ACADEMY OF FINLAND

FIRI 2022: Call for local research infrastructures – applications funded in December 2022 decision meeting

Listed in alphabetical order by research infrastructure name.

Autonomous measurement platforms for environmental data

Finnish Environment Institute

Today, there is an increasing need to perform environmental measurements in the field, either using autonomous measurement systems or portable devices. Their advantage is e.g., the possibility of real-time monitoring of the environment and rapid response to problem situations. However, the use of devices for official monitoring is not yet widely accepted, as there are often unresolved problems with the quality of the data they produce. To address these shortcomings and promote the uptake of product innovations, a metrology research infrastructure is proposed to promote the acceptance and quality of new autonomous measurement systems for various environmental measurements. The project will develop and centralize the Finnish Environment Institute SYKE's mechatronics research infrastructure in Joensuu to better support the current and future needs of environmental researchers, authorities, companies and other stakeholders in the application of autonomous measurement platforms.

Biosphere laboratory

University of Eastern Finland, Geological Survey of Finland

The University of Eastern Finland and the Geological Survey of Finland carry out high-level research that supports the green transition towards a carbon-neutral and biodiversity-supporting Finland. The new biosphere laboratory brings together research on the carbon cycle and plant stress of northern ecosystems. Its aim is to promote the bioeconomy, which is especially important in Eastern Finland, and to support the adaptation of agriculture and forestry to climate change. The Biosphere Laboratory consists of three modules: 1. An experimental laboratory that is located on the university campus and enables experimental research in controlled conditions 2. A mobile field measurement laboratory that enables a broad spatial dimension of the research and rapid reaction to disturbances such as forest fires and

insect damage 3. A data management module that supports efficient data transfer, storage, and research visualization.

Bio and Circular Economy infrastructure

University of Tampere

Bio and Circular Economy (BIC) subunit at the Faculty of Engineering and Natural Sciences (ENS) at Tampere University (TAU) consists of research groups of environmental engineering, Energy and Biorefining, and Synthetic Biology. Our vision is to build a cleaner and safer future for the benefit of people and the environment, and to conserve the limited resources of raw materials. In the infrastructure project, we aim to develop and establish a new BIC-FIRI Hub, which enables holistic approach for the valorisation of different waste streams. BIC-FIRI Hub infrastructure consists of four platforms: microbiome analysis, biomass biorefinery, analytical equipment, and digitalisation. With the upgraded infrastructure, we can provide new services and establish strong connection with local stakeholders by filling analytical gaps in value chains, integrating leading-edge research with applications, and educate new experts for local needs.

Cryosphere Research Infrastructure Platform

University of Oulu, Geological Survey of Finland, Finnish Meteorological Institute, Finnish Environment Institute

Snow and ice condition are changing rapidly due to the changing climate, which poses challenges to the Northern Finland natural and built environment. Past predictions and governance will need to be adjusted, which requires high-quality monitoring data. The current infrastructure for regional snow and ice monitoring needs to be updated and harmonized to meet these needs. CRYO-RI project addresses this challenge by launching regional snow and ice monitoring networks, developing both low cost and state-of-the-art measurement stations, developing new measurements based on emerging technologies, increasing the regional capability to analyze and monitor geomaterial properties subject to freeze and thaw and providing a data sharing platform to allow fast and easy access to the CRYO-RI data for all users. The CRYO-RI platform is maintained and operated in a regional collaboration between the University of Oulu and three regionally important research institutes (GSF, SYKE, FMI).

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Digital electrification infrastructure

University of Tampere

The digital electrification infrastructure consists of three essential elements: systems, digitalization solutions and data. Systems consists of electrification areas and the control and management systems of those. The most essential areas are the mobile working machines and the energy communities (microgrids) consisting of several power electronic converters. Each system has internal structures, but they create a system of systems via digitalization systems, electricity grid and markets. Digitalization solution part of the infrastructure includes sensors and measurement devices, communication and information exchange systems that are needed to control, monitor and optimize the systems' operations, realize services and capabilities via digitalization and securing the performance of electricity and electrified systems as a whole. Data element is creating a platform for the infrastructure to store and share data, ensuring continuity of data access and methods to express metadata.

Digital high-speed electromechanical energy conversion research infrastructure for data-driven informatics environment

Lappeenranta-Lahti University of Technology

High-speed (HS) electromechanical conversion (EC) technology has proven to be a feasible solution to reducing energy use and emissions in the industrial sectors. High rotational speeds are beneficial for improving the energy efficiency and reducing the cost of EC systems. Meanwhile, realizing these benefits presently is challenging because existing modelling and design practices are not fully capable to account for the physical effects arising at high operational speeds. DIGI-REINFORCE offers the physical and virtual test platforms where next-level data-driven research is conducted and next-gen HS-EC technologies are validated. The infrastructure is to facilitate the development of HS electrical machines operating in the megawatts power range by providing the facilities, access to data, technological know-how, and services required for knowledge base development and design validation. It will also promote growth and internationalization of the regional RDI clean-tech ecosystem.

Finnish Thermal Ionisation Mass Spectrometer (TIMS) and metal-free clean room facility

University of Helsinki, Finnish Food Authority, Natural Resources Institute Finland, Geological Survey of Finland

Stable and radiogenic heavy isotopes (e.g., Sr, Nd, Pb, U) allow fingerprinting human, geological and environmental materials (e.g., archaeological finds, food, fuels, plastics, precious metals, waste, water) and their timeline ranging from several millions to tens of thousands of years and to Anthropocene. The elemental cycles within solid Earth, hydrosphere, biosphere and

atmosphere lay foundation to circular economy and carry strong societal importance, e.g., from groundwater monitoring to recycling at waste/mining sites. FINTIMS improves the national and Nordic scientific landscape by establishing a high-precision heavy isotope mass spectrometric and metal-free clean room preparation facility for low abundance isotopes. In improving the sensitivity and precision of heavy isotope analysis, new low-concentration tracer materials are becoming available and new interdisciplinary research and collaborative projects are advanced in the framework of FINTIMS throughout the society.

Flow cytometry unit

University of Helsinki

Flow cytometry allows the characterisation of particles such as cells from animals and plants, all types of microorganisms or other materials such as plastics. It can identify thousands of individual particles in a few seconds and, based on its measurements, sort different populations to be used in other applications. Given its flexibility, this technique is used by researchers in all fields of biological and biomedical sciences. The flow cytometry unit at the University of Helsinki offers access to equipment and know-how in this technique to users from our university, research institutes, hospitals and companies in the Helsinki region. In this project, we aim to provide a better and greener service to our users by replacing our old instruments by modern machines. These machines are more energy efficient and equipped with novel features, allowing our users to do better research on important issues, from impacts of climate change to understanding and treating diseases.

Genome Center of Eastern Finland

University of Eastern Finland

The Genome Center of Eastern Finland was established in 2008 to lead the genetic research in human health and diseases at the University of Eastern Finland (UEF). This has significantly contributed to UEF's current research excellence in human genetics and biomedical genomics. This plan brings the Genome Center services up to date by strengthening our sequencing capacity, automating sample workflow, broadening and streamlining our services, and developing our marketing strategy. These actions support green transition and promote digital transformation in personalized medicine. The renewal of our services will promote regional development through increased innovation potential and collaborations with e.g., Kuopio University Hospital (KUH), Biobank of the Eastern Finland, and local businesses. We believe that these actions will reinforce the UEF Genome Center to unleash our full potential in research excellence, clinical innovations, competence-based growth, and societal impact.

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Northern Utility Vehicle Laboratory

Oulu University of Applied Sciences, University of Oulu

GO!-RI project will release the NUVE-LAB's potential for the research of environmentally sustainable, autonomous commercial vehicles. Oulu University of Applied Sciences implements equipment needed to research and develop environmentally sustainable power sources and power trains. For electric vehicles, besides the energy supply via a battery and fuel cell, also the optimization of the powertrain is necessary. Additionally, University of Oulu will complement the hardware infrastructure of the NUVE-LAB with software-engineering related capabilities and digital twin creation and interoperability capabilities. These will enhance the agility and wide usability of the hardware capabilities towards easily configurable test settings, which will be also interoperable among different actors and machine elements on-site, as well as in interconnected scenarios with other labs in geographically distinct locations. This will enable digital design collaboration and shortens time to market.

Hub for Hydrogen-Materials Interaction Research Infrastructures

University of Oulu, VTT Technical Research Centre of Finland, University of Tampere

The transition to a hydrogen economy poses unprecedented challenges in the energy, raw materials and transportation industries. New hydrogen-based processes and applications need to be introduced in a very short time to meet climate goals. However, little is known about the interactions of hydrogen with materials such as steels, which are central to the functions of our society. Understanding the interactions is becoming increasingly important for the development and commercialization of reliable and safe hydrogen technologies. For example, in load-bearing structures, the embrittlement of materials caused by hydrogen can have catastrophic effects, and the use of hydrogen as a fuel does not produce the same lubricating film on engine surfaces as fossil fuels. H2MIRI's local infrastructures answer to these needs with powerful characterization techniques, strengthen the division of roles between the partners, and deepen know-how and enable the society to produce the information it needs.

Life Science Data Competence Centre

University of Helsinki

Digitalization has become an essential part of life science research. Core facilities in, for example, genomics, proteomics, structural biology and microscopy are the largest data generators in life sciences. Recent technological developments have resulted in massive increases in the amount of data that must be analyzed, distributed and stored efficiently, while at the same time comply to sometimes conflicting requirements for data openness (FAIR principles, Open Data) and security (GDPR, Act for the Secondary Use of Healthcare Data). As a

collaboration between the University of Helsinki IT center and life science core facilities, we propose to set up a Life Science Data Competence Centre (LSDCC) to deal with the critical gaps in core facility research data management. LSDCC will provide local data storage and processing solutions, as well as establish workflows for data management issues for all University of Helsinki LS core facilities.

Oulu 3D single particle analysis facility

University of Oulu

The Oulu 3D Single Particle Analysis facility will be established at the Faculty of Biochemistry and Molecular Medicine, University of Oulu. The research infrastructure is based on already existing local instrumentation and expertise, which will be further strengthened by the purchase of a cryo-electron transmission microscope critical for structural studies of single particles. The facility will significantly enhance the efficiency of ongoing research activities in Oulu on a range of systems, including biological macromolecules and their complexes, lipid vesicles, membrane structures as well as natural and engineered nanoparticles. The infrastructure will facilitate new research collaborations between multiple faculties of the University of Oulu as well as with industries in the Oulu region. The infrastructure will have a significant impact on the University of Oulu research focus areas ‘Lifelong Health’ and ‘Sustainable Materials and Systems’.

Photonics and Materials Research Infrastructure: Printable Luminescent Materials

University of Eastern Finland

Infrastructures are essential in the research and education in natural sciences such as physics and chemistry. The rationale of the Printable Luminescent Materials infrastructure (PRILUMAT) is to replace existing, out-of-the-date pieces of equipment and to get new research started on the 3D printing of tailored luminescent materials. The research will aim to various novel applications in lighting, luminescent solar concentrators, waveguide-based sensing, and switching in optical data transfer. These solutions will support both digitalization and green transition, the ultimate goals of Horizon Europe. Furthermore, the equipment and services enabled by them will be available for the local companies via the existing infrastructure organization of the University of Eastern Finland.

Research infrastructure for the intersection of law and politics

University of Turku, Åbo Academy, University of Turku

LAWPOL pools together political and legal documents and revolutionizes their research. A group led by University of Turku will develop the research infrastructure for the intersections of law and politics based on LAWRADAR (lakitutka.fi) and FINPARL. LAWPOL includes the entire life

cycle of legislation. It comprises of policy documents laying the groundwork for legal reform; documents by the legislator, stakeholders, and experts; parliamentary documents; national and international court cases; research literature; and political agendas and manifestos. New research tools expedite and enhance the research of these documents, promoting unprecedentedly broad research on the interrelations between law and politics. LAWPOL is valuable for multiple disciplines, particularly for research on the law-politics interface. The project also improves the general public's access to information – a fundamental right and cornerstone of democracy.

Turku Immunology Centre

University of Turku

This project aims to promote immunological research in Turku by developing the infrastructure of the Turku Immunology Centre. The funding received will enable us to provide the latest research technology for the specific needs of immunology research and to increase immunological expertise and cooperation opportunities for pharmaceutical, life science and diagnostic companies. The new automated infrastructure emphasizes the objectives of the green and digital transition. The information generated through infrastructure can be used to mitigate climate change, improve human health and well-being, and prevent environmental pollution. More information can be found on the website of the Turku Immunology Centre: https://immunologycentre.fi/

Turku Protein Core

University of Turku, Åbo Academy

Proteins are the building blocks of nature that have allowed life to develop. The study of proteins has made possible the development of numerous drugs to treat various illnesses. Proteins allow environmentally friendly production of fine chemicals and are key to unlocking the potential of bioenergy, both of which will play key roles in the transition to circular economy. Turku Protein Core is a joint undertaking by the University of Turku, Åbo Akademi University and Turku Bioscience to manage and improve research infrastructure essential to carry out high-quality protein research. The current facilities have been evaluated both externally and internally and we have identified several key areas for development. This application will allow hundreds of students, researchers and local industry to gain easy access to numerous state-of-the-art equipment that will greatly improve know-how in a field of science that will become increasingly important for our society in the future.

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Wasa zero emission data centre

University of Vaasa, Åbo Academy, NOVIA University of Applied Sciences, Vaasa University of Applied Sciences

Wasa Zero Emission Data Center (WSTAR) is an infrastructure enabling research on future climate-neutral data centers. As a part of the Technobothnia research infrastructure in Vaasa, the energy capital in Finland, it provides direct and near contacts to the energy industry. Globally, data centers today use around 1% of the electrical energy; this is predicted to rise to 8–21% by 2030! As almost all energy consumed is offloaded as unused waste heat, the carbon footprint of data centers is huge if renewable energy sources are not used.
WSTAR enables research on how to completely change the energy model of data centers, and tight integration with the local energy system allows them to act as efficient electrical grid balancers in combination with renewable energy sources. Future mobile, local, and small-scale data centers, also enables effective edge-based installations, and provides research possibilities to fulfill EU guidelines of climate neutral data centers by 2030.

Wild Animal Phenotyping

University of Helsinki

Knowledge of the morphology, physiology and behavior of organisms i.e. their phenotypes, is an important aspect of life science research across fields spanning conservation biology to medicine. It also contributes to improved forecasting of the resilience of populations and species to environmental changes. ‘Big data’ use is common in many research fields, but animal phenotype data collection lags behind due to its persisting manual, often non-digital, nature. This results in limitations for research, and also conservation and management. WildAP will fill a gap in the Finnish infrastructure landscape via coordinating state-of-the art phenotyping services, training and expertise for the entire Finnish research, conservation and management communities. WildAP brings added value via existing co-operations in several local regions, (Lammi, Evo, Lahti, Helsinki), and by supporting high quality research on animals in variable environments, WildAP directly supports green & digital transitions