research infrastructures face in its full implementation, and discussions of other important issues. In the end, eight organizational units—faculties and institutes of the University of Montenegro, three private faculties, two public institutions, one institution with public authority, two innovation infrastructure entities, and one private company—were mapped.

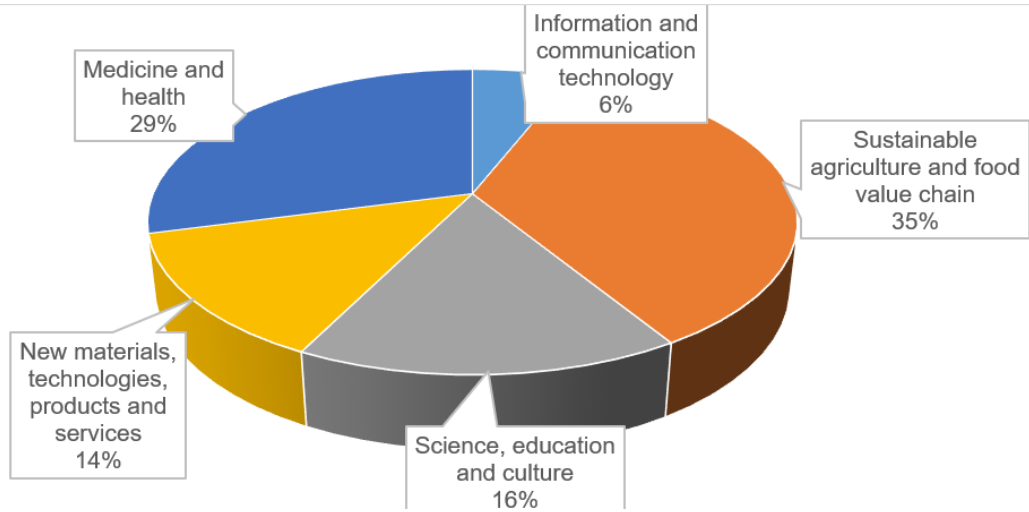
Chart 1. Overview of respondent distribution by sector



The total value of the mapped research infrastructure of the selected institutions amounts to €13,299,000.00.<sup>25</sup>

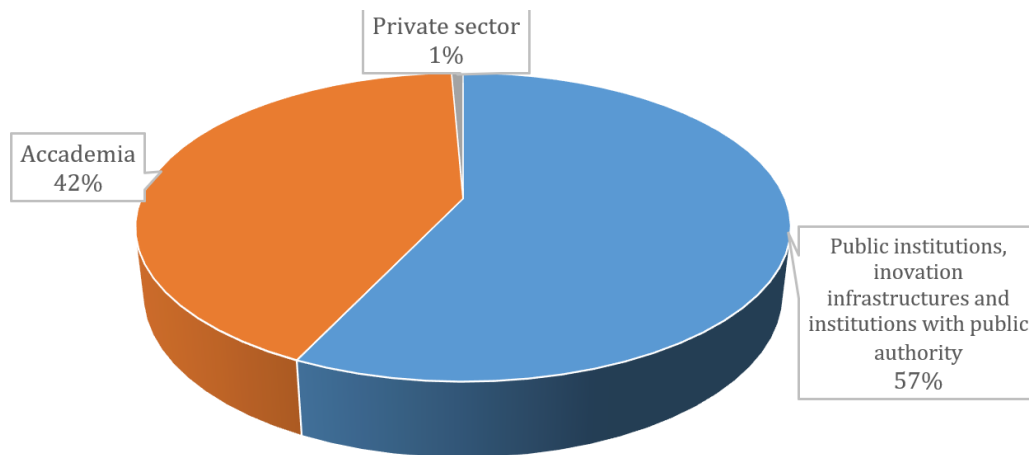
<sup>25</sup> Due to the implementation of a new methodology for mapping research infrastructure, the 2024 results are not comparable to the previous two mapping cycles from 2015 and 2019.

Chart 2. Overview of research infrastructure value distribution by priority areas of the scientific research strategy



In addition to their primary priority research areas, two infrastructures identified additional focus areas, namely: Energy and Sustainable Environment, Medicine and Health, as well as New Materials, Technologies, Products, and Services.

Chart 3. Overview of research infrastructure value distribution by sectors



Based on Chart 3, it can be observed that public institutions, institutions with public authority, and innovation infrastructures possess more significant infrastructure compared to the academic sector. The analysis covered five institutions—two public institutions, one institution with public authority, and two innovation infrastructure entities—alongside eleven institutions from the academic sector. This ratio suggests possible fragmentation within the academic sector. The presence of a larger number of smaller organizational units may limit the efficient use of resources and equipment. On the other hand, the private sector has equipment that is not of particularly high value.

## 2.2 EU Strategic Framework for Research Infrastructure

At the European Union level, the European Strategy Forum on Research Infrastructures (ESFRI)<sup>26</sup> and the European Research Infrastructure Consortium (ERIC)<sup>27</sup> are key instruments for the development and management of research infrastructures. ESFRI was established by the European Commission in 2002 to develop strategies and guidelines for joint planning and development of research infrastructures in Europe, promoting scientific and technological progress. Since 2006, ESFRI has been drafting the Research Infrastructure Development Plan (Roadmap), which sets priorities for investments in European research infrastructures over the next 10 to 20 years and is continuously revised (2008, 2010, 2016, 2018, and 2021). One of ESFRI's tasks is also to encourage member states and associated countries to develop national research infrastructures roadmap.

Montenegro participates in ESFRI's activities, gaining access to strategic priorities and opportunities for the development of research infrastructures in Europe. It is also involved in activities and initiatives related to planning, funding, and alignment of research infrastructures, with the goal of advancing scientific research and innovation in the country.

ERIC is a specific legal framework that facilitates the establishment and management of research infrastructures of European interest. Infrastructure is granted ERIC status by a decision of the European Commission. Membership in ERIC is available to EU member states, associated countries, third countries, and intergovernmental organizations. Access to ERIC infrastructures is granted to the European research community in accordance with the statutes of each individual infrastructure. ERIC consortia offer an excellent opportunity for smaller countries with limited capacity to establish top-tier research infrastructures, providing them access and thereby fostering scientific research. Montenegro is a member of the European Social Survey Research Infrastructure (ESS ERIC)<sup>28</sup> and participates as a partner organization in the Consortium of European Social Science Data Archives (CESSDA ERIC)<sup>29</sup>.

## 2.3 Current Status Review

Research infrastructures represent one of the key elements for advancing the European Research Area (ERA) agenda and implementing its actions. Special emphasis is placed on the importance of a coordinated strategic approach to the development, management, and accessibility of research infrastructures, both at the European Union and national levels<sup>30</sup>. By adopting a comprehensive approach to the development, management, and accessibility of research infrastructures, a solid foundation is laid for integration into the ERA. This approach not only allows for the more efficient use of existing resources but also promotes cooperation between different countries and institutions. A well-structured strategic framework contributes to increasing the accessibility of infrastructures for researchers and institutions, which is crucial for the development of high-quality research activities and the promotion of scientific achievements. Additionally, it opens infrastructures to meet the needs of both the private and public sectors.

At the regional level, the Regional Cooperation Council (RCC) focuses on promoting open access to research infrastructures in the Western Balkans and creating a framework for its implementation.

<sup>26</sup> [https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures/esfri\\_en#:~:text=The%20European%20Strategy%20Forum%20on%20Research%20Infrastructures%20\(ESFRI\)](https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures/esfri_en#:~:text=The%20European%20Strategy%20Forum%20on%20Research%20Infrastructures%20(ESFRI))

<sup>27</sup> [https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures/eric\\_en#:~:text=The%20European%20Research%20Infrastructure%20Consortium%20\(ERIC\)%20is%20a](https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures/eric_en#:~:text=The%20European%20Research%20Infrastructure%20Consortium%20(ERIC)%20is%20a)

<sup>28</sup> [https://www.europeansocialsurvey.org/#:~:text=The%20European%20Social%20Survey%20\(ESS\)%20is%20a%20pan-European](https://www.europeansocialsurvey.org/#:~:text=The%20European%20Social%20Survey%20(ESS)%20is%20a%20pan-European)

<sup>29</sup> <https://www.cessda.eu/About#:~:text=CESSDA%20stands%20for%20Consortium%20of%20European%20Social%20Science>

<sup>30</sup> [Research Infrastructures Make Science Happen, https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures\\_en](https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures_en)

The goal is to strengthen cooperation among researchers by promoting and facilitating seamless access to research infrastructures in the Western Balkans, which will enhance researchers' skills and optimize the use of existing infrastructures.

Montenegro was the first country in this region to carry out a mapping process of research infrastructures in 2015 and adopt the Montenegro Research Infrastructures Roadmap 2015-2020. Due to significant changes in Montenegro's research and innovation ecosystem, a second round of mapping was carried out in 2019, leading to the adoption of the Revised Montenegro Research Infrastructures Roadmap 2019-2020<sup>31</sup>. Since then, Montenegro has witnessed a new momentum in innovation policy, as well as reform activities within the scientific research system, shaping the new approach to research infrastructures presented in the Montenegro Research Infrastructures Roadmap 2024-2028.

With the adoption of Montenegro's Smart Specialization Strategy (S3) (2019-2024), vertical, sector-specific policies were integrated for the first time with horizontal innovation policies. This integration aimed to channel financial resources into sectors with the greatest potential for transformation and future economic growth, particularly in research, development, and innovation (RDI). In addition to providing a clear strategic framework for future priority investments in research infrastructures, the S3 also serves as a crucial document, fulfilling the ex-ante condition for accessing European Structural and Investment Funds (ESIF). ESIF funds represent a major source of funding for research infrastructures in EU member states. In early July 2024, the Science Research Strategy for the period 2024–2028 was adopted, further strengthening the strategic framework for investments in research infrastructures. This strategy builds on the priority areas established in the S3 and identifies additional areas where scientific research can significantly contribute. As the process for drafting a new S3 is ongoing, any new priority areas or changes to the S3 for the upcoming period will automatically be included in the Science Research Strategy. This strategy encompasses various activities, such as training for the implementation of open access and improving infrastructure through equipment procurement. Furthermore, the strategy plans additional support to research infrastructures, including support for national scientific research institutions and teams through national research projects and large-scale research grants aimed at promoting excellence and equipping laboratories. Furthermore, the strategy aims to enhance access to international and European research infrastructures, enabling Montenegrin researchers to participate in research stays, training, and collaborative projects.

The latest 2023 ERA report on Montenegro<sup>32</sup> noted a significant advancement: although Montenegro is not required to implement ERA policy activities, it has developed and implemented strategies that contribute to the realization of this agenda. This progress is especially evident in the adoption of the Science Research Strategy and the Smart Specialization Strategy, positioning Montenegro as a regional leader<sup>33</sup>.

The legal framework for the development of research infrastructures is established by the Law on Scientific Research<sup>34</sup>, which recognizes the Science Research Strategy as the umbrella document for determining the necessary scientific research infrastructure. Programs of general interest serve as a mechanism for improving infrastructure and procuring the equipment necessary to conduct research at the national level. These programs also support regional cooperation and infrastructural integration within research activities. Under the current legal framework, the Science Research Council proposes to the Ministry of Education, Science, and Innovation the

<sup>31</sup> <https://www.gov.me/dokumenta/7b2b7432-ced0-40f0-a798-56a349f20e8c>

<sup>32</sup> ERA Country Report 2023 Montenegro: [https://european-research-area.ec.europa.eu/sites/default/files/documents/2024-04/ERA%20Country%20Report%202023%20Montenegro\\_FINAL.pdf#:~:text=ERA%20COUNTRY%20REPORT%202023:%20MONTENEGRO%20Key%20takeaways:%20%E2%80%A2](https://european-research-area.ec.europa.eu/sites/default/files/documents/2024-04/ERA%20Country%20Report%202023%20Montenegro_FINAL.pdf#:~:text=ERA%20COUNTRY%20REPORT%202023:%20MONTENEGRO%20Key%20takeaways:%20%E2%80%A2)

<sup>33</sup> <https://op.europa.eu/en/publication-detail/-/publication/b42cf8e8-d06e-11ee-b9d9-01aa75ed71a1/language-en#:~:text=The%20Western%20Balkan%20region%20and%20T%C3%BCrkiye%20have%20demonstrated>

<sup>34</sup> Law on Science Research ("Official Gazette of Montenegro", No. 080/10, 040/11, 057/14, 082/20)

adoption of decisions to grant Center of Excellence status. This designation can be awarded to an institution or a group of researchers within an institution that has achieved top-tier, internationally recognized results in their field of scientific research over a five-year period. The status is granted for three years, with the possibility of a three-year extension. While research infrastructures are acknowledged in the legal framework, there is room for improvement. For example, the law does not provide a clear governance framework for infrastructures funded by the state budget. Therefore, additional mechanisms are needed to ensure a coordinated and strategic approach to resource management, development, and the long-term sustainability of research infrastructures. Regarding the centers of excellence, the law stipulates that they are established for a period of three years, after which their status can be extended for another three years. While this extension provides some flexibility, a longer duration could be considered to allow for the full realization of their potential. The Science Research Strategy envisages the adoption of a new Law on Science Research by the end of 2024.

Another important law related to research infrastructures is the Law on Innovation<sup>35</sup>. This law stipulates that part of the research infrastructure simultaneously serves as innovation infrastructure, and as such, it is included in this roadmap.

Scientific research activities in Montenegro are predominantly carried out within licensed scientific research institutions. The Register of Licensed Scientific Research Institutions<sup>36</sup> includes 48 institutions across all four sectors. The majority of these institutions belong to the academic sector, suggesting that most scientific research activities take place within higher education institutions. During the mapping process, the University of Montenegro (UCG) was the most represented, followed by the University of Donja Gorica (UDG), indicating that other universities may be more focused on educational activities.

With respect to jurisdictions, the Ministry of Education, Science, and Innovation plays a formal role in overseeing research infrastructures funded by the state budget, primarily during the duration of projects or programs, thus somewhat limiting the scope of its supervision. Institutions listed in the Register of Licensed Scientific Research Institutions develop, own, and manage research infrastructures. As project implementing entities, these institutions design and submit project proposals, and after (co)financing is approved, they implement and manage research infrastructure projects. In this sense, these institutions are responsible for the success of the research, the maintenance and cost-effectiveness of the infrastructure, as well as for additional investments required due to asset depreciation or technological advancement.

An important approach to managing research infrastructure is open access. Open access to research infrastructure facilities is important for several reasons. First, it facilitates collaboration between researchers and institutions, allowing for the sharing of resources. Second, it increases the visibility of infrastructures, attracting more users and potential associates/partners. Third, it allows for more efficient use of resources, thereby reducing the need for duplication of expensive facilities. Fourth, it enables cost efficiency of the infrastructure. Finally, open access fosters innovation by strengthening collaboration between the academic and business sectors.

In 2020, the University of Montenegro adopted the Open Access Policy for Research Infrastructure<sup>37</sup>, establishing the scope of open-access infrastructure, management methods, user types, pricing structures, and other relevant issues. The implementation of this policy relies heavily on the University's organizational units, which determine how the infrastructure is utilized, including operational hours and service pricing. The adoption of this policy marked

<sup>35</sup> Law on Innovation Activity ("Official Gazette of Montenegro", No. 82/2020)

<sup>36</sup> <https://www.gov.me/clanak/lista-licenciranih-naucnoistrazivackih-ustanova>

<sup>37</sup> [https://www.ucg.ac.me/skladiste/blog\\_616766/objava\\_105846/fajlovi/Politika%20za%20otvoren%20pristup%20istra-zivackoj%20infrastrukturi%20na%20UCG.pdf#:~:text=razvoj%20\(R&D\)%20i%20nastavu%20\(u%20tehni%C3%ABkim,%20prirodnim,%20dru%C5%Altvenim](https://www.ucg.ac.me/skladiste/blog_616766/objava_105846/fajlovi/Politika%20za%20otvoren%20pristup%20istra-zivackoj%20infrastrukturi%20na%20UCG.pdf#:~:text=razvoj%20(R&D)%20i%20nastavu%20(u%20tehni%C3%ABkim,%20prirodnim,%20dru%C5%Altvenim)

a significant advancement in promoting and building capacity for open access. However, the mapping process conducted for this document reveals that most institutions participating in the surveys do not yet have fully developed open access policies for their research infrastructures. Specifically, information about the infrastructure, including pricing lists for services and other key details regulating access, has not been publicly disclosed. All institutions involved in the second round of the mapping process expressed a willingness towards open access but cited the lack of personnel to support the operation of infrastructures and the complexity of introducing an open access policy as the greatest obstacles. It is important to emphasize that all institutions mapped in the second round indicated that they have various forms of cooperation with other institutions, or with organizational units within institutions, at national, regional, and international levels. These collaborations allow researchers from different organizational units or institutions to access available research infrastructure. Additionally, 95% of respondents expressed interest in networking at the regional and European levels, as well as participating in pan-European research infrastructures such as the JRC research infrastructure in Ispra, METROFOOD-RI, and others.

Regarding financial support for infrastructure development in the past period, a support program for centers of excellence has been established, through which over 5 million euros have been invested in projects within priority areas identified by the Smart Specialization Strategy (S3). Additionally, national scientific research projects are an important instrument for the development of research infrastructure, aimed at strengthening and enhancing the capacities of research teams in Montenegro. Substantial funding is allocated for equipment and infrastructure development within this instrument, with over 2 million euros awarded for 24 projects in the most recent cycle. In addition to national funding sources, which include project-based funding, the European Union's Framework Program for Research and Innovation serves as an important source of funding for equipment and research infrastructure. In the latest cycle of the Framework Program (Horizon Europe), Montenegro secured 4.16 million euros for 22 projects from 2021 to the present<sup>38</sup>. Since 2008, when Montenegro began participating in the Framework Program, starting with FP7, it has attracted nearly €13 million. The data clearly indicate an upward trend in securing funding for Montenegrin partners from the Framework Program for Research and Innovation.

In conclusion, while various programs and funding sources for research projects and infrastructure have been established, there is still no specific program framework exclusively focused on financing and developing research infrastructures. This highlights the need for targeted programs to further promote and facilitate research infrastructure development and funding.

<sup>38</sup> <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-dashboard>

## 2.4 SWOT Analysis

<p><b>STRENGTHS</b></p> <ul style="list-style-type: none"> <li>Existing infrastructures provide a solid foundation for further development and modernization</li> <li>A strong strategic framework for research activities</li> <li>Clearly defined priority research areas and focal points for future investments in research infrastructure</li> <li>The presence of excellent national research groups</li> <li>Experience of researchers in implementing projects from the EU Framework Program for Research and Innovation and other EU programs</li> <li>Good networking and collaboration with regional and international research groups</li> <li>Experience of decision-makers in preparing and establishing research infrastructure projects – IPC Tehnopolis, Science and Technology Park of Montenegro</li> <li>Decision-makers are actively working towards integration into the ERA, facilitating alignment with the EU framework for the development of research infrastructures</li> <li>Participation in ESFRI</li> </ul>	<p><b>WEAKNESSES</b></p> <ul style="list-style-type: none"> <li>Lower level of investment in research infrastructure</li> <li>The current legal framework does not define the governance structure for research infrastructure</li> <li>The framework for financial support for research infrastructure is not fully developed</li> <li>The existing legal framework is not sufficiently encouraging for the development and sustainability of centers of excellence</li> <li>The absence of a unified registry for monitoring the development and operation of research infrastructures</li> <li>The policy of open access to research infrastructures has not been fully implemented</li> <li>Fragmentation of research infrastructure and insufficient visibility</li> </ul>
<p><b>OPPORTUNITIES</b></p> <ul style="list-style-type: none"> <li>Further involvement in the work of international bodies and expansion of membership in pan-European research infrastructures</li> <li>Better utilization of open access to major international research infrastructures</li> <li>Better utilization of open access to major international research infrastructures</li> <li>Access to funding from the Reform and Growth Facility for the Western Balkans (2024–2027) and IPA III</li> <li>Availability of funding from the Horizon Europe program</li> <li>Connection to infrastructures at the regional and European level</li> <li>By joining the EU, Montenegro will gain access to the ESIF, which is the most significant source of funding for research infrastructures at the national level</li> </ul>	<p><b>THREATS</b></p> <ul style="list-style-type: none"> <li>Increased competition from other countries may hinder the attraction of funding for research infrastructure</li> <li>Funds from IPA III and the Reform and Growth Facility for the Western Balkans (2024–2027) may be allocated to priorities from other sectoral policies</li> <li>Lack of research personnel for work in medium and large research infrastructures</li> </ul>







# 3. OVERVIEW OF RESEARCH INFRASTRUCTURES IN MONTENEGRO AND MEMBERSHIP IN PAN-EUROPEAN RESEARCH INFRASTRUCTURES AND INTERNATIONAL BODIES

## 3.1 Overview of Minor National Research Infrastructures

The adoption of the Smart Specialization Strategy in 2019 established a strategic framework for future investments in research infrastructures, identifying priority areas with the highest potential for transformation and future economic growth. The Strategy for Scientific Research of Montenegro for the period 2024-2028 outlines nine priority research areas, thereby directing investments in scientific research activities. Montenegro's Smart Specialization (S3) priorities have been integrated into this strategy to enhance the country's competitive advantage by aligning research and innovation capacities with the needs of the economy. Following consultations aimed at enhancing the efficiency of future investments, the priority areas of scientific research activities have been expanded to include additional focus areas:

- Sustainable agriculture and food value chains
- Energy and sustainable environment
- Sustainable and health tourism
- Science, education, and culture
- Medicine and health
- Socio-political and socio-economic challenges of Montenegrin society
- New materials, technologies, products, and services
- Disaster risk management
- Information and communication technologies

Below is an overview of minor national research infrastructures.

### 3.1.1 National Research Infrastructures within the Priority Area of Science, Education, and Culture

The significance of fundamental research in the natural, mathematical, social, and humanities sciences has been recognized as essential for the development of science and the overall advancement of Montenegrin society. Basic research plays a crucial role in strengthening research capacities and fostering connectivity at both national and international levels. The focal areas within this priority include fundamental research, language and literature, intercultural dialogue, cultural heritage research, arts, and digital humanities.

<b>Laboratory for Microbiology and Physiology</b>	
<b>Location:</b>	Faculty of Natural Sciences and Mathematics University of Montenegro Džordža Vašingtona bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	The laboratory specializes in developing biological tests and markers to assess the biological activity of compounds derived from living organisms and mixtures resulting from anthropogenic influences, as well as researching their mechanisms of action. The laboratory is equipped to offer a range of services, including sample collection, processing, and preparation. This includes homogenization and lyophilization, as well as obtaining natural extracts through various methods. Additionally, the laboratory conducts spectroscopic analyses, in vitro and in vivo biological testing using the Danio rerio embryo model, and data processing with specialized software tools. It also focuses on the application of bio-active substances in products and analyzes their effect.
<b>Website:</b>	<a href="https://www.ucg.ac.me//pmf">https://www.ucg.ac.me//pmf</a>
<b>Contact person:</b>	Professor Andrej Perović, PhD

<b>DNA Research Laboratory</b>	
<b>Location:</b>	Faculty of Natural Sciences and Mathematics University of Montenegro Džordža Vašingtona bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	The laboratory conducts various analyses and research on DNA and RNA using a Real-Time PCR machine, which allows for precise quantification and analysis of genetic material. It supports protocols that require maintaining a constant temperature, as well as those involving the centrifugation of samples to separate their components. The laboratory implements protocols for the separation of DNA molecules, which includes confirming PCR reactions and determining the concentrations of various substances.
<b>Website:</b>	<a href="https://www.ucg.ac.me//pmf">https://www.ucg.ac.me//pmf</a>
<b>Contact person:</b>	Professor Danilo Mrdak, PhD danimomrdak@gmail.com

<b>Scientific Research Laboratory for R&amp;D of Solid-State Detectors and Study of Defects in Materials with Large TCT Scanner</b>	
<b>Location:</b>	Faculty of Natural Sciences and Mathematics University of Montenegro Džordža Vašingtona bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	<p>This infrastructure provides services for fundamental research on material defects with applications in high-energy physics (HEP) and medicine. Within the infrastructure, research and development of solid-state detectors are conducted, encompassing both basic research and practical applications in HEP and medicine.</p> <p>The laboratory also offers professional training and preparation for students engaged in scientific research. It supports the development of masters (MSc) and doctoral (PhD) theses and organizes specialized training sessions and workshops for professional development.</p>
<b>Website:</b>	<a href="https://www.ucg.ac.me//pmf">https://www.ucg.ac.me//pmf</a>
<b>Contact person:</b>	Professor Gordana Lastovicka-Medin, PhD gordana.medin@gmail.com
<b>Other priority areas of the research infrastructure</b>	Medicine and Health New materials, technologies, products, and services

<b>Faculty of International Economics, Finance and Business/Entrepreneurial Nest and AXON Center for Mental Health</b>	
<b>Location:</b>	University of Donja Gorica Donja Gorica bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	<p>The Faculty of International Economics, Finance, and Business, the Entrepreneurial Nest, and the AXON Center for Mental Health together form a comprehensive framework for implementing research projects. The laboratory is equipped with state-of-the-art tools and platforms that provide extensive support for research initiatives. Software tools such as MATLAB, SPSS, and Eviews are utilized in this laboratory, enabling the conduct of complex multidisciplinary research. These tools are not just technological resources but also key components in connecting theoretical models with practical solutions, enabling researchers to swiftly and efficiently translate their findings into practice. By employing advanced human resource management tools, the laboratory enables companies to enhance their capacity to absorb new technologies and knowledge, assisting businesses in becoming more agile and better prepared to face the challenges of the modern business environment. The Entrepreneurial Nest is equipped with smart multimedia solutions that facilitate the creation, sharing, and distribution of innovations. A central component of this system is the digital platform EmpowerHR4Inno, which operates as an integrated system for the automatic retrieval, synchronization, sorting, and presentation of information from major scientific platforms such as Academia.edu, Google Scholar, and ResearchGate.</p> <p>Additionally, the platform provides personalized information to users through a library of courses that contains detailed content, research outcomes, digital tools, and human resource management models.</p> <p>The research infrastructure of the AXON Center for Mental Health offers services for measuring physiological responses, such as heart rate, muscle tension, and skin conductance, using the T7525 ProComp 5 SYS with BioGraph Infinity software. This service is beneficial for researching stress, anxiety, depression, and emotion regulation. Users are given the opportunity for neurofeedback training to enhance cognitive functions and regulate emotions, using feedback on brain waves, to better control cognitive and emotional states. The Center also employs the Tobii Pro Fusion screen-based tracker and Tobii Pro Glasses for eye movement tracking in various research and clinical contexts. This service is crucial for understanding visual attention, cognitive processing, and social interaction among individuals. By utilizing eye-tracking technology, the Center provides detailed analyses of cognitive processes such as attention, memory, and decision-making, making it particularly useful for investigating cognitive biases associated with depressive and suicidal states.</p>
<b>Website:</b>	<a href="https://www.udg.edu.me/fakulteti/FMEFB">https://www.udg.edu.me/fakulteti/FMEFB</a>
<b>Contact person:</b>	<p>Professor Maja Drakić-Grgur, PhD, Dean of the Faculty of International Economics, Finance, and Business;</p> <p>Associate Professor Sandra Tinaj, PhD, General Manager of the University of Donja Gorica</p> <p>Marko Nišavić, MSc, Manager of the Entrepreneurial Nest</p> <p>Professor Nela Milošević, PhD, Dean of the Faculty of Applied Science</p> <p>Milena Ratković Fehilly, Manager of the AXON Center for Mental Health</p>

<b>Research Infrastructure of the Faculty of Maritime Studies in Kotor</b>	
<b>Location:</b>	Faculty of Marine Studies in Kotor University of Montenegro Put I Bokeljske brigade 44 85330 Kotor
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	<p>The research infrastructure of the Faculty of Maritime Studies in Kotor includes:</p> <ol style="list-style-type: none"> <li>1. Transas - Wartsila Techsim 5000 ERS Marine Engine Simulator, which is used to enhance research capabilities in maritime sciences and marine engineering. The simulator facilitates research in areas such as the management of ship propulsion and auxiliary systems, maintenance, monitoring, and the efficient operation of marine engines. In addition to this simulator, the Faculty also possesses the Unitest simulator (a marine engine simulator with 3D visualization – LER 3D, gas turbine simulator, SER 2 LNG – steam engine room simulator, and technical diagnostics - TD5).</li> <li>2. Transas NT PRO 4000 Nautical Simulator (1xFMB + 6xClassroom stations) is used for optimizing navigation routes, analyzing maritime safety, reconstructing maritime accidents, studying the impact of human factors, and testing new navigation technologies.</li> <li>3. Laboratory for Marine Electrical Engineering and Electronics at the Faculty of Maritime Studies in Kotor is equipped with advanced equipment for testing and researching electrical systems on ships. The equipment includes the LucasNulle laboratory test bench for testing electrical machines under load, UniTrain platforms for experimental research with virtual instruments, LabVIEW software for data collection and analysis, and multifunctional devices for data acquisition, temperature measurement, and analysis of three-phase electrical power. The laboratory also utilizes MATLAB for simulations and numerical analysis, along with additional sensors to monitor key ship parameters. The available equipment enables research on the starting processes of asynchronous machines under various ship loads (pumps, fans, compressors, elevators), as well as under no-load conditions. It also allows for the investigation of parameter estimation for the equivalent circuit of asynchronous machines and transformers, frequency supply to asynchronous machines under various loads, and measurement and calibration of sensors for non-electrical quantities such as temperature and force.</li> </ol>
<b>Website:</b>	<a href="https://www.ucg.ac.me/pfkotor">https://www.ucg.ac.me/pfkotor</a>
<b>Contact person:</b>	<ol style="list-style-type: none"> <li>1. Associate Professor Miroslav Vukičević, PhD</li> <li>2. Igor Stanovčić, MSc</li> <li>3. Professor Tatijana Dlabač, PhD</li> </ol>

<b>Research Infrastructure of the Faculty of Electrical Engineering</b>	
<b>Location:</b>	University of Montenegro Džordža Vašingtona bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	<ol style="list-style-type: none"> <li>1. The Laboratory for Measuring Electromagnetic Emission Levels conducts electric field level testing in accordance with applicable legal regulations and relevant international standards. The laboratory's measurement method is accredited according to the MEST EN 50413:2020 standard by the Accreditation Body of Montenegro, and it holds the necessary operating permit from the Environmental Protection Agency, as required by law.</li> <li>2. The ICT Laboratory is equipped with tools predominantly used for research purposes in the field of ICT. Part of the equipment is also used for characterizing electronic circuits, sensor interface circuits, and measurement systems developed at the Faculty of Electrical Engineering as part of ongoing research activities. Potential users of this equipment include research institutions and companies engaged in the development and characterization of systems in the field of information and communication technologies, sensor interface electronics, measurement systems, and other technical and technological disciplines.</li> <li>3. The Laboratory for Electric Power Systems (EPS) houses equipment for measuring electrical power quality parameters, testing equipment for relay protection, and a high-voltage (HV) cell with full functionalities of main current circuits, control circuits, signaling, and protection. Through a cooperation agreement with the Institute for Technical Research, the Faculty of Electrical Engineering, specifically the EPS Laboratory, has access to an HV testing transformer of up to 100kV for laboratory purposes.</li> </ol>
<b>Website:</b>	<a href="http://www.etf.ucg.ac.me">www.etf.ucg.ac.me</a>
<b>Contact person:</b>	Associate Professor, Milena Erceg PhD, Vice Dean for Research and Development
<b>Other priority areas of the research infrastructure</b>	Information and communication technologies



<b>Research Infrastructure of the Institute of Marine Biology</b>	
<b>Location:</b>	University of Montenegro Put I Bokeljske brigade 68 85330 Kotor
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	<p>The Institute's scientific services in the field of marine fisheries include research on benthic and pelagic resources, fish developmental stages (ichthyoplankton), analysis of population dynamics, and biomass assessment of key species such as fish, crabs, and cephalopods. Additionally, the Institute focuses on species identification, spatial distribution of marine organisms, biodiversity analysis, fish morphometry, and histological analysis of gonads. It provides scientific support for the protection and enhancement of fish populations, responsible fishing practices, and the sustainable use of marine resources. In the field of marine chemistry, the Institute engages in chemical and biochemical research, including studies on marine pollution caused by heavy metals and toxic compounds. It also explores the extraction of bioactive compounds from marine organisms, particularly endemic species, and examines fundamental physicochemical parameters of seawater and sediment. Furthermore, the Institute investigates the presence and concentrations of heavy metals in water, sediment, and organisms, along with their impact on the ecosystem. Pollution indices, bioaccumulation and geoaccumulation factors are determined, and the physical characteristics of sediment are analyzed through biomonitoring of pollution levels. In the area of primary production and water quality, the Institute undertakes basic, applied, and developmental research on phytoplankton, zooplankton, and bacterioplankton, as well as the assessment of sanitary quality of seawater and sediment. This includes analysis of the composition and abundance of phytoplankton communities, biomass assessment based on chlorophyll concentration, and evaluation of eutrophication levels. Phytoplankton organisms are used as indicators of ecosystem health, and ballast water quality is also investigated. In the field of benthos and marine protection, the Institute performs analysis and monitoring of benthic marine organisms (seabed) and marine conservation. This includes research on phytobenthos (macroalgae and seagrass) in terms of biodiversity, biomass, communities, and the impact of pollution. Valuable marine habitats and protected areas are mapped. Zoobenthos, including sponges, corals, mollusks, and cephalopods, are studied through taxonomic, ecological, and biomass analyses, as well as the impact of pollution on these communities. In the field of mariculture, the Institute focuses on the technology of shellfish and fish farming, improving marine aquaculture, and researching the early developmental stages of fish and shellfish. Special emphasis is placed on advancing the technology for cultivating edible shellfish, biomass and distribution assessments, and diversifying production by introducing new species. It also analyzes farming locations, addresses marine waste issues, and provides advisory services to aquaculture farmers.</p>
<b>Website:</b>	<a href="https://www.ucg.ac.me/ibm">https://www.ucg.ac.me/ibm</a>
<b>Contact person:</b>	Mirko Đurović PhD, Research Associate, Director of the Institute

### 3.1.2 National Research Infrastructures within the Priority Area of Sustainable Agriculture and Food Value Chains

The goal of the priority area “Sustainable Agriculture and Food Value Chains” is to strengthen the value chain of organic production and develop new agricultural products, while improving food systems to make them more sustainable, resilient, and focused on the production of nutritionally valuable and safe food. Additional focus areas include: the development of the organic production value chain; innovation, creation of new products, and the application of new technologies in food production, including the production of ecological and smart packaging; sustainable use of marine resources for innovative products in biomedicine and pharmacology; the creation of new fruit and vegetable products, innovative products from medicinal and aromatic plants (such as oils, cosmetics, pharmaceuticals, spa products, spices, beverages, etc.). There is also a focus on olive oil and other products derived from olives.

Research Infrastructure of the company "13. jul Plantaže"	
<b>Location:</b>	„13. jul Plantaže“ AD Bulevar Šarl de Gola 2 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	The research infrastructure of the company «13. jul Plantaže» provides services aimed at improving production processes and product quality. This includes support in optimizing production and offering advice to enhance the quality of grapes, wine, and fruit. Additionally, it applies new information and communication technologies in agriculture, such as precision farming systems, and offers guidance on using digital technologies for production optimization.
<b>Website:</b>	<a href="http://www.plantaze.com">www.plantaze.com</a>
<b>Contact person:</b>	Sanja Radonjić, PhD, Director of the Department for Development

Research Centers of the Biotechnical Faculty	
<b>Location:</b>	University of Montenegro Biotechnical Faculty Bulevar M. Lalića 15 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	<p>Almost all research centers at the Biotechnical Faculty have their own laboratories, and some centers house multiple laboratory units.</p> <ol style="list-style-type: none"> <li>1. The Agrochemical Laboratory offers a wide range of analytical services, including physical and chemical analyses of soil and plant material. Each year, the laboratory receives authorization from the Ministry of Agriculture, Forestry, and Water Management to conduct these analyses. Soil analysis includes examining mechanical and aggregate composition, density, porosity, moisture content, acidity, conductivity, cation exchange capacity (CEC), and the content of carbonates, organic carbon, nitrogen, phosphorus, potassium, calcium, magnesium, iron, manganese, zinc, and copper. Plant material analysis focuses on total nutrient content.</li> <li>2. Plant Protection unit comprises several laboratories engaged in various fields of research. The Entomology Laboratory studies harmful insects and mites, while the Phytopharmacy Laboratory tests plant protection products, and the Phytopathology Laboratory researches pathogens affecting agricultural crops. The Virology Laboratory analyzes the presence of viruses in plants, while the Nematology Laboratory monitors and prevents the spread of harmful nematodes. Additionally, the Plant Protection and Plant Material Control Laboratory conducts health checks and tests the effectiveness of plant protection products. It is authorized for the molecular identification of the bacterium <i>Xylella fastidiosa</i>.</li> <li>3. The Food and Feed Laboratory and the Molecular Genetics Laboratory located at the Animal Husbandry Center perform chemical composition analyses of plant-based feed and animal-based food including measurements of moisture, dry matter, ash, fat, crude protein, crude fiber, as well as ADF and NDF fibers. Additionally, molecular and genomic analyses of biological material of animal origin are conducted here.</li> <li>4. The Olive Oil Laboratory analyzes various olive oil parameters, such as free fatty acids, peroxide value, refractive index, fatty acid methyl esters (for determining fatty acid composition and authenticity), K values, total phenols, and sensory characteristics.</li> <li>5. The Enology Laboratory performs analyses that include measuring specific gravity, controlling sugar content, total acids, and pH values. For wine, it examines relative density, pH, alcohol content, extract, total and volatile acids, sugar, and free and total SO<sub>2</sub>. The laboratory employs modern instrumental techniques such as spectrophotometry for determining total polyphenols, anthocyanins, proanthocyanidins of low and high molecular weight, antioxidant capacity, as well as the HPLC method for high-performance liquid chromatography.</li> <li>6. The Seed Laboratory conducts quality testing of agricultural plant seeds, including analyses of seed purity, energy and percentage of germination, moisture content, 1000-seed weight, and hectoliter mass.</li> <li>7. The Forestry Research Laboratory carries out research in the areas of forest protection, nursery production of forest plants, and the molecular characterization of pathogenic and symbiotic fungi.</li> </ol>
<b>Website:</b>	<a href="https://www.ucg.ac.me/btf">https://www.ucg.ac.me/btf</a>
<b>Contact person:</b>	<ol style="list-style-type: none"> <li>1. Associate Professor Ana Topalović, PhD and Associate Professor Mirko Knežević, PhD</li> <li>2. Professor Nedeljko Latinović, PhD, Professor Jelena Latinović, PhD, Professor Snježana Hrnčić, PhD, Professor Sanja Radonjić, PhD, Associate Professor Tatjana Perović, PhD, Associate Professor Igor Pajović, PhD, and Associate Professor Jelena Zindović, PhD</li> <li>3. Associate Professor Dušica Radonjić, PhD, Professor Božidarka Marković, PhD, Milena Đokić, MSc</li> <li>4. Sandra Gajević, MSc</li> <li>5. Professor Radmila Pajović Šćepanović, PhD</li> <li>6. Professor Zoran Jovović, PhD</li> <li>7. Jelena Lazarević, PhD</li> </ol>

<b>Laboratory for Food Quality and Safety</b>	
<b>Location:</b>	Faculty for Food Technology, Food Safety and Ecology (FFTFSE) University of Donja Gorica Donja Gorica bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	<p>The laboratory is designed to conduct physicochemical, microbiological, and molecular-biological analyses of food and water. It has two primary objectives:</p> <ol style="list-style-type: none"> <li>1. Organizing laboratory exercises for undergraduate and postgraduate students of FFTFSE, and</li> <li>2. Conducting food sample analyses for both market needs and research activities.</li> </ol> <p>The laboratory is fully equipped to perform honey quality analyses in accordance with the Regulation on the Minimum Quality of Honey and Other Beekeeping Products ("Official Gazette of Montenegro," No. 27/14). This ensures that honey producers can market products with verified qualitative characteristics and improve product quality during production by controlling parameters that significantly influence honey quality. Additionally, using the melissopalynology method, which involves the microscopic analysis of honey sediment, the laboratory can accurately determine the botanical origin (plant source) and geographical origin (region of production) of honey. The laboratory is also equipped with modern equipment to assess key parameters in the winemaking process, providing high-quality technical support to wine producers. Twenty-one accredited methods for wine analysis have been established. The microbiological laboratory is outfitted with state-of-the-art equipment for conducting microbiological food analyses. Within the Laboratory for Food Quality and Safety, there is also a Molecular Biology Laboratory, which applies molecular-biological methods, including the identification of genetically modified organisms (GMOs). Additionally, the laboratory has a real-time PCR device for DNA replication, enabling the detection of specific microorganisms through direct measurement during replication. Furthermore, the laboratory is equipped with DNA sequencing devices, facilitating the identification and assessment of microbial genes.</p>
<b>Website:</b>	<a href="https://foodhub.udg.edu.me/laboratorija-zakvalitet-i-bezbjednost-hrane">https://foodhub.udg.edu.me/laboratorija-zakvalitet-i-bezbjednost-hrane</a>
<b>Contact person:</b>	Professor Aleksandra Martinović, PhD, Dean of the Faculty for Food Technology, Food Safety and Ecology Giuseppe Paderni, MSc, Manager of the Laboratory for Food Quality and Safety

<b>Center for Ecotoxicological Research in Podgorica</b>	
<b>Location:</b>	Center for Ecotoxicological Research in Podgorica (CETR) Bulevar Šarla de Gola 2 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	<p><b>Air Quality Analysis:</b> CETR monitors ambient air quality by measuring key pollutants, including sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), nitrogen monoxide (NO), suspended particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), benzene derivatives (BTX), carbon monoxide (CO), lead (Pb), arsenic (As), nickel (Ni), cadmium (Cd), polycyclic aromatic hydrocarbons (PAH), and ground-level ozone (O<sub>3</sub>). Additionally, CETI evaluates emissions from stationary pollution sources, which is essential for assessing the environmental impact of industrial activities.</p> <p><b>Water Quality Analysis:</b> CETR conducts comprehensive water quality assessments, focusing on the detection of hazardous chemicals such as anthracene, atrazine, benzene, brominated diphenyl ethers, and a variety of pesticides. The laboratory also tests for the presence of heavy metals such as cadmium (Cd), lead (Pb), and mercury (Hg), along with other chemical compounds and pharmaceutical substances that may contaminate water resources.</p> <p><b>Soil Analysis:</b> CETR examines soil's chemical composition, particularly focusing on heavy metals such as lead, cadmium, mercury, and arsenic, as well as polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCB). These analyses provide essential data for assessing soil contamination and potential environmental and health risks.</p> <p><b>Waste Characterization:</b> CETR performs waste analyses to determine its chemical composition, which is essential for accurate classification and proper management. This process helps assess the environmental and health risks associated with waste disposal and treatment.</p> <p><b>Radionuclide Analysis:</b> CETR assesses the presence of radionuclides across all environmental matrices, including air, water, soil, and food. These analyses are critical for evaluating radioactive contamination and potential population exposure risks.</p> <p><b>Physicochemical Food Analysis:</b> CETR conducts comprehensive food safety analyses, testing for the presence of mycotoxins, polycyclic aromatic hydrocarbons, pesticides, chemical elements, and biotoxins, contributing to public health protection.</p> <p><b>Biotoxin Analysis:</b> The laboratory specializes in the detection of biotoxins, particularly in farmed shellfish. This includes testing for DSP (Diarrhetic Shellfish Poisoning), PSP (Paralytic Shellfish Poisoning), and ASP (Amnesic Shellfish Poisoning) to ensure the safety of marine food products.</p> <p><b>Veterinary drugs:</b> CETR offers specialized analyses for detecting residues of veterinary drugs, including steroid hormones, antibacterial agents, and various other pharmacologically active substances. These tests are critical for ensuring the safety and quality of both animal-derived food products and overall animal health. CETR has been accredited under ISO/IEC 17025 standards since 2004.</p>
<b>Website:</b>	danijela.sukovic@ceti.me
<b>Contact person:</b>	Danijela Šuković
<b>Other priority areas of the research infrastructure</b>	Energy and sustainable environment Medicine and health

### 3.1.3 National Research Infrastructures within the Priority Area of Medicine and Health

This priority area focuses on health and healthcare services, emphasizing their interdisciplinary and multidisciplinary connections with other fields. Key focus areas within this priority include the “One Health” approach, personalized medicine, telemedicine, screening programs, and early detection of common diseases, research on chronic non-communicable diseases, vaccination, mental health, oral health, the development of new biomarkers, and rational pharmacotherapy and pharmacy.

Research Infrastructure of the Institute for Medicines and Medical Devices	
<b>Location:</b>	Institute for Medicines and Medical Devices Bulevar Ivana Crnojevića 64A 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	The Laboratory of the Institute for Medicines and Medical Devices provides the following services: determining mass uniformity in single-dose preparations and comparing sample diffractograms with reference diffractograms from a database using the XRPD method. The lab also identifies crystalline phases in solid forms of drugs and supplements through X-ray diffraction and provides semi-quantitative determination of crystalline phases in solid and powdered samples. Additionally, it conducts quantitative elemental analysis of elements ranging from fluorine to americium using the XRF technique, measures mass within the range of 0.01 g to 2200 g, measures pH values of solutions, and performs sample extractions using Clevenger and Soxhlet methods. The Institute also maintains databases on reported adverse drug reactions and drug consumption.
<b>Website:</b>	<a href="https://cinmed.me/">https://cinmed.me/</a>
<b>Contact person:</b>	MD, Specialist Snežana Mugoša

<b>Research Infrastructure of the Institute of Public Health of Montenegro</b>	
<b>Location:</b>	Džona Džeksona bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	<ol style="list-style-type: none"> <li>1. The Center for Medical Microbiology performs the following key tasks and responsibilities: it functions as the national reference laboratory for influenza, measles, rubella, and antimicrobial resistance. The Center employs verified and standardized diagnostic methods (bacteriological, virological, immunological, molecular, mycological, and parasitological methods) to identify pathogens responsible for infectious and other diseases caused by bacteria, rickettsiae, viruses, fungi, protozoa, and helminths. Additionally, it carries out sampling and receipt of human material for various diagnostic analyses. Furthermore, the Center preserves, multiplies, and distributes reference strains of bacteria for quality control of its operations and those of other microbiological laboratories in the country, while also investigating carrier status and parasitic infections. The Center also conducts examinations of food products, water, air, objects of general use, swabs, and other samples using sanitary microbiology methods. Bacteriological and parasitological examinations are performed on samples obtained from individuals under health surveillance, as mandated by legal regulations. For the purpose of colorectal cancer screening, the Center coordinates sample collection, conducts diagnostics for occult blood in the collected samples, and distributes the testing results to healthcare institutions. Similarly, for cervical cancer screening, it coordinates sample collection, performs molecular diagnostics and HPV typing, and disseminates the examination results to healthcare institutions.</li> <li>2. The Center for Health Ecology focuses on identifying, monitoring, and preventing health risk factors caused by infectious and chronic non-communicable diseases, as well as taking measures to mitigate their impact. The laboratories at the Center for Health Ecology utilize modern analytical instruments, including gas chromatographs with various detectors (GC/ECD/FID), mass spectrometers (GCMS, GCMSMS), liquid chromatographs with mass spectrometers (LCMS), HPLC, as well as trace element analysis spectrometers (ICP-OES, ICPMSMS), direct mercury analyzers (DMA), and ion chromatographs. This equipment is used for the analysis of food (detection and quantification of contaminants, additives, nutrients, and residues), water (testing the quality and safety of drinking water, wastewater, and other water samples), as well as the environment (monitoring air pollution, soil, and other ecological factors).</li> </ol>
<b>Website:</b>	<a href="http://www.ijzcg.me">www.ijzcg.me</a>
<b>Contact person:</b>	<ol style="list-style-type: none"> <li>1. Marijana Mimović, PhD, Director of the Center for Medical Microbiology</li> <li>2. Professor Dijana Đurović, PhD, Director of the Center for Health Ecology</li> </ol>

<b>Cancer Biobank</b>	
<b>Location:</b>	Faculty of Medicine University of Montenegro Kruševac bb 81000 Podgorica
<b>Development Cycle Phase:</b>	In preparation
<b>Description:</b>	The establishment of the first cancer biobank in Montenegro is part of a national scientific research project titled “Investigation of the Diagnostic Potential of Multimodal Biomarkers for the Detection of Colorectal Cancer – BIOCAN,” coordinated by the Faculty of Medicine of the University of Montenegro (UCG). This project aims to ensure that the collection, processing, and storage of data and samples are carried out in a precisely defined, uniform, and organized manner, facilitating the establishment of the first cancer biobank in Montenegro. This biobank will serve as a biorepository of high-quality biological samples, along with demographic and clinical data for each patient. In addition, specialized software is being developed for storing data related to the biobank, with a strong emphasis on maintaining security and confidentiality in compliance with all relevant regulations. The establishment of a cancer biobank in Montenegro will provide a platform for innovative biomedical research, particularly in the development of personalized medicine approaches, as biobanks have become critical resources for discovering new preventive, diagnostic, and prognostic biomarkers, as well as developing personalized treatments.
<b>Website:</b>	<a href="https://www.ucg.ac.me/med">https://www.ucg.ac.me/med</a>
<b>Contact person:</b>	Maša Ždravčić, PhD, Research Associate at the University of Montenegro, Head of the laboratory for molecular medicine at the Faculty of Medicine UCG



<b>Center for Scientific Research at the Faculty of Medicine</b>	
<b>Location:</b>	Faculty of Medicine University of Montenegro Kruševac bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	<p>The Center for Scientific Research at the Faculty of Medicine serves as a distributed research infrastructure. It was established to integrate previously independent preclinical research groups, thereby rationalizing resources and enhancing competitiveness at national, European, and global levels. Within the Center, the Laboratory for Molecular Medicine was established between 2018 and 2020, where research is conducted as part of ongoing scientific projects at the Faculty, alongside training for doctoral students. The establishment of the Laboratory for Cell Cultures and the Laboratory for Spectrophotometry, Polarography, and Protein Biochemistry is in its final phase, which will significantly enrich the capabilities and expand the scope of research conducted by our scientists. The Center for Scientific Research at the Faculty of Medicine includes well-established laboratories, some of which are exclusively part of the Faculty, while others serve as teaching bases within the Clinical Center of Montenegro. These laboratories are utilized for both teaching and research purposes:</p> <ul style="list-style-type: none"> <li>- Laboratory for Histology and Cytology and Laboratory for Pathohistology;</li> <li>- Laboratory for Immunohistochemistry and PCR Laboratory (these laboratories belong to the Pathology Center of the Clinical Center of Montenegro, which is one of the teaching bases of the Faculty of Medicine);</li> <li>- Laboratory for Medical Biochemistry;</li> <li>- Laboratory for Medical Physiology;</li> <li>- Laboratory for Anatomy;</li> <li>- Laboratory for Pharmacology; and</li> <li>- Laboratory for Pathophysiology.</li> </ul> <p>The molecular biology and biochemical techniques and methods available at the Center for Scientific Research at the Faculty of Medicine (UCG) include:</p> <ol style="list-style-type: none"> <li>1. Isolation of DNA and RNA from biological samples (plasma, serum, FFPE tissue, saliva, etc.) and their quantification using fluorimetry;</li> <li>2. PCR;</li> <li>3. RT-PCR;</li> <li>4. Post-PCR analyses (agarose gel electrophoresis and gel visualization);</li> <li>5. Cell cultures techniques (cell proliferation, cytotoxicity tests, clonality tests, etc.);</li> <li>6. Spectrophotometric measurements (UV-VIS), including reaction kinetics;</li> <li>7. Polarographic measurements (oxygen consumption measurements);</li> <li>8. Western blotting (semi-quantitative method for determining protein expression, examining post-translational modifications, etc.).</li> </ol>
<b>Website:</b>	<a href="https://www.ucg.ac.me/med/cii">https://www.ucg.ac.me/med/cii</a>
<b>Contact person:</b>	Professor Olivera Miljanović, PhD, CNIR Manager

### 3.1.4 National Research Infrastructures within the Priority Area of Information and Communication Technologies

Information and communication technologies (ICT) in Montenegro represent a key driving force for the development of the digital economy, enhancement of competitiveness, and modernization of various economic sectors. The development of ICT infrastructure, as well as the application of digital solutions in areas such as education, healthcare, administration, and industry, are essential for accelerating the economic transformation of the country. Through the Smart Specialization Strategy (S3), Montenegro focuses on strengthening the innovative capacities of the ICT sector, thereby opening new opportunities for the development of the private sector and increasing competitiveness in the global market. The Strategy for Scientific Research Activities has identified new focal areas, including: artificial intelligence (AI), augmented and virtual reality (AR and VR technologies), blockchain technology, cloud computing, data science and processing of complex datasets, high-performance computing (HPC), the Internet of Things (IoT), mobile technologies, and cybersecurity.

<b>National Competence Center for High-Performance Computing of Montenegro</b>	
<b>Location:</b>	Faculty of Information Systems and Technologies University of Donja Gorica Donja Gorica bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	The National Competence Center for High-Performance Computing (HPC) of Montenegro represents a key part of the research infrastructure of the University of Donja Gorica, offering advanced resources and equipment for high-performance data processing. The Center is equipped with an HPC Node system, the latest NVIDIA GPU hardware, and an HPC cluster service rented from Yotta Advanced Computing. This equipment enables the analysis of large volumes of data and the application of artificial intelligence (AI). The goals of the Center include supporting researchers in the development of innovative solutions for the private and public sectors, as well as promoting the use of high-performance computing (HPC) and HPDA/AI technologies. The National Competence Center for HPC of Montenegro has become a member of the DEADLUS consortium—a consortium for the new mid-range EuroHPC supercomputer in Greece for Eastern Europe, which is planned to become operational by 2025 under GRNET (National Infrastructure for Research and Technology).
<b>Website:</b>	<a href="https://fist.udg.edu.me/">https://fist.udg.edu.me/</a>
<b>Contact person:</b>	Associate Professor Luka Filipović, PhD, Manager of the National Competence Center for High-Performance Computing of Montenegro

<b>Laboratory for Digital Forensics and Computer Network Security</b>	
<b>Location:</b>	Faculty of Information Systems and Technologies University of Donja Gorica Donja Gorica bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	The Laboratory for Digital Forensics and Computer Network Security is equipped with state-of-the-art digital forensics equipment from Cellebrite, intended for academic institutions. The equipment includes an application package of software solutions, peripheral devices, and accessories for mobile device forensics. The advantages and capabilities of this solution are numerous: flexibility and practicality of investigations; support for the widest range of data types; isolation and independence of the environment for forensic processes; and more. This equipment is utilized for research, testing, and certification under the CCNA and CCNP Security programs. The Cisco Certified Network Associate Security (CCNA Security) certification validates the knowledge and skills necessary for securing Cisco networks, including the development of security infrastructure, threat and vulnerability recognition on networks, and the mitigation of security threats. The Cisco Certified Network Professional Security (CCNP Security) certification program aligns with the role of a Cisco Network Engineer responsible for security in network devices, as well as for selecting, implementing, supporting, and troubleshooting security in a network environment.
<b>Website:</b>	<a href="https://fist.udg.edu.me/">https://fist.udg.edu.me/</a>
<b>Contact person:</b>	Professor Ramo Šendelj PhD, Manager of the Laboratory for Digital Forensics and Computer Network Security

<b>Laboratory for Information Technologies</b>	
<b>Location:</b>	Faculty of Information Systems and Technologies University of Donja Gorica Donja Gorica bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	The equipment of the Laboratory for Information Technologies includes modern technology that encompasses sensors for digital signal and image processing. This technology enables advanced analysis and processing of digital signals and images, which is crucial for many applications in the fields of information technology and telecommunications. The implementation of the Internet of Things (IoT) technology connects various devices via the internet, allowing for the collection and exchange of data in real time, which has wide applications across different industries; Embedded System Design, involves creating specialized computer systems that are part of larger mechanical or electronic systems, which are essential for the development of modern devices and applications. Information systems facilitate the management, processing, and storage of information, supporting the efficiency of business processes and decision-making. The Apple Computer Laboratory is equipped with Apple computers, providing resources for application development and testing, design, and other creative activities.
<b>Website:</b>	<a href="https://fist.udg.edu.me/">https://fist.udg.edu.me/</a>
<b>Contact person:</b>	Professor Tomo Popović PhD, Head of the Laboratory for Information Technologies

### 3.1.5 National Research Infrastructures within the Priority Area of New Materials, Technologies, Products, and Services

The priority research area in the technical and technological sciences of Montenegro encompasses the development of new materials and the improvement of existing technologies, products, and services, in accordance with sustainable development goals and the principles of a circular economy. This research has broad applications across industrial sectors such as construction, energy, medicine, and ecology, contributing to competitiveness and innovation. Their multidisciplinary and commercial potential make them essential for the advancement of science and the economy in Montenegro. The focal areas within this priority include space research and the development of related technologies, as well as materials, new products, and services.

Research Infrastructure of the Faculty of Metallurgy and Technology	
<b>Location:</b>	University of Montenegro Cetinjski put bb 81000 Podgorica
<b>Development Cycle Phase:</b>	Implementation
<b>Description:</b>	<p>The Faculty of Metallurgy and Technology possesses research infrastructure that facilitates advanced studies in metallurgy, materials science, technology, and environmental protection.</p> <p>The main tasks of this infrastructure include:</p> <ul style="list-style-type: none"> <li>- Designing new materials, including those for energy storage and biologically active chemical compounds;</li> <li>- Analyzing the microstructure and crystalline structure of metals and alloys to assess their properties;</li> <li>- Conducting qualitative and quantitative analysis of samples using UV-Vis absorption,</li> <li>- Testing the mechanical and electrochemical properties of materials;</li> <li>- Performing elemental analysis and thermogravimetric testing in new laboratories; and</li> <li>- Testing water quality and extracting plant materials to determine antioxidant potential.</li> </ul> <p>Leveraging its research capabilities, the Faculty of Metallurgy and Technology can provide a range of services, including detailed analysis of the microstructure of metallic and non-metallic materials; synthesis of materials through mechanochemical methods; material treatment under high pressure and temperature conditions; identification of crystalline structures and phase analysis of materials; spectroscopic analysis of samples; mechanical testing of materials; and electrochemical measurements and analyses.</p>
<b>Website:</b>	<a href="https://www.ucg.ac.me/mtf">https://www.ucg.ac.me/mtf</a>
<b>Contact person:</b>	Professor Veselinka Grudić, PhD

Laboratory for Material and Structure Testing	
<b>Location:</b>	Faculty of Civil Engineering University of Montenegro Džordža Vašingtona bb 81000 Podgorica
<b>Development Cycle Phase :</b>	Implementation
<b>Description:</b>	The Laboratory for Material and Structure Testing is equipped with scientific research infrastructure that facilitates experimental research in civil engineering. This includes testing construction materials, elements, structures, and their components; conducting seismic engineering studies; evaluating transportation infrastructure; and exploring geotechnics and hydrotechnics, as well as the organization and technology of construction.
<b>Website:</b>	<a href="https://www.ucg.ac.me/gf">https://www.ucg.ac.me/gf</a>
<b>Contact person:</b>	Professor Ljiljana Žugić, PhD

### 3.2 Innovation and Entrepreneurship Center “Tehnopolis” Nikšić<sup>39</sup>

**IPC Tehnopolis is an innovation and entrepreneurship center located in Nikšić that commenced operations in 2014. It has extensive experience working with startups, entrepreneurs, and innovators, as well as with scientists. The Center has established incubation, pre-incubation, and virtual incubation programs. It is particularly noted for providing support in the development of new technologies, connecting the academic and business sectors, and creating a favorable environment for the growth of startups and innovative small and medium-sized enterprises. Since 2016, IPC Tehnopolis has secured nearly 4 million euros through EU projects, primarily related to the Cross-Border Cooperation Program, with funds directed towards improving the business environment, fostering innovations in the agro-food sector, implementing ICT solutions in agriculture, developing energy-efficient materials, and applying additive technologies in manufacturing.**

In terms of research infrastructure, IPC Tehnopolis has established three laboratories focused on sustainable agriculture and food value chains, new materials, technologies, products, and services, as well as information and communication technologies. These laboratories provide an ideal platform for knowledge exchange between the academic and business sectors, enabling collaboration in innovation development.

<sup>39</sup> Article 26 of the Law on Innovation Activities («Official Gazette of Montenegro», No. 82/20):

The Innovation and Entrepreneurship Center is an entity within the innovation infrastructure that provides access to specialized facilities and equipment, as well as professional and advisory services. It offers information and technical training to innovative legal and natural persons, as well as entrepreneurs.

The activities of the Innovation and Entrepreneurship Center are aimed at connecting with potential partners for participation in national and international programs, projects, and funding opportunities across various fields of science. The goal is to create new companies and develop existing ones based on innovation and knowledge transfer, thereby contributing to economic development at the local or regional level.

The rights and obligations between the Innovation and Entrepreneurship Center and its service users are governed by a contractual agreement.

### BioLab Tehnopolis

The BioLab Tehnopolis laboratory is equipped with a drone for monitoring vegetation growth and crop quality, as well as equipment for testing the technical functionality of plant protection machinery. It also features tools for agrochemical and physical-mechanical soil analyses, along with PCR analyses to detect pathogens that cause food spoilage and pharmacologically active substances from veterinary drugs in milk. This equipment enables the application of advanced scientific methods that contribute to sustainable agriculture and product quality. Services offered include the detection of pathogenic bacteria in animal-derived food products using PCR methods for identifying pathogens such as *Salmonella* spp., *Listeria monocytogenes*, *Escherichia coli* spp., and *Staphylococcus aureus*. Additional services include determining antibiotic residues in milk, conducting soil analyses encompassing pH value, humus content, calcium carbonate, total nitrogen, readily available phosphorus, and readily available potassium, monitoring the vegetative cycle with a drone, and testing the technical functionality of plant protection machinery.

Website:	<a href="http://www.tehnopolis.me">www.tehnopolis.me</a>
Contact person:	Đorđije Brkuljan, Coordinator of the Center for Program Activities
Address:	Radoja Dakića bb, 81400 Nikšić

### Laboratory for Industrial Design – Tech Lab Tehnopolis

Founded in August 2020, the Laboratory for Industrial Design – TechLab Tehnopolis aims to strengthen the metalworking and wood industries in Montenegro by introducing modern technologies into the development and production process, thereby increasing the quality and competitiveness of final products. Conceived as a self-sustaining system, Tech Lab encompasses several independent segments, including 3D modeling services using SolidEdge software for modeling of machine parts and assemblies, as well as motion simulations.

The infrastructure offers the following services:

**3D scanning:** Creation of models with textures and physical characteristics that deviate by up to 0.1 mm from the real model, ideal for objects up to 50 cm.

**FDM 3D printing:** Production of objects from various thermoplastics with maximum dimensions of 440x440x590 mm.

**SLA 3D printing:** High precision with over 15 liquid resins, maximum dimensions of 145x145x193 mm.

**BMD 3D metal printing:** Production of complex objects from various alloys.

**CNC milling and turning:** Processing of industrial plastics, stainless steel, aluminum, and softer metals.

**CNC router:** Processing of sheet materials up to dimensions of 1300x2400x120 mm.

Tech Lab also organizes certified training programs for the use of available technologies.

Website:	<a href="http://www.tehnopolis.me">www.tehnopolis.me</a>
Contact person:	Tihomir Ćuzović, Manager of the Industrial Design Laboratory
Address:	Vuka Karadžića bb, 81400 Nikšić

## Data center

The Data Center was established and equipped with the aim of supporting the development of new or the enhancement of existing innovative ideas by development teams, startups, and other enterprises in the IT industry. The resources of the Data Center are available through the support of the Business Incubator IPC Tehnopolis, as well as through various support programs for those developing new ideas with the potential to create sustainable businesses, thereby significantly contributing to the digitalization of Montenegro. Additionally, the resources of the data center can also be made available to the academic community through special cooperation agreements for research projects. In the near future, an important activity of the Data Center will be to provide digitalization services for micro, small, and medium-sized enterprises in Montenegro.

Website:	www.tehnopolis.me
Contact person:	Đorđije Brkuljan, Coordinator of the Center for Research and Development Program Activities
Address:	Radoja Dakića bb, 81400 Nikšić

### 3.3 Science and Technology Park of Montenegro (NTP CG)<sup>40</sup>

The establishment of the Science and Technology Park of Montenegro LLC was formalized through an agreement between the Government and the University of Montenegro in 2019. This paved the way for the creation of a national innovation infrastructure that unifies the innovative, scientific, and entrepreneurial capacities within Montenegro. The Science and Technology Park of Montenegro serves as a key hub for innovation and research, with a clear objective of fostering a dynamic ecosystem that integrates science, technology, and innovative entrepreneurship.

NTP CG focuses on providing support to startup and spinoff companies through incubation programs, enabling them access to necessary capital and markets, thereby promoting their growth and development. It also serves as a central point for innovation, supporting research projects that contribute to the development of new technologies and products.

In June 2024, NTP CG moved into its new premises, marking the beginning of a new phase in the development of innovation and research infrastructure in the country. The first tenants are expected to move in by the end of the year. NTP CG has issued three types of public calls for its first tenants, which will include startups and spinoffs with significant innovative potential, legal entities engaged in scientific research and innovation activities—including licensed research in-

<sup>40</sup> Article 25 of the Law on Innovation Activity («Official Gazette of Montenegro», No. 82/20):

A Science and Technology Park is an entity within the innovation infrastructure that offers specialized business spaces and equipment, along with professional and advisory services to innovative legal and natural persons.

The Science and Technology Park offers services and conducts activities aimed at networking the academic community and the economy, stimulating and managing the transfer of knowledge and high technologies, enhancing the internationalization of businesses and commercialization of scientific research, creating new and developing existing innovative enterprises, creating and applying innovations based on top scientific results, and promoting a culture of innovation and competitiveness of knowledge-based companies and institutions, with the goal of developing the economy and the state as a whole.

An innovation infrastructure entity referred to in Article 24, paragraph 2, items 2 to 6 of this law, may obtain membership status in the Science and Technology Park.

Users of the services provided by the entity described in paragraph 1 of this Article may also attain membership status in the Science and Technology Park.

The rights and obligations between the Science and Technology Park and its members are governed by a contractual agreement.

stitutions that develop innovative products, services, or technologies—as well as complementary organizations that support projects and activities aligned with NTP's strategic goals.

In September 2024, a Memorandum of Understanding was signed between the Government of Montenegro, the University of Montenegro, and NTP CG to facilitate technology transfer in Montenegro, which led to the establishment of a Technology Transfer Office at NTP CG. This office will play an important role in connecting researchers, innovators, investors, and innovative companies, facilitating the transfer of knowledge and technology from universities and research institutions to the market. The office will provide professional support in areas such as intellectual property assessment and protection, innovation promotion, and startup development assistance.

NTP CG offers basic services, including multifunctional office spaces and flexible coworking spaces, as well as a conference hall and meeting rooms. In addition, it provides extensive professional and business support tailored to the growth and development of startups, spinoffs, and other entities engaged in innovation activities. This support includes training and educational programs for skill and knowledge enhancement, as well as mentoring services for the development of business strategies and innovations. Furthermore, within its marketing services, NTP CG supports the promotion of products and services and provides assistance in networking with domestic and international business partners.

Plans are underway to establish four research laboratories specializing in various fields. These laboratories will provide researchers and innovators with access to modern technologies and resources for the development of new products and services, serving as a platform for collaboration between academic institutions and the economy.

### **3.4 Regional Project for the Establishment of the South East European International Institute for Sustainable Technologies (SEEIIST)**

The SEEIIST project is a regional development initiative in Southeast Europe, initiated by Montenegro in March 2017. The initiative was formalized as a regional project with the signing of the Declaration of Intent on October 25, 2017, at the Ministerial Conference held at CERN, Geneva.<sup>41</sup>

This is a major research and medical infrastructure with a pan-European dimension. The project targets one of the biggest social and healthcare challenges—the fight against cancer. Specifically, it involves infrastructure for cancer therapy and biomedical research using protons and heavy ions, which today represents a modern and effective method for treating a wide range of tumors. The institute will also be conceived as the first green infrastructure in the field of cancer treatment.

The project is currently in its second phase of development, known as the design phase, which involves preparing the technical design of a compact medical accelerator. This phase began in 2019 and will continue until the end of 2024. The project is poised to transition into the third preparatory phase, which will define the details for construction, establish the legal entity for SEEIIST, determine the location and financing models, and set up logistics and management plans.

During the design phase, funding was secured from EU funds (€5 million from the EU H2020 HITRIplus project<sup>42</sup>), along with an in-kind contribution of €700,000 from CERN, CNAO, and the TERA Foundation. Moreover, the inclusion of the SEEIIST project in the European Roadmap for

<sup>41</sup> The signatory parties of the Declaration were: Albania, Bosnia and Herzegovina, Bulgaria, Montenegro, Kosovo\*, North Macedonia, Serbia, and Slovenia. Croatia agreed 'ad referendum,' while Greece took on the status of an observer.

<sup>42</sup> <https://www.hitriplus.eu/#:~:text=5%20Project%20objectives.%20Discover.%20Consortium.%20The%20consortium%20consists>



Research Infrastructures—“ESFRI Roadmap 2026”—is particularly significant for the current phase. The inclusion of SEEIIST in the ESFRI Roadmap would grant it a pan-European dimension and potentially increase its access to funding through EU sources.

The total investment for the construction of SEEIIST is estimated at around €250 million, with completion expected by 2031.

The implementation of the SEEIIST project will bring significant advancements in the field of high technology and research infrastructure. The construction and equipping of the hadron cancer therapy center is expected to enhance the local technological base, including advanced accelerators, medical devices, and data centers, thereby raising the technological level of the country. The SEEIIST project requires the construction and modernization of significant infrastructural facilities, such as research laboratories, medical units, and technical support facilities. These works will include advanced construction techniques that will improve existing building standards and practices. The center will provide excellent conditions for research and development, thereby enhancing the capacity of researchers and scientists in Montenegro and the region. These changes are anticipated to have long-term positive effects on the country's research capabilities and technological potential.

The SEEIIST center will serve a dual purpose: it will be the most modern clinic for cancer treatment, capable of treating up to 1,000 patients annually, and it will function as a unique cancer research center in Europe, expected to attract around 1,000 researchers, along with numerous industries and organizations, such as the European Space Agency (ESA), which will be potential users of the SEEIIST accelerator.

The SEEIIST project has been included in Montenegro's Reform Agenda for 2024–2027. As part of the Economic Investment Plan for the Western Balkans, SEEIIST has been recognized as the only medical and research infrastructure and has also been acknowledged by the Western Balkans Agenda for Innovation, Research, Education, Culture, Youth, and Sports, where it is presented as a green research infrastructure project for cancer therapy, aimed at enhancing scientific and technological cooperation in the region.

### **3.5 Access and Membership in Pan-European Research Infrastructures and International Bodies**

Access to international bodies and pan-European research infrastructure networks is of crucial importance, as it enables researchers and institutions to actively participate in the European Research Area (ERA). This access is key for the academic community and research institutions, allowing them to utilize resources and technologies available through international projects, thereby improving the quality of their research. Such access is also important from the perspective of economic development, as it fosters cooperation between science and industry, which can lead to the development of innovative products and services.

Membership in international bodies and pan-European research infrastructures brings numerous benefits, including the ability to participate in shaping joint policies, easier access to resources, greater visibility of research activities, and, in some cases, support for building national research infrastructure.

When it comes to access to research infrastructures, the recent recommendation from the European Commission on research infrastructures as strategic investments highlights the importance of strengthening transnational access and adapting to new user communities. Transnational access allows free access to top-tier research infrastructures across Europe. Access

to research infrastructures can be physical, remote, or virtual, thereby facilitating collaboration among various users.

Below is an overview of the international bodies and pan-European infrastructures in which Montenegro holds membership or participates.

## CERN

The European Organization for Nuclear Research (**CERN**) is the world's largest laboratory for particle physics. It brings together 23 member countries and has cooperation agreements with 38 additional nations. Its main instruments are accelerators and particle detectors, along with other infrastructure necessary for high-energy physics research. In the accelerators, particles are accelerated to nearly the speed of light and directed to collide. By observing these collisions with detectors, data is obtained about the interactions of the particles.

CERN's flagship project is the Large Hadron Collider (LHC), which uses proton and heavy-ion collisions at high energies to provide data for studying the processes that occur during these collisions, helping to answer some of the most fundamental questions in modern science. Since July 2017, Montenegro has been a full member of the CMS experiment, and since 2019, the University of Montenegro has been a full member of the RD50 scientific collaboration.

## CESSDA

The Consortium of European Social Science Data Archives (**CESSDA ERIC**) offers comprehensive, integrated, and sustainable data services for the social sciences, bringing together social science data archives from across Europe. Its mission is to promote the results of social science research and support national and international research collaboration.

There are plans to establish the Montenegrin Social Science Data Archive (MSSDA), which will serve as a national infrastructure for the long-term preservation and distribution of social science research data generated by Montenegrin researchers. Montenegro holds partner organization status within CESSDA ERIC.

## EMBC, EMBO i EMBL

**EMBO** (European Molecular Biology Organization) was founded in 1964 and brings together more than 1,900 leading scientists from Europe and around the world. Its aim is to promote the natural sciences and facilitate international collaboration and exchange. It co-funds courses, workshops, and conferences and publishes five scientific journals.

**EMBC** (European Molecular Biology Conference) is an intergovernmental organization that provides the financial framework for many of the activities carried out by EMBO. It was established in 1969 and consists of 30 member countries that fund various programs such as fellowships, workshops, and research projects.

**EMBL** (European Molecular Biology Laboratory) is Europe's leading laboratory for the natural sciences, currently comprising 27 countries. It operates six laboratories across Europe, employs 1,800 people, and publishes hundreds of scientific articles each year.

Montenegro is a member state of EMBC, EMBO, and EMBL. EMBL has signed a Memorandum of Understanding with the University of Montenegro to encourage ongoing collaboration and strengthen the framework for cooperation between EMBL and Montenegro.

## ESS ERIC

**ESS ERIC** (European Research Infrastructure Consortium for European Social Survey) organizes and conducts research measuring the social attitudes, values, and behaviors of citizens across various European countries. These surveys are conducted every two years, and the data is used to analyze social changes, compare countries, and develop policies. ESS ERIC sets high standards in comparative research, provides training, and offers free access to its data and documentation through its online platform.

ESS ERIC explains the interaction between changing institutions, as well as the attitudes, beliefs, and behavioral patterns of different European populations. It was granted ERIC status in 2013, and Montenegro is a full member of ESS ERIC.

## ICGEB

**ICGEB** (International Centre for Genetic Engineering and Biotechnology) is a unique intergovernmental organization, initially established as a special project of the United Nations Industrial Development Organization (UNIDO). Autonomous since 1994, it operates over 45 advanced laboratories in Trieste, Italy, New Delhi, India, and Cape Town, South Africa, forming an interactive network of nearly 70 member states, with its activities aligned with the United Nations. ICGEB plays a key role in biotechnology, promoting excellence in research, training, and technology transfer to industry, contributing specifically to sustainable global development.



## 4. RESEARCH INFRASTRUCTURES DEVELOPMENT VISION

### Vision:

**By strengthening national research infrastructures and participating in international scientific bodies and pan-European infrastructures, Montenegro will secure a recognized position within the European Research Area (ERA), while contributing to the development of innovation, competitiveness, and overall societal progress at the national level.**

### Mission:

**Through the establishment of a comprehensive framework for the management, funding, monitoring, enhancement, and development of research infrastructures, along with promoting international collaboration and actively involving Montenegrin scientists in pan-European research infrastructures, a foundation will be created for stronger integration of Montenegro into the European Research Area (ERA). This approach will enable more efficient use of resources, enhance capacities across various scientific disciplines, and improve collaboration between science and industry, ultimately contributing significantly to the excellence and visibility of Montenegrin science and boost innovation at the national level.**

In the coming period, Montenegro will focus on strengthening its infrastructure capacities by consolidating national research potential, modernizing existing infrastructures, and strategically investing in new research projects. It may be necessary to expand the mandate of the Scientific Research Council or establish a new body responsible for the development and management of research infrastructures. This would include developing procedures and criteria for selecting and monitoring national infrastructure projects in line with the strategic directions of the ERA. Such an approach would create a favorable framework for expanding cooperation and networking with leading European and international researchers, institutes, and organizations. This strategy will significantly enhance collaboration within the national research community and foster stronger connections with the business and public sectors.

To achieve the vision and mission, the following measures, which also serve as recommendations, should be taken:

- **Expanding the mandate of the Scientific Research Council or establishing a new national body for the development and management of research infrastructure**

Implementing this recommendation is crucial to ensure the long-term development of existing and new research infrastructures at the national level. It will also help establish criteria for selecting international research bodies of strategic importance to Montenegro. The primary task would be overseeing and coordinating all aspects related to the development and monitoring of national research infrastructures, as well as memberships in international research bodies and pan-European research infrastructures.

The existence of a dedicated structure with clear responsibilities for the development and management of research infrastructures is essential. It enables a coordinated strategic approach to resource management, capacity development, and the long-term sustainability of infrastructures. This will ensure optimal allocation of funds, prevent investment duplication, and promote transparency. Moreover, it will facilitate Montenegro's integration into international research bodies and pan-European research infrastructures, providing access to cutting-edge resources, equipment, and research groups worldwide.

<b>Description of Responsibilities for the Development and Management of Research Infrastructures</b>
<p><b>Providing guidelines for the development and investment in national research infrastructures:</b> Supporting the growth of existing national research infrastructures and investing in new ones, in accordance with national and European strategic frameworks</p>
<p><b>Recommendations for improving existing and expanding international cooperation:</b> Offering guidance on Montenegro's participation in international research infrastructures and bodies, and approving the allocation of national funds for membership fees</p>
<p><b>Project selection:</b> Proposing criteria for the selection of projects and monitoring the selection process related to the development of national infrastructures</p>
<p><b>Monitoring the operation of research infrastructures:</b> Proposing criteria and indicators for monitoring the performance of research infrastructures and overseeing the process according to developed guidelines and indicators</p>
<b>Developing, monitoring, and updating the Research Infrastructures Roadmap</b>
<p><b>Collaboration with advisory bodies in the field of innovation:</b> Cooperating with the Innovation and Smart Specialization Council to support the development and investment in research and innovation infrastructures</p>
<p><b>Coordination with EU bodies:</b> Collaborating with national ESFRI delegates, members of the EU Framework Program Committees for research and innovation, and other relevant EU body members, to foster the development and investment in national research infrastructures and collaborate in international infrastructures and projects.</p>

#### **- Establishing a National Register of Research Infrastructures**

The primary goal of the national register of research infrastructures is to catalog, describe, and promote the research infrastructures available in Montenegro, including individual equipment, laboratories, research centers, and larger infrastructure projects. By establishing this register, the organization and coordination of existing research capacities will become more efficient, preventing unnecessary or duplicate investments. Public access to this information will encourage resource-sharing between research institutions and teams. Additionally, the register will elevate the visibility of Montenegrin research infrastructures at regional and international levels, promoting their integration into broader European and global research networks. Furthermore, access to information on research infrastructures will assist the business sector in finding partners within the academic community, thereby supporting knowledge and technology transfer and strengthening innovation potential.

## - Support for the Development of Research Infrastructures through EU and National Programs

At the European Union level, the Horizon Europe Action Plan for Research Infrastructures (2023-2025), with a total budget exceeding €660 million, has been adopted<sup>43</sup>. It is emphasized that research and technological infrastructures should contribute to broader European political goals, optimizing the societal impact of science and technology while enhancing Europe's competitiveness. It supports both fundamental and disruptive research to maintain Europe's scientific excellence and drive future technological advancements.

In addition to supporting existing European infrastructure projects, the emphasis is placed on building new infrastructures and developing human resources. This includes training users of research infrastructures and strengthening the scientific, technical, and managerial skills of staff. Activities aimed at expanding membership and access to existing ERIC infrastructure projects are also supported.

At the national level, Montenegrin scientists and organizations will continue to receive support for participation in the Horizon Europe program, with a special focus on new actors and small and medium-sized enterprises through the network of National Contact Points (NCPs). Participation in this program will also be co-financed through the annual Call for Co-Financing of Research Activities<sup>44</sup>, the Call for Co-Financing Participation in the EU Framework Program for Research and Innovation "Horizon Europe" – Pillar III INNOVATIVE EUROPE<sup>45</sup>, as well as public calls encouraging the networking of potential project partners.

Upon Montenegro's accession to the European Union, access to the European Structural and Investment Funds (ESIF) will open, providing significant resources for national research infrastructure. For example, under the Horizon 2020 program (2014-2020), 2.2 billion euros were allocated for research infrastructures, while 6.6 billion euros were provided from the European Regional Development Fund for the same purpose.<sup>46</sup>

One of the main challenges for future members is ensuring that research infrastructure projects are ready for ESIF funding. Therefore, it is crucial to establish new support models for preparing research infrastructure projects that will later be funded by ESIF. New funding opportunities for project preparation will be sought through IPA III (2021-2027) and the new Reform and Growth Facility for the Western Balkans (2024-2027).

## - Improving the Principles of Operation of National Research Infrastructures

As Montenegro continues its integration into the European Research Area (ERA), strengthens its connections with research infrastructures in the Western Balkans, and promotes the use of research infrastructures by research groups from other institutions, as well as the business and civil sectors, it is essential to improve the operating principles of national research infrastructures.

## - Enabling Open Access

The European Charter for Access to Research Infrastructures establishes the guidelines and

<sup>43</sup> [https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2023-2024/wp-1-general-introduction\\_horizon-2023-2024\\_en.pdf#:~:text=This%20work%20programme%20will%20foster%20excellence%20in%20research](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2023-2024/wp-1-general-introduction_horizon-2023-2024_en.pdf#:~:text=This%20work%20programme%20will%20foster%20excellence%20in%20research)

<sup>44</sup> <https://www.gov.me/clanak/raspisan-konkurs-za-sufinansiranje-nid-u-2024-godini>

<sup>45</sup> <https://www.gov.me/clanak/raspisan-konkurs-za-sufinansiranje-ucescu-u-eu-okvirnom-programu-horizont-evropa>

<sup>46</sup> Research Infrastructures Make Science Happen: <https://op.europa.eu/en/publication-detail/-/publication/6702e82f-e4c3-11e9-9c4e-01aa75ed71a1/language-en>

principles for managing and providing access to research infrastructures in Europe.<sup>47</sup>

The Charter outlines three primary models of open access:

- Excellence-driven – Based solely on scientific excellence, originality, quality, and the technical and ethical feasibility of the application; access is granted following evaluation by internal and external experts.
- Market-driven – Access is defined by a specific agreement between the user and the research infrastructure, typically fee-based and possibly confidential.
- Wide Access – Provides the broadest possible access to scientific data and digital services regardless of the user's location. This type of access ensures wide availability and visibility of research infrastructure data and services.

According to the ESFRI report,<sup>48</sup> the most commonly used access mode is “Excellence-driven” utilized by 70% of respondents. Research infrastructures may apply a single access model or a combination of these approaches.

It is important to highlight that research infrastructures should clearly and transparently provide information on their websites about the infrastructure itself, services, open access policies, data management policies, as well as terms and conditions. Where applicable, this information should include available equipment, costs, fees, contractual obligations, rules and procedures related to health, safety, environmental protection, and other important matters. Research infrastructures may impose access restrictions based on quotas or predefined user groups, with a clear obligation to communicate these conditions to users.

Establishing open access to research infrastructure is a complex process that requires setting clear access rules (also known as access policies), defining user contributions, developing a pricing structure, managing data, establishing ethical guidelines, and preparing user manuals. Another key challenge during the operational phase involves addressing the staffing and operational costs associated with conducting experiments.<sup>49</sup>

To promote the adoption of open access, it is essential to plan support mechanisms. A crucial component of this effort is training and providing ongoing support to the staff responsible for managing research infrastructure projects. This includes education on open access principles, best practices for data sharing, and addressing the legal and ethical issues surrounding open access. Looking ahead, financial incentives are expected to be introduced for research institutions that demonstrate both the readiness and capacity to implement open access. These funds will support the modernization of equipment, staff training, and the development of platforms for data sharing.

## - Application of FAIR Principles in Data Management

As we move further into the digital age, the volume of research data is expanding, and the increasing availability of online content makes it essential to consider long-term data preservation from the moment the data is generated.

FAIR<sup>50</sup> is an acronym that stands for four foundational principles of sharing research data:

<sup>47</sup> <https://op.europa.eu/en/publication-detail/-/publication/78e87306-48bc-11e6-9c64-01aa75ed71a1/>

<sup>48</sup> ESFRI Report Access to Research Infrastructures and Charter on Access to RIs December 2023: <https://str-esfri.eu/latest-esfri-news/esfri-publishes-report-access-ris#:~:text=The%20outcomes%20of%20the%20survey%20are%20present-ed%20in>

<sup>49</sup> ESFRI Report Access to Research Infrastructures and Charter on Access to RIs December 2023

<sup>50</sup> «The FAIR Guiding Principles for scientific data management and stewardship» published in „Scientific Data“



Findability, Accessibility, Interoperability, and Reusability. The goal of these principles is to simplify the process for researchers to discover and utilize data, facilitate seamless access and sharing, and ensure the data reusability.

### 1. Findability

Research data must be described with rich metadata to make it easily discoverable by both humans and machines. Metadata should also be registered or indexed in a searchable resource and assigned a persistent identifier (e.g. DOI).

### 2. Accessibility

Data should be available to users under clearly defined conditions, whether openly available or subject to restrictions due to commercial or security concerns. It is crucial that data is accessible on standardized platforms, with transparent communication of access conditions and any limitations. Even when data is no longer actively used, proper storage should be maintained to ensure its continued availability.

### 3. Interoperability

To facilitate interoperability, data should be stored in standardized formats that allow for long-term preservation, combination, and reuse. Recognizable, standardized, and accepted language and controlled vocabularies should be employed. Metadata should also include qualified references to other datasets.

### 4. Reusability

To achieve the main goal of the FAIR principles, data and metadata should be described in detail to enable reproduction and/or integration in different contexts. Reusability also requires that data be assigned a license that permits and defines its reuse.

The FAIR principles not only help realize the full potential of research data but also increase the visibility and citation of research. This enhances the reproducibility and credibility of results. At the research infrastructure level, these principles promote new collaborations between researchers, the private sector, policymakers, and the broader community, aligning with international standards and approaches.

## - **Data Management Plan**

The Data Management Plan for research infrastructures provides guidance to staff and users on the proper management of both administrative and research data. This policy sets out rules for data storage over a reasonable period, ensuring availability for verification and reuse, and adheres to the FAIR principles (Findable, Accessible, Interoperable, Reusable), while also addressing responsibility and security. The Data Management Plan must be made publicly available.

Additionally, future plans include introducing tools to provide support through training and the development of guidelines for implementing FAIR principles and creating the Data Management Plans, including methods for storing, accessing, and sharing data.

### - **Enhancing the Visibility of Research Infrastructures**

To enhance visibility, research infrastructures should ensure the availability of essential information, including a detailed description of the infrastructure, contact information, a catalog of services and resources, clearly defined open access policies, and a Data Management Plan. This information should be regularly updated. Each infrastructure will be required to have a website in both Montenegrin and English.

### - **Updating the National Research Infrastructure Register**

Each research infrastructure that is (co-)financed from the state budget should be required to update its list of available equipment and other research infrastructure annually.

### - **Development of Operational Plans for Research Infrastructures**

An operational plan for research infrastructures should outline specific goals and tasks, with a detailed allocation of human, financial, and material resources. It should identify potential risks and establish strategies for managing them. Mechanisms for monitoring and evaluating progress must be included, along with plans for collaboration and networking with other institutions. Training and educational programs for staff and users should also be considered. The financial section of the plan should include a cost analysis and strategies for securing funding from various sources. The operational plan will serve as the foundation for tracking the performance of research infrastructures.

### - **Framework for the Selection of National Infrastructure Projects**

The selection process for new research infrastructures will be coordinated and overseen by the Council for Scientific Research Activities or a newly established governing body. This process will take place in several stages, starting with an administrative review and an initial round of selection, where project concepts will be evaluated against established criteria. International experts will conduct the first-round evaluation through a peer-review process, with the relevant ministry proposing a list of qualified experts for this phase. The top-ranked projects from this round will then proceed to the second evaluation phase. During this stage, and with financial support from the Ministry, feasibility studies will be conducted, including cost-benefit analyses. An international panel of experts, proposed by the Ministry and selected from specialists in the relevant field, will assess these studies. The panel will then compile a final ranking of projects recommended for (co-)financing. High-ranked project implementing entities will be asked to submit more detailed project proposals, including revised feasibility studies that incorporate all feedback received from the international panel. The final decision on the allocation of funds will be made by the Ministry. This two-step evaluation process ensures a thorough, high-quality, and fair assessment of all proposals, allowing only the most qualified projects to receive (co-)financing support.

Future criteria and sub-criteria for evaluating research infrastructure projects should be developed in alignment with ESFRI and InRoad guidelines<sup>51</sup>, considering the following dimensions:

51 Towards better Synchronization of Priority Settings and Evaluation Mechanisms for Research Infrastructures Beyond National Relevance, <https://cordis.europa.eu/project/id/730928>

1. **Scientific Dimension:** The quality of scientific and technological excellence of the research, including potential for national and international collaboration, as well as the degree of internationalization;
2. **Management and Sustainability Dimension:** This relates to management, leadership, and human resources, strategic planning, financial planning and funding framework, user attraction strategy, open access policy, as well as risk monitoring and management;
3. **Strategic Dimension:** The relevance of the infrastructure concerning national and EU development goals and priorities, and its uniqueness at the national or European level; and
4. **Socioeconomic Dimension:** This relates to the contribution of the research infrastructure to sustainable development goals, assessment of interest from the business community, and evaluation of the impact on education and skill enhancement.

#### - **Framework for Membership in International Research Infrastructures and Bodies**

Participation in international research infrastructures and bodies is important for several reasons:

- Access to top research resources – It allows researchers to use globally recognized research centers and resources, thereby enhancing their scientific and technological quality
- Strengthening international visibility – Membership in international bodies facilitates the exchange of knowledge, technologies, and ideas with leading researchers and institutions across Europe. Through this international cooperation, opportunities open for participation in joint projects and co-authoring scientific publications.
- Support for the development of national infrastructure – It enables countries not only to access existing infrastructures but also to receive support in developing their own research capacities. National infrastructures can serve as part of a broader network of European capacities, ensuring their sustainability and increasing their usability on an international level (ERIC consortium).
- Improving educational and research capacities – By participating in European infrastructures, researchers can engage in training, exchanges, and joint projects, thereby enhancing their knowledge and skills.
- Boosting innovation potential – The transfer of knowledge and technology from international research infrastructures has a significant impact on the national economy by fostering innovation, improving competitiveness, and creating new jobs.

The Scientific Research Council is responsible for recommending to the relevant ministry which infrastructures and membership fees should be covered by national funds. These fees pertain to membership in international scientific research bodies that are strategically important for Montenegro. When considering requests for membership in a specific international body of strategic interest, a cost-benefit analysis must be conducted, which includes:

- **Assessment of the impact on the national scientific research system:** Membership should benefit leading research institutions and individuals whose work significantly contributes to the development of the national research ecosystem.
- **Evaluation of the number of potential users and the clear benefits that membership brings:** Membership should benefit a wide range of universities, research institutes, and small and medium-sized enterprises (SMEs), with clear joint actions leading to tangible benefits and cost savings.

- **Assessment of relevance of the infrastructure to identified national deficiencies:** The analysis should consider how the membership can address identified gaps at the national level and whether there is potential for developing national infrastructure through this membership.
- **Assessment of alignment with national development goals and priorities, as well as the specific national context:** It is necessary to assess how the membership aligns with key national development goals and priorities, the uniqueness of the resources or services offered by the infrastructure, and the value they add at the national level.

Strategically significant memberships usually entail considerable long-term financial commitments that require careful planning.

#### - **Framework for monitoring national research infrastructures**

A framework for monitoring national research infrastructures is essential to ensure their long-term efficiency and sustainability. This framework allows for continuous assessment of key aspects, such as resource use, scientific outcomes, technological innovation, and financial stability. It is important to monitor the alignment of infrastructures with national and European strategic goals, ensuring their contribution to the advancement of science and the economy. Special emphasis should be placed on transparency through open access policies for data and resources. By regularly evaluating infrastructure usage, condition, and outcomes, this framework will enable informed strategic decision-making regarding future investments, modernization, and the development of research infrastructures. It is recommended that the responsible ministry establish procedures for regular monitoring through reports submitted by research infrastructures.

Proposed reporting criteria<sup>52</sup>:

- **Alignment with the operational plan:** Assess whether activities are being carried out according to the operational plan
- **Service users:** Assess who the users are (researchers, PhD students, the business sector), their number, availability of services, frequency and duration of use, and the context of their usage (research, development, education, knowledge transfer)
- **Visibility and quality of services:** Evaluate the visibility of available services and the quality of the services provided, as rated by users;
- **Scientific productivity:** Assess scientific productivity based on the number of new methodologies developed, the number of scientific papers published in the WoS or Scopus databases as a result of using the research infrastructure, and the citation impact of the papers produced through this infrastructure;
- **Collaboration with the business sector:** Evaluate the effectiveness of collaboration based on the number of companies using the research infrastructure and the number of medium- and long-term research and development agreements with the business sector;
- **International cooperation:** Assess the degree of internationalization based on the number of international cooperation agreements and partnerships the research infrastructure participates in, as well as the number of national, European, or international projects focused on infrastructure development.

In addition to reports, research infrastructures should submit revised Management Plans.





**Ministry of  
Education, Science  
and Innovation**