Skisser med relevans innenfor e-infrastruktur

Tabell: Oversikt over skisser med relevans for området **e-infrastruktur**

Prosjekt-nummer	Prosjekttittel	Søkerinstitusjon	Prosjektleder	Estimert søkt beløp fra NFR
314415	E-INFRA 2020 - A National e-infrastructure for Science	**UNINETT SIGMA2 AS** (UiO, UiB, NTNU, UiT)	Stein Inge Knarbakk	396 650 000
315742	Norwegian Centre for Nanoscale X-ray Tomography	**NTNU** (UiO, NTNU)	Ragnvald H. Mathiesen	33 250 000
316241	Historical Registers	**NORSK REGNESENTRAL** (NA, NL, FHI, SSB, UiT, The Norwegian Historical Data Centre (NHDC), UiB)	Lars Holden	30 000 000
316385	COAT Basic: Basic infrastructure functions of the Climate-ecological Observatory for Arctic Tundra (COAT)	**UiT** (NPI, NINA, MET, UNIS)	Rolf Anker Ims	29 290 000
316396	Agricultural Robotics and Intelligent Sensing Ecosystem; Robust, Flexible and Scalable Automation for Norway.	**NMBU** (NMBU, NOFIMA, Østfoldforskning, OsloMet, NVI)	Alex Mason	76 900 000
316398	Experimental Infrastructure for Exploration of Exascale Computing, Phase II	**SIMULA** (UiB, UiT, OsloMET, NTNU, UNINETT Sigma2, Graphore, Dolphin Interconnect Solutions, Numascale)	Are Magnus Bruaset	94 500 000
316402	NeIC-Norway: Norwegian Participation in the Nordic e-Infrastructure Collaboration	**UNINETT SIGMA2 AS** (Danish e-Infrastructure Cooperation, ETAIS - Estonian Scientific Computing Infrastructure, CSC - IT Center for Science Ltd., Rhnet, Swedish National Infrastructure for Computing SNIC, NordForsk)	Hans A. Eide	40 000 000
316406	Coordinated Online Panels for Research on Democracy and Governance in Norway	**UiB** (UiO, UiA, NTNU, Institutt for samfunnsforskning, NORCE, NSD, ideas2evidence)	Anne Lise Fimreite	75 000 000
316414	Norwegian Infrastructure for Microbial Genomics	**FHI** (OUS, UiO, UiB, HUS, NTNU, St. Olav hospital, NMBU, UiT, UNN, NVI, Nofima)	Dominique A. Caugant	90 400 000
316438	Aerosols, Clouds, and Trace gases Research InfraStructure in Norway	**NILU** (MET, CICERO)	Cathrine Elisabeth Lund Myhre	40 308 560
316441	Norwegian AI Cloud	**UiO** (NTNU, UiB, UiT, UNINETT Sigma2)	Gard Olav Sundby Thomassen	60 500 000
316446	Context-Sensitive Data for Open Research	**UiO** (NSD, UNINETT Sigma2, USIT/UiO, Uit, UB, OsloMET)	Kirsti Klette	23 473 200
316447	The EMERALD Physically Integrated? eXperimEntal Landscape	**UiO** (UiB, NORCE, NINA, NIBIO, NILU)	John Faulkner Burkhart	54 072 000

316449	National Infrastructure for Multiphase Flows - 2020	**IFE** (SINTEF, UiO, NTNU)	Karin Hald	23 000 000
316466	Norwegian Scientific Data Network - an extension	**MET** (USIT, MET, Nansensenteret, NILU, HI, NPI)	Øystein Arne Godøy	20 000 000
316468	Infrastructure for Precision Diagnostics for Clinical Cancer Trials; InPreD - Norway	**OUS** (OUS, HUS, UNN, St. Olavs Hospital, SUS, Ahus)	Hege Elisabeth Giercksky Russnes	115 000 000
316474	Cerenkov Telescope Array-Norway	**UiB** (NTNU, UiO)	Anna Lipniacka	33 395 000
316479	Electric Future Accelerator Initiative? Laboratory	**SINTEF ENERGI AS** (NTNU)	Christian André Andresen	72 000 000
316482	Infrastructure for MoBa	**FHI** (NDE, NTNU, UiO, UiB)	Jennifer R. Harris	98 660 000
316483	Online Road Safety Measure Research and Decision Support System	**TØI** (Statens Vegvesen)	Alena Høye	7 000 000
316485	National Geoscientific Data Infrastructure	**NGU** (UiT, NTNU, UiO, UiB, NP, HVL, UNIS, Store Norske Spitsbergen Kullkompani AS)	Johannes de Beer	45 000 000
316487	ELIXIR3 - Strengthening the Norwegian Node of ELIXIR	**UiB** (UiT, NTNU, NMBU, UiO)	Inge Jonassen	190 000 000
316488	Research infrastructure for preventative care	**USN** (Norway Health Tech, Nova Discovery, Vestre Viken Hospital Trust)	Hilde Eide	110 000 000
316491	GeoCloud Research	**NGI** (NTNU, NGU)	Kristoffer Skjolden Skau	20 000 000
316492	Forskningsinfrastruktur for miljø- og ressursdata for bærekraftig innovasjon (LCA data)	**ØSTFOLDFORSKNING AS** (NMBU, PRé, NILU, NIFU, SINTEF, Treteknisk, IFE, Asplan Viak)	Ole Jørgen Hanssen	25 000 000
316493	Norwegian Marine Data Centre - Interoperable Infrastructure	**HI** (NERSC, NP, NIVA, MET, NORCE)	Helge Sagen	46 000 000
316496	Research and clinical infrastructure at Oslo SPeLL (Oslo SpesialPedagogikk- og LæringsLab)	**UiO** (UiB, NUBU, UiO, Sunnaas, Statped, OUS)	Vasiliki Diamanti	4 139 000
316498	Infrastructure for the Digitalisation of Process Industry	**SINTEF AS** (USN, NORCE; Nofima, UiA)	Frode Brakstad	147 260 000
316501	Living Norway Ecological Data Network	**NINA** (NTNU, UiO (NHM), UiB, NMBU, NIBIO, NIVA, NBIC)	Erlend Birkeland Nilsen	31 200 000
316505	e-INFrastructure fOr e-health research aNd InnovAtion	**HELSE BERGEN HF** (Helse Vest IKT)	Tine Nordgreen	56 100 000
316509	Digital extension of the Zero Emission Building and climate adaptation laboratories	**SINTEF AS** (NTNU)	Berit Time	19 400 000

316510	Infrastructure for Norwegian Rock Art Research	UiB (UiO, NTNU, UiS, MUSIT, Universitetsmuseenes IT-organisasjon; Alta Museum, World Heritage Rock Art Center)	Trond Klungseth Lødøen	130 000 000
316525	Norwegian Chemical Palaeoecology Laboratory	UiB (NMBU)	Alistair Seddon	33 599 000
316526	Smart Mobility	NTNU (NORD Unviersitet, SINTEF, Trøndelag County council, Stjørdal municipality)	Frank Lindseth	50 000 000
316530	EBRAINS Norway: Norwegian Node of the European Research Infrastructure for Brain Research and Brain-Inspired Sciences	UiO (NMBU)	Jan G. Bjaalie	77 500 000
316540	Norwegian technology platform for industrial macroalgae cultivation and utilization (MACROTECH)	SINTEF OCEAN AS (NTNU, SINTEF Industri)	Aleksander Handå	170 000 000
316541	European Plate Observing System - Norway (EPOS-N) Phase-II	UiB (NORCE, NORSAR, NGU, NMA, NGI, UiT)	Kuvvet Atakan	93 569 000
316543	Artistic Research and Innovation InfraStructure	UiB (NMH, HK, KHiO, NENU, UiS, INN, HIØ, USN, MCB)	Anne-Helen Mydland	81 500 000
316545	ECCSEL Virtual laboratory	SINTEF ENERGI AS (SINTEF Industri, IFE, NORSAR, ECCSEL ERIC)	Francesco Finotti	120 000 000
316548	Norwegian e-infrastructure for research on LAM collections	NASJONALBIBLIOTEKET (Arkivverket, UiO biblioteket, UiB biblioteket)	Jon Arild Olsen	102 500 000
316551	SUSTAINHEALTH-workflow, an Infrastructure for Food, Health, and Sustainability	FHI (NVI, SSB, UiO, NFSA)	Helle Margrete Meltzer	32 000 000
316553	Norwegian Digital Subsurface Lab	SINTEF AS	Ane Elisabet Lothe	75 000 000
316557	NTS Infrastructure	TØI (The Public Roads Administration (NPRA))	Trine Dale	9 000 000
316562	FAIR Data Management Plan	NSD	Katrine Utaaker Segadal	7 566 000
316563	National bio-mechatronics infrastructure for ASSISTive and AugmeNting Technology in personalised healthcare	UiA (OsloMet, UiO, UiT, HVL, USN, UiS,I4Helse, NORA, NAIS, NOBIM, Sørlandet Hospital, Sunnaas Rehabilitation Hospital, SUH, NSCC, Norway Health Tech)	Filippo Sanfilippo	102 000 000
316566	SEFIRE: Research infrastructure for knowledge-building on societal health, security and sustainability	NIVA (NIVA, VEAS, NTNU, FHI, NILU, NMBU)	Malcolm Reid	75 940 000
316574	Digital BioBank Norway	HELSE BERGEN HF (HELSE Bergen HF, SUH, Helse Fonna HF, UiB, HVL)	Hauke Bartsch	50 000 000

316580	Power-to-X systems lab at Tiller	**SINTEF AS** (SINTEF Ocean AS, SINTEF Energy AS, NTNU)	Kyrre Sundseth	42 500 000
316581	Enabling LHC Physics at Extreme Collision Rates II	**UiO** (UiB, HVL, USN)	Alexander L. Read	100 579 000
316582	DataverseNO Plus	**UiT** (NTNU, UiB)	Philipp Conzett	13 600 000
316587	Norwegian Family Based Life Course Study - Competence Hub	**UiO** (FHI, NTNU)	Øyvind Erik Næss	18 645 000
316591	eInfrastructure for digital, user centric and sustainable digital transformation in urban smart cities	**IFE** (UiO, Østfold University College, Østfoldforskning, OsloMet, Smart Innovation Norway, NILU, Halden kommune, Logiq, ITS Norway, Halden næringsutvikling)	Petter Kvalvik	200 000
316593	World of Wild Waters – Virtual lab «WoWW-lab»	**NTNU** (Telenor, Offshore Sim Center)	Oddbjørn Bruland	45 100 000
316598	Smart Buildings Energy and Indoor Air Quality e-infrastructure	**STIFTELSEN SINTEF** (SINTEF Digital, SINTEF Energi, NTNU Ingeniørvitenskap og NTNU Arkitektur og Design)	Karen Byskov Lindberg	32 700 000
316605	National Infrastructure for AI-Powered Autonomous Cyber-Physical Systems	**UiA** (Gullknap aerial center, MIL, Omron, ABB, NORCE, NTNU, UiT, SIMULAMet, Hydo Energy, RedRock)	Linga Reddy Cenkeramaddi	174 000 000
316606	Norwegian Travel Industry Monitor: Digital lab for big data analysis of economic development of businesses and destinations	**USN** (Telemark Research Institute Norwegian Tourism Partners)	Kåre Sandvik	30 000 000
316608	Norwegian Biobank for Nature (NORBINA)	**UiO** (UiB, NTNU, UiT, NMBU, UiA, NIVA, NIBIO, NVI)	Arild Johnsen	53 117 000
316613	Robust and fault-tolerant network infrastructure with 5G access (ROBUST5G)	**SIMULA AS** (NTNU, UNINETT, Norwegian Metrology Service)	Haakon Bryhni	17 188 905

Project number: 314415
Title: E-INFRA 2020 - A National e-infrastructure for Science
Applicant (partners): UNINETT SIGMA2 AS (UiO, UiB, NTNU, UiT)
Project Manager: Stein Inge Knarbakk

Short summary:
UNINETT Sigma2 AS (Sigma2) has a strategic responsibility for and manages the national e-infrastructure for large-scale data- and computational science in Norway. In addition, Sigma2 coordinates Norway's participation in international collaborations on e-infrastructure.

Sigma2 is mandated to provide services for high-performance computing and data storage to individuals and groups involved in research and education at all Norwegian universities and colleges, and other publicly funded organizations and projects.

The Sigma2 activities are jointly financed by the Research Council of Norway (RCN) and the Sigma2 consortium partners, which are the universities in Oslo, Bergen, Trondheim and Tromso.

While historically (and still currently), the operations of Sigma2 have been funded jointly by the universities and the Research Council of Norway, the funding for investment in e-infrastructure has been largely financed by the Norwegian Research Councils INFRASTRUKTUR program.

While the base funding for Sigma2 is under revision, it is currently too early to determine the final outcome of this process. Hence, Sigma2 applies, through this application, for funding for investment in e-infrastructure for the period of 2022-2024 through the INFRASTRUKTUR-program, as usual.

Project number: 315742
Title: Norwegian Centre for Nanoscale X-ray Tomography
Applicant (partners): NTNU (UiO, NTNU)
Project Manager: Ragnvald H. Mathiesen

Short summary:
X-ray imaging is a field in tremendous development, both at large-scale facilities and at university laboratories. In addition to the fundamental science aspects, X-ray imaging distinguishes itself by its applications in virtually all the natural and life sciences, and industry. X-ray imaging is consequently of utmost importance for Norwegian competitiveness, and there is a rapidly growing number of X-ray computed tomography (CT) instruments nationwide, both at the universities and in industry. In this landscape, there is a strong need for national coordination, also to ensure optimal use of the expensive infrastructure, alignment of investments and knowledge sharing. The NEXT consortium aims to fill this role, similarly to X-ray imaging centers abroad.

NEXT has hubs at UiO and NTNU, uniting the leading national research groups in X-ray imaging. NEXT will be coordinated by NTNU IFY, which is Norway's leading research unit in X-ray physics and imaging. The center has national and international affiliated collaborators, including several Centres of Excellence (CoE). In particular, the NTNU hubs are part of CoE PoreLab (www.porelab.no), and enjoy close collaboration also with CoI CASA (www.ntnu.edu/casa). NEXT will provide access to state-of-the-art X-ray imaging infrastructure for Norwegian users, both through upgrades of existing infrastructure and through established collaborations with imaging centers abroad. NEXT aims to maximize quality and cross-fertilization across disciplines, while maintaining a particular focus on porous media and mesoscopic structures.

The NEXT consortium has extensive X-ray imaging infrastructure, with complementary instruments covering life science, via environmental and geophysics, to material science. The labs are operated as open-access facilities with large and increasing external user demand. The proposed investments within X-ray CT and imaging are extensions to this existing infrastructure, planned to provide an optimal portfolio of methodologies in a united national perspective. Coordinating and strengthening the national X-ray imaging capability at mesoscopic scales is of huge importance to the climate, environment, energy, health and Norwegian industry.

NEXT will introduce and refine X-ray imaging techniques, such as phase-contrast based methods and time resolved studies, and actively support and educate users from a wide range of science disciplines through introductory courses, workshops, seminars and advanced training. NEXT will operate as a national competence center, ensuring that Norway stays abreast with the latest developments in X-ray imaging. The national competence center has as an aim to give Norwegian industry a competitive edge and aims to secure that the national X-ray imaging resources are exploited in the best possible way to maximize the advantage to society.

Project number: 316241
Title: Historical Registers
Applicant (partners): NORSK REGNESENTRAL (NA, NL, FHI, SSB, UiT, The Norwegian Historical Data Centre (NHDC), UiB)
Project Manager: Lars Holden

Short summary:
The project will build an infrastructure for historical registers, Histreg. The major component is the Norwegian Historical Population Register (HBR) with the objective to identify and link all persons living in Norway after 1801 across censuses, church books, emigrant lists and vital statistics up to and including the Central Population Register starting in 1964. Histreg will also include two additional components: 1) a full national register of properties and residences 2) a number of thematic historical registers (e.g. health, education, income). All these registers will be fully linkable between the registers and to modern register data. The HBR component has been funded in part by the Infrastructure program in the period 2014-2019 (denoted phase one) and is on the Norwegian Roadmap for Research Infrastructure. The systems and technical solutions for building HBR efficiently are now largely in place, but still far too rudimentary for most research purposes. In the proposed project we will be complete HBR by exploiting the investments made in phase one.

Histreg will be used in a large number of research projects in areas such as history, demography, economics, sociology, medicine, psychology and genetics by all the large universities, a large number of other universities, university colleges, research institutes and university hospitals.

The register is owned and administrated by the National Archives of Norway (NA). The register will have five platforms for dissemination: Statistics Norway (SN), NA, National Institute of Public Health (NIPH), UiT/NHDC and the online histreg.no. Other national register data will be linked to HBR. The project apply for funding to build the register and to develop new software systems where the main goal is to give a diverse user group improved access to the register. NA, SN, NIPH and UiT/NHDC are responsible for the maintenance and dissemination of the register as part of their public funding and responsibility. Norsk Regnesentral (NR) coordinates the building of the register and The National Library (NL) is important for dissemination and to reach minorities.

Project number: 316385
Title: COAT Basic: Basic infrastructure functions of the Climate-ecological Observatory for Arctic Tundra (COAT)
Applicant (partners): UiT (NPI, NINA, MET, UNIS)
Project Manager: Rolf Anker Ims

Short summary:
Climate-ecological Observatory for Arctic Tundra (COAT) is a long-term research initiative that will enable real-time documentation of climate change impacts on terrestrial arctic ecosystems. COAT aims to provide an adaptive knowledge system and open access services that underpin rational management actions & policy decision and that shall inform the general society about the state of arctic ecosystems. As similar observatories are entirely lacking from the Eurasian Arctic, COAT will considerably strengthen Norway's position as an international leader in research and management of arctic environments. Thus, this enterprise is in accordance with the ambitions expressed in governmental white papers. COAT has received substantial funding from various sources that has enabled the development and establishment of its observation system; i.e. the infrastructure components that will facilitate the generation and storage of long-term time series of ecosystem and climate state variables from both high- and low-arctic Norway. Due to these investments, COAT is ready to be operational towards the end of 2021. However, the costs associated with the operations to maintain the basic functions of the observation system will be higher than what is available from the COAT partners internal budgets - and presently from external funders - because: (1) COAT's geographically distributed infrastructure with the maintenance of a large number of sensors and experimental devises at remote Arctic locations, (2) the requirement of processing big and diverse raw data into operational ecosystem state variables for various users, and (3) the ambitions of maintaining an active user interphase. While other nations have established dedicated funding channels for long-term ecosystem observatories, Norway is in lack of such. These are the reasons for why COAT seeks partial funding of its operation cost from RCN-Infrastructure for the first 5 years of its operations (2022-2026).

Project number: 316365/ 316396
Title: Agricultural Robotics and Intelligent Sensing Ecosystem; Robust, Flexible and Scalable Automation for Norway
Applicant (partners): NMBU (NMBU, NOFIMA, Østfoldforskning, OsloMet, NVI)
Project Manager: Alex Mason

Short summary:
The establishment of the ARISE Research Infrastructure at NMBU aims to improve the uptake of intelligent automation (i.e. robotics and sensing) within the Norwegian agri-food sector. The initiative promises to bolster the multidisciplinary collaboration of the engineering and biosciences disciplines and provide unparalleled facilities for basic and applied R&D for Norwegian agriculture, and significantly improve new and existing research-based education programmes.

This is a sector which prioritises constant improvement of productivity, as well as having a strong desire to improve the quality of the working environment which can be characterised by long working days, tough physical labour and menial or repetitive tasks. Such factors have led to increased difficulty finding workers on farms and at food processing facilities, a challenge made more acute by

the 2020 COVID-19 outbreak, where travel advisories or restrictions have further reduced the availability of foreign workers for seasonal activities. Moreover, Norwegian agri-food production entails unique logistical challenges (weather, seasonal variation) in addition to speciality batch-scale production, for example, which contribute to existing automation solutions often being unsuitable.

Norway must therefore rise to the challenge of developing robust, flexible and scalable automation systems to suit its own agri-food sector requirements. To achieve this, an approach which considers both production and processing in the value-chain is required. ARISE prioritises three key themes: (1) Crop Farming; (2) Animal Health and Welfare and; (3) Food Processing. In particular, it will focus on aspects related to industrial scale cognitive systems capable of handling heterogenous and flexible materials (e.g. meat, berries), multimode robot operation (i.e. full- or semi- autonomous, collaborative working), as well as the ability to develop new ways of working with and adapting equipment (e.g. virtual or augmented environments: digital twins). In addition, support for disruptive concepts such as mobile automation equipment (e.g. milking, slaughter) should be established to solve or improve logistic and welfare challenges imposed by existing culture. Furthermore, infrastructure to establish and improve traceability in the value-chain will optimise automation solutions and provide feedback to key points in the value-chains (e.g. to improve sustainability through enhanced productivity and reduced waste), enabling the Norwegian agri-food sector to realise Industry 4.0 potential.

 ARISE will be well placed to provide this opportunity as it builds upon existing expert areas at NMBU, and it particularly exploits the closer relationship enjoyed between NMBU faculties resulting from the relocation of NMBU's Faculty of Veterinary Medicine to Ås. The initiative also aligns itself with the cross-University strategy to UN sustainability goals, for example "Industry, Innovation and Infrastructure" and "Health and Wellbeing". Additionally, several other external institutions and companies will be involved. This will be described in the full application. Altogether, ARISE is aiming for research on an international top level.

Project number: 316398
Title: Experimental Infrastructure for Exploration of Exascale Computing, Phase II
Applicant (partners): SIMULA AS (UiB, UiT, OsloMET, NTNU, UNINETT Sigma2, Graphore, Dolphin Interconnect Solutions, Numascale)
Project Manager: Are Magnus Bruaset

Short summary:
The Experimental Infrastructure for Exploration of Exascale Computing (eX3, 2017 – 2022) [1] is an existing national research infrastructure for experimental research on High Performance Computing (HPC) technologies. These technologies are expected to be vital for emerging supercomputers, cloud services, and data centers, thus placing eX3-based research at the heart of the omnipresent digitalisation. The eX3 infrastructure is hosted by Simula Research Laboratory with NTNU, UiB, UiT, OsloMet, Uninett Sigma2, Dolphin Interconnect Solutions, Graphcore, and Numascale as partners. In the recently updated Norwegian Roadmap for Research Infrastructure [2], eX3 is listed as a key national infrastructure in ICT. After its first year in regular use, eX3 is already a vital asset in a large number of research projects [3], and has proven to be very attractive and unique also in an international setting. The international value of the infrastructure has recently been highlighted by being a core testbed in two EuroHPC proposals receiving outstanding scores (14/15 and 15/15) that

are currently shortlisted for funding, and through an invitation to become a node in the European research infrastructure SLICES that is currently being proposed to ESFRI.

The current proposal targets the next generation of this experimental infrastructure, referred to as eX3-II. During the first phase of the eX3 infrastructure, the consortium has been allowed access to the internal technology roadmaps of several HPC vendors, which has resulted in giving Norwegian HPC researchers very early access to emerging technologies. In the eX3-II project, we will push this work even further and continue to build and run a national infrastructure that offers an experimental approach to exploring extremely heterogeneous (HPC) solutions. This will include handson access to next-generation HPC accelerators (including FPGAs and application-optimized processing units like ML/Deep-learning chips); emulators of quantum computers; emerging memory, storage, I/O and interconnection network technologies; and potentially other types of yet-to-be-announced disruptive HPC-relevant hardware.

The ambition of eX3-II is to facilitate continued world-leading Norwegian research and innovation towards the coming age of extreme heterogeneity in HPC. By means of the future-embracing experimental hardware testbed of eX3-II, Norwegian scientists and innovators, and their collaborators, will conduct research on utilization of massively parallel processors and heterogeneous systems of accelerators (e.g., explore FPGA optimization, research novel programming models, and develop next-generation software tools); research smarter networking (e.g., study in-network computing, dynamic network reconfiguration for resilience and congestion management, and alternative topologies and routing configurations in lossless networks); demonstrate capability and usability of HPC research results; collaborate with world-leading Norwegian industrial partners in their endeavor towards nextgeneration HPC hardware and software; and more. All consortium partners in the existing eX3 project have expressed interest in joining the next phase.

Project number: 316402
Title: NeIC-Norway: Norwegian Participation in the Nordic e-Infrastructure Collaboration
Applicant (partners): UNINETT SIGMA2 AS (Danish e-Infrastructure Cooperation, ETAIS - Estonian Scientific Computing Infrastructure, CSC - IT Center for Science Ltd., Rhnet, Swedish National Infrastructure for Computing SNIC, NordForsk)
Project Manager: Hans A. Eide

Short summary:
This application is for Norway's membership and participation in the Nordic e-Infrastructure Collaboration (NeIC). The current funding period is until the end of 2022. The application to be submitted in November 2020 will be for the period 2023–2027.   Since 2012, NeIC has facilitated common Nordic development and operation of digital infrastructure for the research sector. NeIC has an operational responsibility for the Nordic distributed WLCG Nordic Tier-1 facility, which provides computing and storage for CERN to be used by high energy physicists worldwide. NeIC is responsible for a set of development projects that aim to explore, evaluate, develop and deploy innovative infrastructure services in response to common strategic priorities within the Nordic region in the area of e-infrastructure and the needs of the national e-infrastructure providers, like Sigma2 in Norway. NeIC is also collaborating with a range of domain-specific communities, e.g. biodiversity, biomedical sensitive data and earth system modelling. NeIC coordinates a European Commission funded project on Nordic contributions to EOSC.

NeIC is part of NordForsk which is under the Nordic Council of Ministers and provides an environment for research and research infrastructure cooperation across the Nordic region. NeIC's member states are Norway, Denmark, Estonia, Finland, Iceland and Sweden. Norway is actively involved in all of the current NeIC activities and projects. Norway is represented in the NeIC Board by UNINETT Sigma2. Through NeIC, Sigma2 connects Norway to other national and Nordic e-infrastructure service providers in the form of collaborative activities.

Project number: 316406
Title: Coordinated Online Panels for Research on Democracy and Governance in Norway
Applicant (partners): UiB (UiO, UiA, NTNU, Institutt for samfunnsforskning, NORCE, NSD, ideas2evidence)
Project Manager: Anne Lise Fimreite

Short summary:
High quality scientific data is a core feature of existing research on the democratic governance structure in Norway. Our survey and registry data are among the best in the world. However, digitalization now challenges us to imagine and build new infrastructures equipped to meet the demands for high-quality scientific data in our digital age. Unique opportunities exist in Norway due to its high internet coverage. By establishing the proposed new national infrastructure KODEM - Coordinated Online Panels for social science and multidisciplinary research on Democracy and Governance - we take full advantage of these unique opportunities. For the first time KODEM will coordinate data-collection in panels that cover the entire core of democratic governance-citizens, elected representatives, public administrators, judges, and journalists. KODEM will generate scientific discoveries, more collaboration across institutions and disciplines, high quality international cooperation, more policy-relevant research, higher research pace, larger research scale, and better resource efficiency. In the fall of 2020, a pilot - KODEM_DEMO - will be fielded as a trial. Organizationally, KODEM will make use of a time-sharing model successfully piloted at the Digital Social Science Core Facility (DIGSSCORE) at the University of Bergen. This time-sharing model will serve the needs of the broad-based national consortium containing participants from the large research universities in Norway, from important research institutes and from data archives and data collectors. KODEM will enable scientific advances across a wide range of scientific fields including Political Science, Public Administration, Media and Communication Studies, Legal Studies, Economics, Psychology, Sociology, and Public Health.

Project number: 316414
Title: Norwegian Infrastructure for Microbial Genomics
Applicant (partners): FHI (OUS, UiO, UiB, HUS, NTNU, St. Olav hospital, NMBU, UiT, UNN, NVI, Nofima)
Project Manager: Dominique A. Caugant

Short summary:
The development of new sequencing technology is permitting rapid elucidation of whole genomes of microbes involved in all kind of infections and is having a determinant impact on our understanding of disease transmission and evolution. This is illustrated in our present fight of the global threat elicited by SARS-CoV-2. Analysis of the first 160 complete virus genomes sequenced from human

patients elucidated the original spread of this new coronavirus. Now thousands of coronavirus genomes have been sequenced and identification of different phylogenetic viral lineages might help predict future global hot spots of disease transmission and surge.

The Norwegian Infrastructure for Microbial Genomics (NIMG) is a national initiative bringing together the leading research environments within microbial genomics in Norway. Its aims are to promote the use of advanced sequencing technology, to provide means for handling large amount of sequence data and developing new bioinformatics tools in order to solve important research questions concerning infectious diseases, such as those related to antimicrobial resistance development, the development of virulence and the epidemiological spread of pathogens between humans, and to humans from animals and the environment.

This funding application is a request for: 1) establishment or adaptation of a general IT infrastructure that facilitates storage, sharing and analysis of microbial sequence information linked to sensitive data; 2) setting up analytical pipelines that can be easily accessible, facilitating sharing of both genomic sequence data as well as corresponding metadata and tools; 3) setting up a team of experts (help desk) that can assist users in performing their analyses; and 4) building microbial bioinformatics expertise in Norway by establishing a network of bioinformaticians serving the different partners. The NIMG infrastructure is working in close collaboration with ELIXIR through BioMedData (funded by RCN) in the development of a structure allowing portability of the microbial and human data between the partners and exchange of expertise, especially in the metagenomics area. As an IT infrastructure, NIMG will permit storage, immediate sharing and analysis of data linked to microbial sequence information in a secure way and as such will be an essential tool to fight infectious diseases.

Project number: 316438
Title: Aerosols, Clouds, and Trace gases Research InfraStructure in Norway
Applicant (partners): NILU (MET, CICERO)
Project Manager: Cathrine Elisabeth Lund Myhre

Short summary:
ACTRIS-Norway is an essential contribution to the pan-European Research Infrastructure on Aerosols, Clouds, and Trace gases Research InfraStructure (ACTRIS). ACTRIS produce high-quality data for the understanding of short-lived atmospheric constituents and their trends, impact and interactions. These constituents have a residence time in the atmosphere from hours to weeks. The short lifetimes make their concentrations highly variable in time and space and involve processes occurring on very short timescales. These considerations separate the short-lived atmospheric constituents from long-lived greenhouse gases, and calls for a fourdimensional distributed observatory, covering Europe and even larger geographical scale.

ACTRIS offers data from observational or exploratory National Facilities (NFs) complying with state-ofthe-art procedures to ensure adequate information to enable atmospheric research on climate, air pollution and health. The ACTRIS observational platforms are fixed ground-based stations that produce long-term data based on a regular measurement schedule and common operation standards. In addition to these, atmospheric simulation chambers serve as ACTRIS exploratory platforms. These chambers are among the most advanced tools for studying and quantifying atmospheric processes and are used to provide many of the parameters incorporated in air quality and climate models. All ACTRIS data are managed and made available to the user communities

through the ACTRIS Data Centre, which combines several specialized topical data centres though a common interphase. This proposal is addressing required developments of the ACTRIS Data Centre, i.e. improvement, development, re-newel, and new functionalities, and builds on the long-term efforts NILU has offered internationally over many decades. With evolving scientific needs for observations and access to data and data products, the ACTRIS data centre and curation of data is a comprehensive and complex task that requires multidisciplinary expertise. The main objectives of ACTRISNorway are to:

- upgrade and re-new the core existing e-infrastructure for surface in situ observations, EBAS – http://ebas.nilu.no
- implement new the ACTRIS Data portal, the unique entry point to all ACTRIS data, and add new functionalities and ensure formal link to ACTRIS ERIC
- improve access to data, both through human and machine-to-machine interfaces and ensure that data exchange is following FAIR1 principles across the ACTRIS infrastructure and beyond, including traceable data production, attribution and implementation of licenses.
- Develop tools required for science and policy-oriented use of data, for users in Norway and elsewhere, such as comprehensive trend tool where observational data are combined with model data.

Project number: 316441
Title: Norwegian AI Cloud
Applicant (partners): UiO (NTNU, UiB, UiT, UNINETT Sigma2)
Project Manager: Gard Olav Sundby Thomassen

Short summary:
Digital tools have revolutionized our ability to collect, manage, and process vast amounts of data. Traditional tools are falling short and a new methodology of data driven science has emerged. These methods revolve around highly advanced analysis via machine learning (ML), deep learning (DL) and the training of models of artificial intelligence (AI). The purpose of the Norwegian AI Cloud (NAIC) is to address the entire life cycle in data driven science, providing hardware, software stacks, ready trained models, and advanced user support to ensure researchers can tackle increasingly complex problems, and do so more efficiently and in adherence with best practices of open science. By anchoring NAIC as a national IT infrastructure, we can provide researchers with compute power on demand, limiting the need for individual projects or research groups to wrestle with buying their own dedicated machine learning hardware - hardware that often ends sitting idle much of the time.

Data analysis often involves tasks that today are ready to be automated, provided there exists an appropriately trained model that can solve the task. Some examples of such tasks are transcription of audio, classifying images, and even more general data wrangling. We aim to host such open-sourced models as part of the infrastructure, freeing up time for the researcher to work on the tasks that require genuine intelligence. Such an offering would also be of great help to researchers who do not themselves work on projects where they have their own data scientist, thus enabling them to conduct more complex types of analysis without the need to hire extra staff, or spend significant amounts of time and resources on learning complex computational methods and programming.

NAIC will be based on a consortium of IT partners having experience with national-scale HPC and storage systems (UNINETT Sig ma2 AS, NTNU-IT, UiB-IT, UiO-IT, UiT-IT) and research partners with experience in solving computationally expensive problems based on AI (NTNU, UiB, UiO). NAIC will

work closely together with national networks such as the Norwegian Artificial Intelligence Consortium (NORA) and the Norwegian Open AI Lab (NAIL), as these have established partnerships with universities and research institutes, companies, and organizations in the public sector with an expressed interest in AI/ML.

Project number: 316446
Title: Context-Sensitive Data for Open Research
Applicant (partners): UiO (NSD, UNINETT Sigma2, USIT/UiO, Uit, UB, OsloMET)
Project Manager: Kirsti Klette

Short summary:
In order to benefit from the rapid growth of video, multi-media and online data ("context-sensitive data" as a collective term) in the social sciences, the humanities and health research, a concerted effort is needed for the development of a flexible research infrastructure for advanced analysis – supporting data storage, sharing, reanalysis and synthesizing research in line with the FAIR-principles. The main objective for CoSedOr (Context-Sensitive data for Open research) is to establish a secure and flexible system for sharing contextsensitive data that meet these requirements and national / international privacy standards. The infrastructure will enable research collaboration between projects, countries and time spans, as well support security and quality in the delivery of research-based resources for teaching and professional training in several disciplines and occupational areas. Furthermore, the infrastructure will be a "testbed" for new solutions related to secure storage and metadata systems across various research fields, both in Norway and across the Nordic countries. CoSedOr is an upgraded and expanded development of eVIR (eInfrastructure for Video Research, 2017-2020/22). The project is organized thematically in four work packages: Wp1. Ethics, confidentiality, privacy protection and intellectual property rights. New regulations / variation across countries of informed consent and privacy schemes will be integrated in CoSedOR and tested in a multidisciplinary, national and international (Nordic) context. Wp2. Metadata solutions for sharing data. A key idea for CoSedOr is to develop a multi-unit system that enables capturing relevant metadata to facilitate long term FAIR reuse of the data described above. Wp3. Interoperability and integration of data sources. The main objective for this WP will be to facilitate the interoperability of selected support tools and systems. Wp4. Implementation and provision of services for a specter of user environments. This WP will identify the needs of the expected user environments for CoSedOr, i.e. students / candidates at MA and PhDlevel and researchers in educational science (teaching and learning), social science and health (psychotherapy), humanities (musicology and linguistics), health and law. CoSedOr is a distributed construction that engages the above-mentioned disciplines in the development and testing of the research infrastructure. It will draw on the expertise of key institutional actors in fields related to this eInfrastructure: (1) At four universities, (2) National archive functions, (3) National and international standards for data management and indexing of data, (4) National standards for ethics and privacy, (5) technical solutions, (6) key administrative professional stakeholders, and (7) international partners.

Project number: 316447
Title: The EMERALD Physically Integrated eXperimEntal Landscape
Applicant (partners): UiO (UiB, NORCE, NINA, NIBIO, NILU)
Project Manager: John Faulkner Burkhart

Short summary:
The concept of a Physically Integrated Experimental Landscape (PIXEL) is introduced as a core infrastructure that specifically serves the remote sensing and land surface / earth system modeling communities. The EMERALD PIXELs will establish dedicated observational super sites for validation of Energy and Water Balance Exchange with an emphasis to measure variables across gradients and scales. The ambition is to be a catalyst for international partnerships working to develop a global network of `PIXEL' sites that may be used to develop high quality algorithms for both remotely sensed data and to improve Land Surface Model (LSM) parameterizations; both platforms which operation at the pixel scale rather than the point scale.

The EMERALD PIXEL (hereafter EPIX) will offer several services critical to enable high quality acquisition of fundamental parameters. These services include: novel data acquisition capabilities, communication and data dissemination services following the FAIR principles, and a substantial increase in the value of several nationally funded initiatives through the development of legacy "super sites" that will serve the remote sensing and land surface / earth system modeling communities. The unique services and capabilities will benefit the research community by significantly reducing a duplication of efforts related to field campaign observations, and by providing data and modeling services that will benefit experimental design.

EPIX is borne out of a well-established national network within the EMERALD project- a large, nationally coordinated RCN project led by the Department of Geosciences, UiO. The EPIX Research Infrastructure will further contribute to several International activities including GEOSS, GEWEX and the ESFRI Roadmap projects: ICOS and eLTER.

Project number: 316449
Title: National Infrastructure for Multiphase Flows - 2020
Applicant (partners): IFE (SINTEF, UiO, NTNU)
Project Manager: Karin Hald

Short summary:
Currently, IFE, SINTEF, NTNU and UiO have ten different laboratories for research in multiphase flow. The laboratories perform experiments for both industrial and academic partners and are among the best in the world in their focus areas, with a capacity for multiple different measurement methods.

To ensure that the laboratories can continue to deliver up-to-date experimental data to national and international research environments, the partners will apply together for infrastructure funding for upgrade, maintenance, operation and expansion of existing process equipment and instrumentation.

The application will also include funding to establish an extensive searchable database for large amounts of multiphase data which have been collected over decades. Such a database will be an important tool for improving simulator tools and models and will have great commercial value. It may also contribute to increased understanding of central challenges in fluid mechanics.

Project number: 316466
Title: Norwegian Scientific Data Network - an extension
Applicant (partners): MET (USIT, MET, Nansensenteret, NILU, HI, NPI)
Project Manager: Øystein Arne Godøy

Short summary:
The Norwegian Scientific Data Network (NorDataNet) is a distributed cross-disciplinary data management infrastructure providing the scientific community with integrated, cost-efficient and sustainable e-services for data management and publishing relying on established standards for data documentation, long term preservation, discovery and reuse. The main emphasis is on coordination of efforts and requirements across running data centres and infrastructures. This includes enhancing interoperability between these and NorDataNet, improving user interfaces for data search and retrieval, and development of toolboxes for data documentation to reduce technical and governance obstacles for data providers and consumers. The infrastructure provides online access to data and facilitates long term preservation, in order to maximise the benefit of public funds invested in the datasets. Existing institutional data management systems are linked through standardised discovery metadata and services enabling access to the relevant datasets regardless of location. While interoperability at the discovery level is achieved, interoperability at the data level is still pending for many datasets. The main priorities within this proposal for extension of NorDataNet are: (1) increased user interaction and education to increase the knowledge of FAIR data as concept, (2) enabling data providers to close gaps in FAIRness including data licenses, adequate metadata for reusability, use of standard vocabularies and correct implementation of standards, (3) showcasing the benefits of FAIR data and services for the scientific community through improved toolboxes and services integrating data with analysis tools, and (4) to prepare data repositories for integration with European services as developed through European Open Science Cloud and ENVRI.

Toolboxes and services will be based on open source software from the science community and capitalize on mature development environments such as VREs and Docker. The proposal is rooted in geoscience but is by approach interdisciplinary although focused on geolocated data with a temporal dimension. The approach is linked to the Open Data Directive and improved access to public sector data regardless of being research or management related.

Project number: 316468
Title: "Infrastructure for Precision Diagnostics for Clinical Cancer Trials;
InPreD - Norway"
Applicant (partners): OUS (OUS, HUS, UNN, St. Olavs Hospital, SUS, Ahus)
Project Manager: Hege Elisabeth Giercksky Russnes

Short summary:
A key element guiding modern cancer treatment is the ability to perform detailed molecular characterization of biological properties of each patient's disease – precision cancer medicine. During the last decade, clinical cancer trials have increasingly demanded extended molecular testing (incl. multidisciplinary diagnostics), but no dedicated national research infrastructure supporting such activities have been established. As a consequence, there is a gap between the opportunities for precision cancer medicine provided by advances in technology versus molecular diagnostics implemented in cancer diagnostics. A reform of practice towards precision cancer diagnostics and treatment requires controlled testing through clinical trials. The university hospitals in Norway have

built competence in individual technology areas, but in order to make these investments benefit the patients through clinical trials, interactions across disciplines must be improved and the competences and technology available nationally must be coordinated. A national Infrastructure for Precision Diagnostics (InPreD – Norway) will secure a robust, interactive structure facilitating clinical cancer trials on a national level by providing equal access to advanced diagnostics, state-of-theart competence and technology. It will be complementary to other infrastructures supporting clinical trials (i.e. NorCrin) and synergize with established technology-defined infrastructures. InPreD – Norway will facilitate Norwegian researchers to conduct molecular defined clinical trials at an international level, but will also enable interaction between Norwegian and international clinical trial groups in larger precision medicine multicenter trials. The infrastructure will secure faster transitions from research tools to diagnostic tests and will secure Norwegian cancer patients access to front-line medical treatment and at the same time provide multi-disciplinary research opportunities and allow new stake-holders, such as biotechnological industry and start-ups to connect to national infrastructures for clinical trials and pre-clinical research.

Project number: 316474
Title: Cerenkov Telescope Array-Norway
Applicant (partners): UiB (NTNU, UiO)
Project Manager: Anna Lipniacka

Short summary:
The Cherenkov Telescope Array Observatory (CTAO) will be a NEW international open observatory specialized in observing cosmic gamma rays from the entire Universe. It will have sensitivity 10 times higher than eXisting laboratories, and eXtremely rich scientific programme ranging from studying and mapping the very high energy phenomena in the Universe to the possible identification of the Dark Matter particles. Norway is active in the present pre-construction phase of the CTAO. and a member of CTA Consortium since 2012. There are faculty members at UiB, UiO and NTNU working on key science projects of CTA. The Norwegian CTA community has recently been strengthened by 2 FTE thanks to "Promising Young Researchers" grant from the Research Council of Norway. To fully eXploit our long-term investment, we need to join the construction phase and secure privileged access to CTAO data and discoveries. This is the goal of the present application.

Project number: 316479
Title: Electric Future Accelerator Initiative Laboratory
Applicant (partners): SINTEF ENERGI AS (NTNU)
Project Manager: Christian André Andresen

Short summary:
The vision of a zero-emission society is materializing in national and international policies and initiatives such as the EU Green Deal1. Strategy documents such as Energi212 and Digital213 outline the power system as a key component for the Norwegian transition towards such a society. A robust power system is critical to progress in the electrification of Norway. The future power system will also need to evolve according to present development trends often summarized through the 4 D's (Decarbonization, Digitalization, Decentralization and Democratization). In order to meet the ambitious goal of a zero-emission society, it is essential to research and develop technologies for operating the future energy infrastructure considering faster dynamics, tighter market interaction, a

larger degree of atomization, higher variability in both production and consumption patterns and a fundamentally increase in the level of digitalization in every part of the power system. ElectriFAI LAB will provide a research infrastructure to research, develop, test and demonstrate solutions for the future operation of the power system. The infrastructure will encompass the present needs for educational purposes (e.g. study programs in Digital Electrical Energy) and for research and development covering the TRL levels from prototyping to full-scale testing. The ElectriFAI LAB is a collaboration between NTNU and SINTEF, supported by major industry actors. The new infrastructure will partly build on existing laboratories as the National Smartgrid Laboratory4 and the ElPowerlab5, and partly develop new research facilities. The infrastructure project is organized in 5 infrastructure groups spanning from grid emulations to market simulators to Human-Machine-Interaction facilities all interacting to make one integrated laboratory environment. A national infrastructure covering these focus groups is identified to be needed to enable the development that makes the operation of the future power system robust and efficient.

Project number: 316482
Title: Infrastructure for MoBa
Applicant (partners): FHI (NDE, NTNU, UiO, UiB)
Project Manager: Jennifer R. Harris

Short summary:
This project will upgrade and expand the existing data infrastructure for the Norwegian Mother, Father and Child Cohort Study (MoBa). MoBa is a nationwide-pregnancy cohort that is well-recognized as one of the most unique and valuable health research resources ever created. Its ongoing genotyping effort of ~284,000 individuals will make MoBa one of the world's largest cross-generation genotyped studies specifically designed to address research questions beyond the scope of single-generation cohort studies. MoBa is a living entity; its scientific value will increase tremendously as the participants transition through their life course. The MoBa children will become parents, the MoBa parents will become grandparents. Capturing changes in health and well-being as participants age and expanding the study to include the next generation will enable new opportunities for powerful studies that are globally unrivalled.

Since its inception in 1999, MoBa has been developed as a national research resource. During the last 20 years its scientific scope has grown dramatically. MoBa has provided data and biological samples to more than 550 projects, at all the major Norwegian universities, smaller universities and numerous academic centers. MoBa data also feature prominently in international collaborations and consortia, spanning more than 20 countries and more than 60 thematic research areas. MoBa is also proving to be invaluable for the study of communicable diseases as witnessed by its centrality in monitoring the current corona pandemic. Most recently, MoBa data (genetic and non-genetic) are the basis for multiple new studies and research applications investigating risk factors for Covid-19 infection and severity.

During the lifetime of MoBa, dramatic advances have occurred both in the technologies associated with databasing and in the Norwegian health data landscape, as reflected by national strategy under the Norwegian Directorate for e-health (NDE). Dedicated funding is critical for MoBa to modernize and scale its infrastructure to meet the demands of these changes and manage all the MoBa data, including the newly generated genetic and health surveillance data. This expansion and upgrade will achieve a unified, strategically coherent, and cost-effective data management infrastructure (iMoBa)

founded on best practice, and the FAIR Data Principles. A critical component of the infrastructure will be the development of solutions enabling the full complement of the MoBa trio data to be hosted on the Health Analysis Platform (HAP). This will greatly increase the ability to make large amounts of high-quality digitized data available to researchers.

Project number: 316483
Title: Online Road Safety Measure Research and Decision Support System
Applicant (partners): TØI (Statens Vegvesen)
Project Manager: Alena Høye

Short summary:
In the proposed project we will develop an "Online Road Safety Measure Research and Decision Support System". This is a tool for conducting systematic reviews and meta-analysis of road safety studies and for publishing the results. It will build on the current Norwegian online version of the Handbook of Road Safety Measures which contains results from systematic reviews and metaanalyses of over 150 road safety measures and has been supported by the Norwegian Public Roads Administration and the Ministry of Transport. The developed system will allow efficient continuous updating of the Handbook, improve the transparency and accessibility of the results, both nationally and internationally, and it will facilitate their application for practical and research purposes.

The system will consist of three parts: A database, an analysis tool, and a publication tool. These will be developed in close cooperation with the Norwegian Public Roads Administration to ensure the practical applicability and usefulness in decision processes.

Project number: 316485
Title: National Geoscientific Data Infrastructure
Applicant (partners): NGU (UiT, NTNU, UiO, UiB, NP, HVL, UNIS, Store Norske Spitsbergen Kullkompani AS)
Project Manager: Johannes de Beer

Short summary:
"our habitable environment today depends on complex interactions between the surface and deep Earth, through rock, soil, rivers, oceans and atmosphere"[1]

The above quotation reflects on some of the core challenges of our time: climate change, sustainable resourcing of the world and preserving natural diversity and ecosystem services. Understanding the Earth System is a key to forming strategies and policies to face those challenges. The Earth Sciences collectively cover a broad area of relevance to the UN Sustainability goals and are crucial for providing research and data necessary for the transition to a more sustainable, low emission society, and for handling the risks and hazards paving the road toward such.

The Norwegian Geoscience community carries out research within the fields of understanding the deep dynamic processes in the earth; understanding the surface processes and landscape development; climate change and paleoclimate; primary and secondary (recycled) mineral resources; soils and agricultural resources; natural geochemical background and impact of anthropogenic pollution; groundwater; nature types and systems; marine geology and interactions with ecosystems; sea floor mineral resources; hydrocarbon resources and geohazards (in Norway: landslides and

earthquakes). Collectively, this research has a steadily increasing impact on the choices we make to develop a society where the needs for human welfare are well integrated with a reduction of our environmental footprint. Through more than 100 years, millions of physical samples (rock specimens, fossils, drill cores, soil samples, etc.), geoscientific analyses and observations carried out by many institutions, have provided a large amount of data. The collective research potential provided by this geoscientific data is of national importance, both for scientific research and for applied research and development. Yet, there is a conspicuous lack of a nationwide infrastructure for both physical and digital storage of geoscientific data, including a national data management system. Absence of this infrastructure effectively hinders the findability, accessibility, interoperability, and reusability (FAIR-principles) of geoscientific data, one of the major pillars of the Norwegian Government's research strategy[2].

The National Geoscientific Data Infrastructure (NGDI) will provide the necessary e-Infrastructure to enable geoscientific research data to be managed and curated in such a way that full advantage of their potential for a wide range of applications can be achieved. NGDI will support and enhance the management and data sharing capabilities of research institutes, museums and universities that operate physical storage facilities and carry out geoscientific research. As recently commented in Nature: Store and share ancient rocks; geological samples must be archived for all if we are to solve the riddles of Earth's complex history[3].

Project number: 316487
Title: ELIXIR3 - Strengthening the Norwegian Node of ELIXIR
Applicant (partners): UiB (UiT, NTNU, NMBU, UiO)
Project Manager: Inge Jonassen

Short summary:
With the ELIXIR3 proposal, we apply for funding to continue and to upgrade the operation of ELIXIR Norway, the Norwegian node of ELIXIR, the European research infrastructure for life science data, an ESFRI Landmark. Within the ELIXIR3 project, we seek to intensify our support towards users working with human data and precision medicine, biodiversity, and also users integrating data from several 'omics data sources. Alongside with this, we will continue and upgrade our operation as the Norwegian bioinformatics infrastructure, by offering an e-infrastructure platform for storing, sharing and analysing data, to provide bioinformatics user support, including data management support, at different levels, with tailored workflows to ease analysis, and training in using our tools and resources. Furthermore, we will contribute to the operation of ELIXIR on a European level and to provide tools and data resources that form part of the ELIXIR portfolio of services. Open processes, involving external scientific review, will be set up to allow bioinformatics research groups at the institutions owning the infrastructure to apply for their resources to be included and supported in the set of services provided by the Node. Our data management activities as part of the BioMedData infrastructure will be integrated into ELIXIR3 when BioMedData ends in 2023. Throughout our activities, work will be done in coordination and collaboration with relevant research infrastructures, including data generating platforms, domain-oriented networks and infrastructures, the generic e-infrastructure provider Sigma2, as well as Digital Life Norway. Outreach and training activities will be coordinated with national research schools and institutional educational programs.

Project number: 316488
Title: Research infrastructure for preventative care
Applicant (partners): USN (Norway Health Tech, Nova Discovery, Vestre Viken Hospital Trust)
Project Manager: Hilde Eide

Short summary:

Preventable non-infectious chronic diseases cost the EU countries more than €700 billion each year in terms of management. This burden can be reduced if the value chain is re-designed to give more attention to prevention and prediction with corresponding economic benefit and improvement of citizens health. The development of Health Tech and drugs has a new paradigm: human in silico trials. We are proposing to build a new research infrastructure for preventative care (IT-Prevent) by applying in silico modelling and simulation (M&S) to prevention, prediction and self-management. USN will build on its current assets to provide the foundations for the ITPrevent Platform, enabling early collaboration between existing research infrastructures, municipalities, health care providers and industry. Specifically, IT-Prevent will start by requesting proof of need for their idea from candidate teams combining industry with health & social care providers. Proposals will be assessed against criteria for prevention and predictive products (apps and devices) and related services. If proof of need is demonstrated then IT-Prevent will support testing proof of concept, technology validation and technology validated in virtual environments using in silico testing.

Project number: 316491
Title: GeoCloud Research
Applicant (partners): NGI (NTNU, NGU)
Project Manager: Kristoffer Skjolden Skau

Short summary:

The GeoCloud database will consist of geotechnical data from lab tests and field investigations and be available for research at NGI, NTNU and other national and international research institutions. The behaviour of soils is characterized and described based on experimental testing. Most research within the field is therefore dependent on a firm experimental basis. However, both laboratory testing and field investigations are generally costly and therefore often too limited in research project. This weakens the scientific basis and quality of the research within the field of geotechnics. Smaller research groups and industry players in Norway without capacity to perform field investigation and host advanced geotechnical laboratories is therefore constrained from innovation and development with basis in geotechnical data. This would be significantly improved if historical investigation and experimental data were made accessible to researchers

The use of machine learning (ML) and Big Data analyses are currently on the rise within the field of geotechnical engineering. The recent years, NGI and NTNU have hosted PhDs and executed several research projects, that apply statistical methods and ML techniques on geotechnical data sets to solve industry relevant problems. A clear outcome of these projects was that the strength of the methods and analyses could not reach their potential due to limited data and poor data quality in the empirical data sets. A data platform able to relate the information of soil materials across parameters such as test methods, geographical location and time will boost the data driven research within the field.

Project number: 316492
Title: Forskningsinfrastruktur for miljø- og ressursdata for bærekraftig innovasjon (LCA data)
Applicant (partners): ØSTFOLDFORSKNING AS (NMBU, PRé, NILU, NIFU, SINTEF, Treteknisk, IFE, Asplan Viak)
Project Manager: Ole Jørgen Hanssen

Short summary:
The NorEnviro infrastructure project will be based in the infrastructure project proposal from 2018, with main focus on developing and implementing a research infrastructure for environmental and resource data (LCA data) of relevance for Norwegian research organizations, for the Norwegian business sector, business organisations and governmental authorities and for higher education. There is a strong need for making available high quality LCA data to support sustainable innovations in all sectors, where the food sector, the building sector, the energy sector, mineral and metal producers will be given high priority. The research infrastructure is of high relevance for future EU-funded research projects as well as national projects and is vital to change from a linear fossil-based economy, towards a circular and biobased economy. Compared with the proposal from 2018, there will some significant changes in this application, as Østfoldforskning in collaboration with PRé has moved on with development of stage I in the technology for data management and data sharing, as well as with developing the systems and routines for data verification and meta data system, and started work to systemize existing data available in Østfoldforskning from some ongoing and newly finalised projects (e.g. Exilva project, Sustainable Biogas Systems etc). In collaboration with NMBU, data sharing is also tested at a stage I level for data from Norwegian livestock production, developed through the ongoing Livestock project financed by the Research Council.

Project number: 316493
Title: Norwegian Marine Data Centre - Interoperable Infrastructure
Applicant (partners): HI (NERSC, NP, NIVA, MET, NORCE)
Project Manager: Helge Sagen

Short summary:
"Seamless access to marine data" is the vision of the national research infrastructure Norwegian Marine Data Centre (NMDC) established in 2011. Marine research is by nature multi-disciplinary, combining physical, geological, chemical, and biological knowledge and data. High quality and efficient marine research require easy and rapid access to marine data across institutions and disciplines. Since the inception of NMDC, the volume, velocity and veracity of data captured by new sensors and observing networks have grown exponentially. In the same period, a need has emerged to support reproduceable science and provide a strong foundation for decision-making in public and private sector. To meet the new demands, NMDC will extend its capacity to operationalise the flow of measurements from the ever-increasing number and variety of instruments to quality-controlled datasets, following best practices for marine data and the widely accepted FAIR principles for data management.

Through the proposed extension, the NMDC infrastructure aims to give seamless access to marine data by delivering interoperability between distributed data centres, offering human and machine friendly interfaces for data processing and documentation, access and archiving. The infrastructure simplifies the technical obstacles scientists encounter when finding and using data from various sources. To provide a cost-effective solution for data providers NMDC is ensuring proper long-term

stewardship for data, bridging the extensive knowledge of marine data providers with that of data managers. Documenting and storing marine data in a sustained infrastructure will contribute to uncovering information hidden in previously inaccessible historical datasets, allowing scientists, marine operators and decision-makers to analyse long time series of important ocean variables. NMDC will continue to mobilize data that was previously unavailable, in close collaboration with marine data providers to make their valuable datasets publicly available in a form that allows reuse in science, business and society. To increase the use and uptake of NMDC, an open call mechanism will be established where external parties can bid for funds to develop an application utilising NMDC datasets and services. These applications, which can also utilise data from other data infrastructures such as EOSC and SeaDataNet, will showcase how the marine community can benefit from a FAIR compliant national data infrastructure for marine data.

Project number: 316496
Title: Research and clinical infrastructure at Oslo SPeLL (Oslo SpesialPedagogikk- og LæringsLab)
Applicant (partners): UiO (UiB, NUBU, UiO, Sunnaas, Statped, OUS)
Project Manager: Vasiliki Diamanti

Short summary:
OSLO SPeLL was established at the Faculty of Educational Sciences, UiO, with the aim of providing support for research, education and clinical activities. This application is about the procurement and development of infrastructure to support these activities. We have 3 focus areas that need support: (a) Creation of digital tests for assessment. It is of great importance that researchers across disciplines gain access to standardized, validated, normed, and user-friendly digital tests through a national platform. Target groups include researchers and practitioners in educational science, psychology, health and medicine. (b) Creation of a searchable word database for clinical and research use. This is crucial in research related to language, including language development, developmental linguistic disorders, language difficulties in the context of pervasive developmental delays, specific learning difficulties in reading and/or writing. It will also be an important tool for the development of digital tests (a) in relation to languages. (c) Procurement of eye tracking equipment for basic research in social, educational and medical sciences and alternative communication methods. Eye tracking can also be used to examine cognitive processes, or medical and health conditions. The procurement of a new eye tracker will increase OSLO SPeLL's capacity to serve researchers whose work aims at gaining a deeper understanding of, among other things, reading and writing skills, language skills, mathematical skills, communication difficulties, and developmental difficulties. Many of our national partners do not have access to expensive and advanced eye tracking equipment and they lack the requisite expertise. Through OSLO SPeLL they will be able to use such methods in their own research.

Project number: 316498
Title: Infrastructure for the Digitalisation of Process Industry
Applicant (partners): SINTEF AS (USN, NORCE, Nofima, UiA)
Project Manager: Frode Brakstad

Short summary:
The INDIGO infrastructure will unite interdisciplinary competence in digitalisation and industrial processing, to build a national infrastructure that enables advances in land-based process digitalisation, including research in novel robust sensor technology and advanced analytics and modelling. This research will be supported by an advanced e-infrastructure that allows large-scale

testing of technology and online process characterisation, including data visualisation, management and security.

Why digitalise? There is undoubtedly an international drive for digitalisation in the process industry, as seen by the number of white papers and reports 1,2,3,4,5. Digitalisation, which includes smart sensors, Artificial Intelligence (AI), Machine Learning (ML), Big Data, the Internet of Things (IoT) and Autonomous Systems, gives the potential for:

- Optimisation of recipe specification and raw materials feedstock into the processes and formulations
- Improvements to process control, resolution of quality issues, and equipment failure prediction
- Increased throughput, boosted yield and reduction of energy use x Improved exploitation of food raw materials and less food waste
- Process insight generation through online data and analytics

The vision of process digitalisation and the potential benefits is more or less adapted by the process industry. It is, however, a vision that is hampered by challenges, and requires a new way of researching and developing. INDIGO will address the challenges several industry sectors face when progressing to digitalised processes. One of the main critical pillars of digitalisation is the online data, often generated by sensors that link the physical data to the process analytics. Chemical and metallurgical processes expose sensors to harsh environments such as high acidity, high temperature, high magnetic fields, and scaling damage. The food industry struggles with natural variation of raw materials, seasonal variation, and hygiene constraints, and the challenge of obtaining reliable quality measures of highly heterogeneous biomaterials. The simple fact is that many of these challenges become evident over time and are not addressed by short term testing and demonstrations. The ability to conduct long-term testing in real online environments, with advanced analytics of large datasets, combined with theoretical models of the process, will open up a new form of research in digitalisation that will enable different sectors to benefit from each other.

Project number: 316501
Title: Living Norway Ecological Data Network
Applicant (partners): NINA (NTNU, UiO (NHM), UiB, NMBU, NIBIO, NIVA, NBIC)
Project Manager: Erlend Birkeland Nilsen

Short summary:
The accelerating degradation of our planet's ecosystems and the associated biological diversity is among the main present-day societal challenges, and cutting-edge ecological research is increasingly needed to describe, understand and mitigate these challenges. There is currently a severe mismatch between data availability and research needs, and a general agreement within the environmental research sector that improved data management following FAIR principles would be greatly beneficial to the scientific progress. It is therefore a dire need for an infrastructure that mobilize data from research projects and monitoring programs collecting data about the state and functioning of our biosphere. Living Norway Ecological Data Network is a direct answer to this challenge, and will be in high demand by the research community. To this end, Living Norway Ecological Data Network will:

- Serve as the main data-infrastructure for ecological data, including software to prepare, map, publish and archive data through established e-infrastructures, retrieval of data relevant for state-of-the-art ecological research, and held desk services supporting the community.
- Serve as a hub facilitating the necessary cultural transformation and increasing the human know-how with respect to data sharing and FAIR data management in the ecology community.
- Contribute to continued development and implementation of open standards for ecological data, making them more widely applicable and used in ecological research.
- Work closely together with the Norwegian GBIF node, and serve as an extension for mobilizing new data types that are needed for state-of-the art ecological research.

The consortium consists of eight institutions that together represent the breadth in Norwegian ecological research. Our ambition for Living Norway is that this will be the core hub for Norwegian ecological data in science and society.

Project number: 316505
Title: e-INFrastructure fOr e-health research aNd InnovAtion
Applicant (partners): BERGEN HF (Helse Vest IKT)
Project Manager: Tine Nordgreen

Short summary:
The vision for the e-INFrastructure fOr e-health research aNd InnovAtion (INFONIA) is to improve public health through research on e-health interventions. INFONIA will facilitate e-health research with the aim to improve mental, behavioral and physical health within the context of collaborative and distributed primary and secondary healthcare services. The research on digital prevention and treatment requires an accessible einfrastructure where digital interventions can be developed and evaluated. This infrastructure should be available to clinical expertise and research projects in order to reduce the need for technology-development in every single clinical e-health project, and consequently increase the cost-effectiveness in e-health. Our goal is to offer cross-disciplinary e-health-research teams (users, health personnel, health researchers, Information Communication Technology (ICT) researchers, and ICT industry, a secure, accessible and reliable infrastructure where sensitive digital health data can be collected, stored, shared, analyzed, and fed back to the users and health care providers. This includes the possibility to quickly and thoroughly gather evidence on the effects of e-health interventions by supporting clinical trials.

The INFONIA infrastructure will move the e-health research in Norway, including international partners, well beyond state-of-the-art. The infrastructure will also have a positive impact on the society at large: Two thirds of the Norwegian population asks for more digital communication with the health services. However, the existing research infrastructure do not facilitate our abilities to reach these ambitions. For the public sector INFONIA will increase the access to evidence-based e-health interventions. Increased digital collaboration will provide the patients with long-term needs a seamless chain of health care across services: primary, secondary, somatic and psychiatry. As a long-term impact for the industry, INFONIA will provide easier access for SMEs in general by defining a technological infrastructure with application programming interfaces (API's) which allows the integration of solutions from third parties. This will stimulate innovation in private sector resulting in high-quality e-health related products.

Project number: 316509
Title: Digital extension of the Zero Emission Building and climate adaptation laboratories
Applicant (partners): SINTEF AS (NTNU)
Project Manager: Berit Time

Short summary:

Climate change is a grand challenge that has been referred to as a `super-wicked' problem, because of the scale, scope, and time horizon of which mitigation and adaptation efforts must take place. It requires a collective action among multiple and diverse organizations. Laboratory and field measurements, simulation techniques, semi-quantitative interviews and observation studies are all necessary to pave the way for new innovative solutions.

The *ZEBextend* research infrastructure aim to bridge interdisciplinary challenges regarding zero emission and climate adapted buildings and close-proximity infrastructure.

The *ZEBextend* research infrastructure will encompass physical and digital infrastructure consisting of
- An entry point for industry to the *ZEBextend* research infrastructure. This will enable design, development, testing, safety assessment, and upscaling of climate adapted, zero-emission solutions and components for buildings and adjacent infrastructure/power-grids. This will be done through front-end development and industry outreach which will provide industry a *digital map* with information and give easy access to the testing facilities they need for their specific purpose. Data analytics infrastructure and visualization will be included in this.
- A digital infrastructure comprising a dynamic and digital copy of the physical laboratories : a so-called constellation of "digital twins" (See Figures 1 and 2). This will strengthen cross-disciplinary coordination between laboratories and research communities and will support the industry into its digital transformation in the context of Internet of Things (IoT), Industry 4.0 and Industrial Internet of Things (IIoT).
- An extension of existing physical infrastructure for characterization of efficiency and climate-robustness of renewable energy harvesting (e.g. BIPV) and storage (electric/batteries) systems. This will support the industry into its green shift transition.

Within the research topic of energy use in buildings, an extensive physical infrastructure[1] has been built up around previous and ongoing Research Centres for Environment-Friendly energy, FME *ZEB (Zero Emission Buildings)* and *ZEN* (*Zero Emission Neighbourhoods in Smart Cities)* and the Center for Research-Driven Innovation SFI *Klima 2050 (Risk reduction through climate adaptation of buildings and infrastructure)*. Amongst them, the *ZEB Laboratory* is a full-scale commercial building for exploring individual components and materials in practical use that will be completed in 2020. All these physical labs will constitute the core of the *ZEBextend* laboratories.

Covid-19 measures
In light of the Covid-19 situation we see a risk for reduced willingness from industry to participate in research and innovation projects. This can lead to a critical reduction of industry projects related to the *ZEB Laboratory*. We also apply for funding for the basic operation of the *ZEB Laboratory*, due to these extraordinary circumstances.

Project number: 316510
Title: Infrastructure for Norwegian Rock Art Research
Applicant (partners): UiB (UiO, NTNU, UiS, MUSIT, Universitetsmuseenes IT-organisasjon; Alta Museum, World Heritage Rock Art Center)
Project Manager: Trond Klungseth Lødøen

Short summary:

The ImAge project (Infrastructure for Norwegian Rock Art Research) will establish a national infrastructure for advanced research on prehistoric rock art, available for archaeological and interdisciplinary approaches. This will be achieved by implementing a digital infrastructure where virtual access, dissemination, and visually displayed georeferenced past imagery – in its landscape setting – will be the objective. Among the deliverables are interactive databases with detailed image information, digitised historic documentation and high-resolution 3D-scans from Norwegian rock art sites. Increased capacity to observe, share and use data for research from larger numbers of locations, even remote sites, will be a major contribution by ImAge. The infrastructure will open for multivariate, deep learning, big data and other such analyses.

Rock art as such, are prehistoric images, potential memories and expressions of both ideology and belief systems made by past societies. It is part of our common cultural heritage, where digital documentation produces new value for future research. The rock art in Norway spans over several thousand years, from the Early Stone Age into the Early Iron Age, with great variation in location, motives, techniques and styles. As this tradition also encompasses great disparity across time and space, it provides insight and addresses issues of cultural change. Collection and documentation of rock art in Norway started in the early 19th century and has undergone enormous changes from initial pen on paper depictions, via plastic tracings, photos, some digital documentation and will by ImAge be brought further into the digital age.   The digital national infrastructure for Norwegian rock art will be achieved by the combination of three processes: 1) produce new high-resolution 3D scans and photogrammetry of rock art sites and images across Norway, 2) harmonize information in available digital archives, integrated into unified digital database solutions, and 3) digitise all analogue rock art archives at host and partner institutions. The end-result of ImAge will be databases and digital archives that facilitate and interconnect large numbers of sites, individual motives, compilations of images and types of documentation – thus enabling analytical search and advanced research procedures for Norwegian rock art. Information accessible by the ImAge-implementation will be available for both researchers, heritage management, people in general, and open new possibilities for research on rock art in a modern and unprecedented way. The project follows up on the very recent White Paper (St.meld 16, 2019-2020), where digital infrastructure is pointed out to be significant for the future of culture heritage in Norway as an asset for both research and management. The new infrastructure will be integrated and later maintained by MUSIT – the national infrastructure for the university museums in Norway.

Project number: 316525
Title: Norwegian Chemical Palaeoecology Laboratory
Applicant (partners): UiB (NMBU)
Project Manager: Alistair Seddon

Short summary:

Palaeoecology uses the sub-fossilised plant remains preserved in sediments to reconstruct past ecosystem changes, and their responses to climatic variations and human activity, over thousands of years. Although keystone components of ecosystems (i.e. trees) can often have generation times spanning decades to centuries, standard Elong-term' ecological research projects only incorporate assessments of vegetation and other ecological changes spanning years-decades. Palaeoecological data are vital to fill the critical knowledge gap that cannot be addressed using traditional ecological techniques. Indeed, the information from sediment archives is the only way to obtain empirical information relevant for understanding long- term ecological dynamics and functioning.

Work by members of the Bergen Palaeoecology Laboratory and NMBU over the past 5 years has contributed to pioneering a new approach in palaeoecological research through the analysis of the chemical variations in the outer wall (exine) of the pollen grain, composed of a complex biomolecule known as sporopollenin. Sporopollenins are resistant to corrosion under anoxic conditions and can remain chemically stable for millions of years. Evidence is also accumulating that the chemical variations of sporopollenin, in addition to other components of the pollen grain, may vary as a result of both changing environmental conditions and phylogeny. As a result, the analysis of biomolecules in sporopollenin has the potential to revolutionise palaeoecological research- through new techniques in identification, and for the reconstruction of new environmental variables (e.g. UV-B radiation). However, the infrastructure and access to reproducible workflows is relatively underdeveloped for the application of pollen chemical techniques, both within Norway and internationally.

This infrastructure grant aims to develop Norwegian capacity for a fully integrated network of instrumentation and expertise to develop the application of chemical analysis of pollen grains for a suite of palaeoecological applications. The end result will be a world-leading centre providing access to the full spectrum of a state-of-the-art research tools to enable research projects based on (i) developing new chemical-based proxies for palaeoclimate reconstructions; (ii) developing new workflows for chemical based analysis and identification of microfossils in sediments; and (iii) tools for the integration of multiple-sources of information (traditional light-microscopy methods; vibrational spectroscopy and py-GC-MS; ancient DNA; and other multi proxy information). In addition, much of the equipment purchased has widespread applications across numerous research themes relevant across Norway, specifically for research into environmental microplastics, biotechnology, microbiology and animal and veterinary sciences, and biomedicine.

Project number: 316526
Title: Smart Mobility
Applicant (partners): NTNU (NORD Unviersitet, SINTEF, Trøndelag County council, Stjørdal municipality)
Project Manager: Frank Lindseth

Short summary:
The infrastructure Smart Mobility aims to become an innovative and forward-looking testing arena and research centre for regional, national and international players in the future car and transport system. The key focus areas and associated infrastructure will be concerned with R&D in modern vehicle technology using alternative fuel (such as electricity), intelligent transport systems (ITS), traffic safety, new charging technologies (such as inductive charging), automated driving processes and fully autonomous driving (self-driving). The infrastructure aims to become the world's first test laboratory that can offer "four seasons" testing opportunities on the same day. The infrastructure will contribute in achieving goals within transport safety, increased efficiency and sustainability, and big data analysis.

Project number: 316530
Title: EBRAINS Norway: Norwegian Node of the European Research Infrastructure for Brain Research and Brain-Inspired Sciences
Applicant (partners): UiO (NMBU)
Project Manager: Jan G. Bjaalie

Short summary:
The scope of this proposal is to establish a National node in EBRAINS: the European distributed Research Infrastructure (RI) for brain research and brain-inspired sciences. EBRAINS is currently a platform (https://ebrains.eu) developed by the EU Flagship Human Brain Project (HBP), with funding until 2023 and continued support for basic infrastructure through other ICT funding mechanisms. Seven institutions from across Europe, including the University of Oslo, have established EBRAINS AISBL (an International Non-Profit Organization based in Brussels, Belgium) to facilitate the effort of transforming the EBRAINS platform into a distributed RI on the ESFRI roadmap. The EBRAINS RI will lay the technical foundations for a new model of ICTbased brain research, driving integration between data and knowledge from different disciplines, and catalysing a community effort to achieve a new understanding of the brain, new treatments for brain disease and new brain-like computing technologies. Through a range of services, allowing researchers to collect, share, access, analyse, and integrate brain data, and to perform modeling and simulation of brain function, EBRAINS will allow creation of the necessary synergy between the (often fragmented) different national efforts to tackle one of the most challenging targets of research: understanding the brain in health and disease. Users of EBRAINS will be basic, computational, and clinical neuroscientists, as well as developers of brain-inspired technologies for AI. Norway holds a leading role in the ongoing EBRAINS infrastructure developments. Within the distributed RI, the Norwegian Node at UiO will contribute to services in the domain of Data and Knowledge (FAIR data services), Brain Atlases and related analytical workflows, with partner NMBU contributing to Modeling and simulation services and the organization of the pan-European EBRAINS High-Level Support Team. With Norway being an active participant in EBRAINS, all researchers in Norway will have access to all services provided by EBRAINS.

Project number: 316540
Title: Norwegian technology platform for industrial macroalgae cultivation and utilization (MACROTECH)
Applicant (partners): SINTEF OCEAN AS (NTNU, SINTEF Industri)
Project Manager: Aleksander Handå

Short summary:
Cultivation of the oceans is required to meet demands for food, feed, materials, and energy for a growing global population. Norway, with one of the world's longest tempered and productive coastlines, can take a leading role. The Norwegian technology platform for industrial macroalgae cultivation and utilization (MACROTECH) will provide research groups and industry with 6 nodes to facilitate testing and development of enabling technologies in order to scale up the macroalgae value chain: 1) Land farms, 2) Sea farms, 3) Simulation and surveillance, 4) Vessels and logistics, 5) Preprocessing and storage and 6) Processing and products. With 10 years of RCN-funded research accomplished, Norway has created an interdisciplinary knowledge basis on macroalgae cultivation biology and technology, processing, and product development, to make significant steps towards industrial cultivation. The annual global production of macroalgae has exceeded 30 million tons and is mainly based on manual labor. The results of the RCN-funded knowledge platform MACROSEA (SINTEF-lead, www.macrosea.no) indicate that Norway has the potential to produce 70-220 tons of macroalgae per hectare. Mid-Norway alone has the possibility to cultivate in the order of 20 million tons (fresh weight), which in turn results in 2 million tons of dried raw materials. Large food and feed companies are ready to invest in macroalgae-based products, but neither product formulas nor the biomass supply chain exists at industrial scale. The RCN-funded knowledge platform Norwegian Seaweed Biorefinery Platform (NTNU-lead, www.seaweedplatform.no) will advance research on processing and product development to unlock this potential. MACROTECH will provide research infrastructure to enable the development of new and standardized technologies for upscaling and cost reduction along the macroalgae value chain. Integrating new macroalgae knowledge centres such as MACROTECH with research environments and industry will promote world-leading innovation clusters, advance research and accelerate industrial growth. Industrial scale production of macroalgae may be a major contributor to innovative and climate-friendly solutions, a green transition, and the movement towards a low-emissions society to fulfill the Paris Agreement. Investment in a research infrastructure is a prerequisite for success.

Project number: 316541
Title: European Plate Observing System - Norway (EPOS-N) Phase-II
Applicant (partners): UiB (NORCE, NORSAR, NGU, NMA, NGI, UiT)
Project Manager: Kuvvet Atakan

Short summary:
EPOS-Norway (EPOS-N: www.epos-no.org) is the Norwegian node of the European Plate Observing System (EPOS) ERIC (www.epos-ip.org) – a distributed research infrastructure for Solid Earth Science in Europe. The goal of EPOS-N is to gather all Solid Earth Science data in Norway and to make this data available and accessible to the full geoscience community and public through the newly developed EPOS-N Portal. The first phase (Phase-I) of the project is now in its final year (2016–2020). In this proposal, we apply for funding for a second phase (Phase-II), where we expand with new partners, new datasets, and a wider range of applications. The added expertice of these new partners along with new equipment will significantly enhance the monitoring capacity within Solid

Earth Science in Norway and the Arctic. In this proposal we aim to address the increased political and economic interest in the Barents Sea, the Svalbard Archipelago, and the surrounding areas. In EPOS-N Phase-II, an enhanced solid Earth monitoring capacity, together with access to a national solid Earth science database, will allow to establish a baseline in the Arctic for studies on geohazards and georesources. This is especially important seen from environmental perspectives.

In Phase-II, we will improve the monitoring in the Arctic by procurement, installation, and facilitating data access from the following: Broadband Ocean Bottom Seismometers (OBS) for earthquake monitoring and subaerial slope instabilities in fjords (tsunami hazard), broadband seismometers for a new seismic array in Finnmark (seismic hazard) co-located with infrasound sensors for environmental monitoring, short-period seismometers for cryospheric research (climate change studies), magnetic observations and airborne electromagnetic instruments for a range of geoscience applications.

EPOS-N Phase-II involves new partners: The Arctic University of Norway (UiT), Norwegian Geotechnical Institute (NGI) and a new group from NORCE (formerly Norut). In addition to the seismological, geodetic and geological/geophysical databases implemented in Phase-I, extended data and services from the new partner institutions will include: Geomagnetic data (Tromsø Geophysical Observatory, UiT), rock physics laboratory data for Earth's internal and atmosphere processes (Rock Physics Laboratory, UiT), InSAR data – integrated InSAR/GNSS velocity datasets, gravimetry data (NGU), OBS data (mainly campaign-based data collection offshore, including submarine slope instability surveys to improve knowledge of the tsunami hazard potential), and borehole data (energy-related boreholes and shallow boreholes for groundwater, and NADAG – National Database). A particular focus is dedicated to developing eInfrastructure for providing access to tsunami hazard models (NGI) within Norwegian fjords – a major societal concern and interest.

Project number: 316543
Title: Artistic Research and Innovation InfraStructure
Applicant (partners): UiB (NMH, HK, KHiO, NENU, UiS, INN, HIØ, USN, MCB)
Project Manager: Anne-Helen Mydland

Short summary:
There is no existing digital research infrastructure for Artistic Research (AR) which fulfils the needs for storing and archiving the research process and results. Neither any coherent platform for rights clearance of artistic content. Thus, leaving the research discipline of artistic research unable to fulfil its obligations for storing and sharing research as well as answer to the expectations of open science. There is also a need for infrastructure that is suitable for digital coproduction and communication, and for sharing high cost digital tools or equipment cross-national institutions. The need for this project and a digital infrastructure is therefore evident for all the AR disciplines, and the ARIIS project aims to fill this gap. ARIIS represents a state-of-the-art infrastructure for AR for high-resolution storage of multimedia content and with shared access to tools for creation, production, publishing and dissemination. Furthermore, ARIIS will inter¬connect researchers, creators, performers, expensive HW and venues across Norway in a way that never has been possible, and thereby, create a national distributed community for AR in a way that allows them to work together and produce internal and external research and events, as if they were located in the same building. The ARIIS network will unite all AR institutions, staff and students in Norway, and will thereby contribute to more efficient research cooperation and dissemination. ARIIS can also be widely used by other research environments where data modelling, audio/image high-resolution documentation, IPR and

communication are central tasks, and thus contribute to a ground-breaking, generic infrastructure solution for IPR/Copyright/Privacy protection and data management. The cross-sectoral relevance is evident in the cultural sector, especially museums and creative industries. The need for digital archiving and access to the collections, events or sites has become even more evident during the COVID-19 period. ARIIS will potentially have a significant effect on the Norwegian creative industries, currently characterized by a high number of free-lance workers who are in a vulnerable position with respect to protecting their artistic intellectual rights and copyrights. Creative industries and museums can hire the ARIIS infrastructure components for archiving, innovative solutions for production and performances; independently or in cooperation with the Norwegian AR community, and will thus provide an incentive for establishing knowledge clusters. ARIIS will provide the required tools and expertise for protecting rights and as a "state-of-the-art infrastructure for hire" for creators, producers, publishers, distributors, and event organizers. ARIIS could thereby represent a reference project for other countries, and be the first step towards a potential EU-project.

Project number: 316545
Title: ECCSEL Virtual laboratory
Applicant (partners): SINTEF ENERGI AS (SINTEF Industri, IFE, NORSAR, ECCSEL ERIC)
Project Manager: Francesco Finotti

Short summary:
ECCSEL V-lab aims to help tackle the remaining gapstowards large-scale deployment of CCS and realise the RCN's vision of ensuring that

 resources are opened to all relevant research institutions and industries in the country. It will do so by guaranteeing high-quality, industrially relevant data generation from national research infrastructures and ample data sharing both nationally and internationally, levering on international research cooperation entities from NCCS and ECCSEL ERIC.

ECCSEL V-lab responds to (a) the need for coordination and integration of existing ECCSEL infrastructures, (b) the need to improve access to the RIs and enable an integrated approach tothe EU FAIR (Findable, Accessible, Interoperable, Reusable) data policy, and (c) the need to ensure thecompetitiveness of Norwegian industry towards a sustainable future. ECCSEL V-lab is composed of two parts: (a) a digital infrastructure to provide a unified approach in sharing, processing, storing, and interpreting data generated from the activities of ECCSEL Research Infrastructures (RI); and (b) the first step towards Tiller Sustainability Lab, a National industrial-scale and competitive industry and energy processes. The digital infrastructure is divided into four user cases (UC), each addressing a specific portion of the CCS value chain. The UCs are designed to integrate relevant partner institutions, thus enhancing cross-institutional cooperation. The physical infrastructure addresses the vision of a national, industrial-scale research infrastructure for a sustainable industry.

Project number: 316548
Title: Norwegian e-infrastructure for research on LAM collections
Applicant (partners): NASJONALBIBLIOTEKET (Arkivverket, UiO biblioteket, UiB biblioteket)
Project Manager: Jon Arild Olsen

Short summary:

As research becomes increasingly data-driven, the humanities and social sciences need powerful digital infrastructures in order to remain relevant and help tackle the social challenges of today. Norway has long been at the international forefront of digitizing its documentary heritage. This includes text, film, photo, and audio from collections in libraries, archives, and museums (LAM). However, as recently pointed out in many research policy documents (e.g. Humaniora i Norge, Oppfølging av evaluering av humanistisk forskning i Norge, and Norsk veikart for forskningsinfrastruktur), a common infrastructure for searching, accessing, and analysing Norwegian LAM collections is sorely lacking.

The aim of the present proposition is to create a national distributed e-infrastructure – eLAM – that can realize the research potentialities created by the collective digitization efforts of the LAM sector. By offering coordinated access to digital collections as well as relevant tools and services for data extraction, processing, analysis, and management, the infrastructure will open up Norwegian LAM collections and allow researchers to detect and explore information and patterns that have previously remained hidden in isolated datasets.

The infrastructure will be developed by some of the main actors in the Norwegian LAM sector. Together, the collections of the National Library and the National Archives constitute the major part of Norwegian documentary heritage. The University of Bergen Library hosts important special collections and has taken steps towards a national coordination in this field. The National Archives hosts a national publication platform for archival institutions and museums. The participation of the University of Oslo Library and the University of Bergen Library ensures that the infrastructure is developed in close cooperation with and according to the needs of the academic community. eLAM will also be instrumental in developing natural language processing and artificial intelligence solutions in Norway. By adapting parts of the infrastructure to the public, eLAM will help spread knowledge and inspire public debate.

Project number: 316551
Title: SUSTAINHEALTH-workflow, an Infrastructure for Food, Health, and Sustainability
Applicant (partners): FHI (NVI, SSB, UiO, NFSA)
Project Manager: Helle Margrete Meltzer

Short summary:
Worldwide, transforming food systems in the direction of sustainability with a high priority on health and food safety is getting increased attention, and in Norway, several projects are or will soon be addressing various issues in this respect. The work processes towards those goals are, however, not as efficient as they could and should be, and lack of infrastructures supporting the workflows needed is a major obstacle.

Currently, we lack many of the tools for the comprehensive research and development work needed for concerted attacks on these problems in an efficient, persistent and quality-assured way. We need efficient access to co-ordinated and updated databases and metadata, and tools to utilize the data.

This project will provide the research community, actors in the food systems context, health authorities and general public with a data- and knowledge infrastructure that links diet, food, human and animal health, agricultural and environmental information and constitutes a basic element in a sustainability research and development toolset.

Overall aim: To build a data and knowledge infrastructure that supports transdisciplinary research and development, bridging food production, food security, food safety, health and sustainability.

Some of the specific aims: **1.** Develop a distributed infrastructure in the form of an integrated network of services on both the provider and user side. A workbench approach will furnish users and developers/maintainers with tools for developing, maintaining and using the services provided. **2.** Develop tools and methods to facilitate monitoring of the sustainability of food production and food consumption, in part based on a OneHealth approach, integrating and making optimal use of existing data sources and dataflows, e.g. Landbrukets dataflyt. **3.** Provide necessary access to food production and composition data, facilitating the development and use of validated dietary and health assessment tools for diet and health connections, and consistent with national health and biomonitoring surveys. **4.** Provide simple and standardized access to data on food production, composition and consumption for research, evidence-based advice, policy development and evaluation, in part supported by linkage with data on health outcomes.

The handling of sustainability will be based on the UN SDG indicator set and similar international initiatives. Being unique, scalable and internationally usable, this research infrastructure will facilitate high-calibre research and attract international partners, top researchers and students. The infrastructure will be useful for researchers within public health and health analysis and sustainability projects, and will be valuable to the public, health personnel, health authorities and a number of international bodies.

Project number: 316553
Title: Norwegian Digital Subsurface Lab
Applicant (partners): SINTEF AS
Project Manager: Ane Elisabet Lothe

Short summary:
Norway's O&G technology strategy for the 21st century calls for "Technologies and Innovation for a Competitive Norwegian Petroleum Sector", and the "Roadmap for Research Infrastructure" mentions digitalization of all petroleum industry disciplines and a need for infrastructure for improved subsurface understanding as priorities. The Rystad Energy Report quantifies the huge potential in value creation related to improved subsurface understanding. At the same time, the Norwegian government and European Commission underline the importance of a transition to a greener economy and sustainability, and we are at a point where a digital transformation and transfer of know-how and technology from oil and gas to more environmental-friendly, sustainable geoscience applications (e.g., geothermal energy, hydrogen/CO2/gas/heat storage, and water resource mapping) could help combat climate change and support UN sustainability goals. The Norwegian Digital Subsurface Lab (NorDigS Lab) targets all the above-mentioned challenges and opportunities by providing eInfrastructure for quality-assured subsurface data and interoperable open-source software. With NorDigS Lab, we want to establish a national arena for building expertise, sharing crossdisciplinary knowledge and data, and stimulating innovation related to digitalization in a range of subsurface applications. The goals of the infrastructure will be achieved by offering Norwegian scientists and students a unified platform for rapid/remote access to subsurface data and software,

and tools for machine learning and big data. In this way, the platform will support digitalization of the petroleum industry, transfer of knowledge from oil and gas to more sustainable and environmental-friendly subsurface disciplines, and it will be an asset for researchers/students in everything from small to major research efforts within a range of application areas. The initiative consists of: 1) establishing a new Digital Subsurface Data Platform following the Open Subsurface Data Universe standard and providing unified access to key data sets from, e.g., industry, NPD's Diskos database, and partners' proprietary databases; 2) establishing a new Digital Subsurface Software Platform, communicating with the Data Platform and offering a range of open(-source) interoperable subsurface software and standard libraries for big data handling and machine learning; 3) upgrading NORCE' web-enabled software infrastructure OpenLab and integrating this with the Data and Software Platforms.

Project number: 316557
Title: NTS Infrastructure
Applicant (partners): TØI (The Public Roads Administration (NPRA))
Project Manager: Trine Dale

Short summary:
In the proposed project, we will develop an online database for storing, managing, computing, analysing, and sharing travel behaviour data from Norway. This includes both previous and future surveys. The Norwegian National travel survey (NTS) is a central data source in both planning and research purposes in the transport sector. Since 1985, the survey has been carried out regularly, and the data are used by a wide variety of users. There are however, several issues with the current solution for gaining access to the NTS data. Firstly, the process can be tedious. Secondly, it is not straight forward how users should weight and filter the data in order to secure representativeness and validity.

We propose a database for storing and accessing the NTS data. Both previous and future surveys will be included in the infrastructure. This database will have several advantages compared to the current solution. The data will include the weights and secondary data needed to get meaningful results. At the same time, the available data will be sufficiently anonymized. We will also build in statistical filters, that prohibit the extraction of small sub samples with low representativeness. The infrastructure will be developed and maintained by the Institute of Transport Economics (TOI), in cooperation with The Norwegian Public Roads Administration (NPRA) and other partners and subcontractors.

Project number: 316562
Title: FAIR Data Management Plan
Applicant (partners): NSD
Project Manager: Katrine Utaaker Segadal

Short summary:
The FAIR Data Management Plan (FAIR-DMP) project aims to upgrade and improve NSDs' set of integrated tools and services for Data Management Planning, helping researchers and institutions in making their data FAIR and shareable. The portfolio of services consists of three tools with machine-actionable functionality: a Data Management Plan tool1, a Data Policy Manager2, and a Data

Management Plan Overview3 for institutions. The upgrade of these DMP services will include several new integrated support tools that will help researchers in planning for sharing their research data. The upgrades will include services such as: a license selector that will guide the researchers in selecting licenses for both open- and restricted data; a guide for identifying relevant metadata standards; a built-in guide for estimating storage and computing costs connected to data management; and a mechanism for assigning tasks, and setting roles and responsibilities regarding data management and data processing.

Additionally, the upgrade will build a system for turning all (final version) DMPs into FAIR Digital Objects4 by assigning them with a DOI5 and allowing researchers to publish them in a national public registry of DMPs.

An upgrade of this portfolio of services will contribute to cultural change with respect to data FAIRness and is an initiation towards a broader national FAIR ecosystem for keeping research data as open as possible and as closed as necessary.

Project number: 316563
Title: National bio-mechatronics infrastructure for ASSISTive and AugmeNting Technology in personalised healthcare
Applicant (partners): UiA (OsloMet, UiO, UiT, HVL, USN, UiS,I4Helse, NORA, NAIS, NOBIM, Sørlandet Hospital, Sunnaas Rehabilitation Hospital, SUH, NSCC, Norway Health Tech)
Project Manager: Filippo Sanfilippo

Short summary:
Vision and objective. The national biomechatronics infrastructure for ASSISTive and AugmeNting Technology in personalised healthcare (ASSISTANT) will be an interdisciplinary research infrastructure that focuses on the concept of human empowerment with support by technology, which will fundamentally improve human life. ASSISTANT will enable the exploitation of assistive and augmenting technology to provide personalised healthcare with shorter and efficient response times such that the costs are minimised, and patients can manage independent living. To achieve this, it is required to envision cross-disciplinary knowledge that cannot be found in a single research group and needs a transnational effort to reach a wide community of researchers, users, patients and practitioners. The necessary core discipline is biomechatronics. Moreover, different additional expertise are needed, such as eHealth, Robotics, Human-Machine Interaction (HMI), Internet of Things (IoT), Signal Processing, and cognitive Artificial Intelligence (AI). It is essential to synergistically integrate these disciplines working jointly to create new conceptual, theoretical, methodological, enabling and translational innovations that move beyond discipline-specific approaches. ASSISTANT will boost innovation, efficiency and sustainability in the field of personalised healthcare.

The overall objective of ASSISTANT is to establish a novel national research infrastructure that will encourage cooperation and networking across patients, practitioners, technology providers and service levels, to lay the foundations for better personalised assistive healthcare with shorter and efficient response times such that costs are minimised and patients can lead a more independent life with equalisation of social health inequalities. The objective of this infrastructure is twofold, first to developed the necessary national infrastructure comprising the leading institutions in biomechatronics, eBealth, robotics, BMI, information and communications technology (ICT), IoT, signal processing, and machine learning (ML); second, to establish a digital cooperative networking

framework to reach the desired wide community of researchers, patients and practitioners. This will contribute towards implementing the future of personalised assistive healthcare.

Project number: 316566
Title: SEFIRE: Research infrastructure for knowledge-building on societal health, security and sustainability
Applicant (partners): NIVA (NIVA, VEAS, NTNU, FHI, NILU, NMBU)
Project Manager: Malcolm Reid

Short summary:
Municipal wastewater (or sewage) is generally regarded as just waste with no real value. However, sewage represents an inexhaustible repository of information and is said to mirror society: disease [1], antimicrobial resistance [2], diet [3], human exposure to chemicals and environmental stimuli , micro-plastics [4], use of narcotics [5], and the impact of allergies can all be measured in sewage. In addition, the impact of most domestic and industrial activities, and modern living in general, are also part of the information included in sewage. Collectively, this allows for unprecedented holistic research into societal activity and wellbeing, and in turn allows informed management decisions regarding public health, pollution and security [6].

SEFIRE proposes to establish unprecedented national infrastructure to take advantage of this novel field of investigation and turn waste into research, societal improvement and value. The development of a near-real time national sewage surveillance system for the analysis and acquisition of these indicators would dramatically increase our ability to govern or manage timely and effectively and even predict future events [7]. While the scope may differ greatly between the fields of public health, environment and security, these fields share a common need for accurate data to aid research and ultimately make successful decisions and to measure the impacts of those decisions.

SEFIRE will also establish a tool to allow retrospective mining of information that could have been neglected before. By establishing a national centre for sewage-based services for use at research and governmental level, SEFIRE will increase the interaction between research infrastructures and improve the coordination of existing and future research and monitoring programs.

Project number: 316574
Title: Digital BioBank Norway
Applicant (partners): HELSE BERGEN HF (HELSE Bergen HF, SUH, Helse Fonna HF, UiB, HVL)
Project Manager: Hauke Bartsch

Short summary:
Establishing eInfrastructure for the national priority area of health has been a focus of Norwegian efforts for more than two decades. As part of these attempts to address computing- and data-intensive challenges at a national level we propose the creation of a central coordinating facility for a Digital Biobank in Norway (DBB-NO). The main purpose is to combine the efforts of individual hospital-based technological research environments in Norway, capitalizing on the latest international research developments. Combining the best local and international efforts and providing them on a national level allows every health research institution in Norway to access environments for the safe evaluation of the latest technology and provides nation-wide access to shared resources and expertise supporting individual and local efforts. Research projects can focus

on core expertise while benefitting from the best technology available. This integration of active research developments into hospitals is a requirement for the accelerated evaluation of novel solutions in clinically relevant settings, a fast-fail system that provides essential feedback to researchers and a platform for clinicians to learn about and demonstrate short-comings of proposed solutions, ethical- and privacy issues and edge-cases. The major benefit of DBB-NO is that it will lead to an accelerated cycle of technological development that does not have to focus solely on peer-reviewed publications and the involvement of incubator industry efforts before health-solution can be evaluated in a relevant environment. It will allow findings to be replicated across Norway and the distribution and integration of solutions to individual hospitals in the routine clinic and when facing urgent health crisis.

Project number: 316580
Title: Power-to-X systems lab at Tiller
Applicant (partners): SINTEF AS (SINTEF Ocean AS, SINTEF Energy AS, NTNU)
Project Manager: Kyrre Sundseth

Short summary:
The use of hydrogen and hydrogen-based energy carriers are gaining momentum both nationally and internationally, as a pillar to decarbonize transportation and the energy system towards 2050. Recently, GWscale hydrogen initiatives have been taken by several countries in Europe, boosted by the upcoming Covid19 EU Recovery Plan. Norway has world leading industry and research institutions with vast potential for value creation from development and future export of hydrogen technology and hydrogen and H2-energy carriers.

This proposal outlines a Power-to-X (P2X) pilot-scale systems infrastructure at Tiller in Trondheim for hydrogen and ammonia. The proposed infrastructure will facilitate for pilot-scale (100 – 1 000 kW) testing of electrolysis systems, ammonia and bio-oil processing, and end-use of hydrogen and ammonia in fuel cells and gas turbines. The proposed infrastructure will thereby complement existing infrastructure to create full test facilities along the entire value chains for hydrogen and ammonia. The value chains are carefully selected in dialogue with Norwegian industry to ensure the relevance and future utilization of the facilities.

The proposed infrastructure will allow Norwegian research institutions and industry to reduce costs, and to improve technology performance and lifetime of P2X systems. Focus is put on strategically important areas where Norwegian industry has competitive advantages, such as electrolyser technologies, ammonia, and systems engineering.

Currently, there is no such pilot infrastructure available, neither in Norway nor in Scandinavia. Even in the European domain such infrastructure is fragmented. While proof of concept has been demonstrated in most relevant technology areas, pilot scale validation and system optimization are crucial to provide for eventual market implementation. As an integral part of the proposed P2X-infrastructure, education of Master and PhD candidates (primarily linked to NTNU) is foreseen. Through open access, the infrastructure will be pivotal for generating innovation projects, increasing competence levels and boosting the industry's competitiveness.

Project number: 316581
Title: Enabling LHC Physics at Extreme Collision Rates II
Applicant (partners): UiO (UiB, HVL, USN)
Project Manager: Alexander L. Read

Short summary:
The Large Hadron Collider (LHC) at CERN is one of the most successful international scientific infrastructures in the world, in particular famous for the discovery of the Higgs boson. In the years to come LHC will be upgraded to enable more advance physics searches and hopefully discoveries. The new High-Luminosity LHC aim to start operation in 2027. The upgraded intensity leads to 2-10 times higher collision rates delivered to the experiments as well as higher radiation doses. Norway is member of ATLAS and ALICE, two experiments that both will need to enhance their detectors, trigger systems, and computing systems accordingly. The first part (step 1) of the ALICE and ATLAS upgrades, NorLHC, have been funded by the RCN infrastructure program for the period 2018-2022. We hereby apply for the funds for the second period 2022-2027 NorLHCII (step 2), which will allow us to complete the hardware upgrade of the LHC experiments ALICE and ATLAS and maintain and prepare and upgrade the e-infrastructure for the experiments in the same period. HL-LHC is part of the ESFRI roadmap.

The ALICE and ATLAS experiments at the LHC provide an internationally unique infrastructure to conduct research in high-energy physics, in which over 200 Norwegian scientist, engineers, PhD and Master students participate in the HENP and HEPP projects. For ALICE most of the NorLHC upgrade, comprised mainly of new readout electronics for the TPC and ITS sub-detectors, will be completed by spring of 2021. For NorLHCII the three innermost layers of the ITS will be replaced by super-thin wafer-size MAPS sensors, and a new forward calorimeter - FoCal - will be added in time for the high-luminosity running to start in 2027. For ATLAS, the upgrades are for HL-LHC and our contributions to the Inner Tracker. Funds from NorLHC have been used to build up laboratory facilities to enable us to build around 200 novel silicon pixel modules and test them. Funds from NorLHC-II will be necessary to cover the period of module construction and commissioning both hardware and personnel. After 5 years of operation, a significant part of the NorLHC e-infrastructure will need replacing and an upgrade in order to manage the 3-5 times higher luminosity starting in 2027. The einfrastructure is distributed globally, with the Norwegian contribution located at the Universities of Bergen and Oslo.

Project number: 316582
Title: DataverseNO Plus
Applicant (partners): UiT (NTNU, UiB)
Project Manager: Philipp Conzett

Short summary:
This DataverseNO Plus proposal is about upgrading, expanding and integrating the DataverseNO repository and the OA publishing services at the partner institutions with the following main goals:

- Increasing the FAIRness of research data
- Making the FAIRification of research data more feasible and awarding for researchers, and more efficient for support staff
- Enhancing the transparency and reproducibility of published research results

To achieve these goals, the DataverseNO Plus project will develop enhanced methods, workflows, and tools to (1) improve the effective FAIRification of research data deposited into the DataverseNO repository; (2) integrate these research data management support resources with OA publishing services at DataverseNO partner institutions to establish trusted and awarding models for data verification and publication; and (3) improve the informed reuse of these data in research, teaching and training.

The outcomes of this project are expected to contribute considerably to propel the cultural changes in scientific communication that are required to make Open Science become the new default in the Norwegian research landscape.

Project number: 316587
Title: Norwegian Family Based Life Course Study - Competence Hub
Applicant (partners): UiO (FHI, NTNU)
Project Manager: Øyvind Erik Næss

Short summary:
The Norwegian Family Based Life Course study (NFLC) has been operating since 2003 and continuously expanding with several sub-studies. Each of the studies in the NFLC are using data platforms that are among the most comprehensive for population based medical and health research in Norway. The NFLC study has shown viability and long-term commitment. As of May 2020, 6 studies have been established. Until now all stages of legal applications, data-management and research design have been handled by a limited number of individuals in the project group. These have been mostly researchers with no formal training in operating such large-scale data sources. There appears to be a gap between expectations in the national and international research community of what large-scale Norwegian register data and or biobanks can deliver, and the number of researchers with in-depth competence in how to bring research ideas into reality. This problem is even more pronounced in areas involving complex family and longitudinal data, which include more than two data-sources.

The Norwegian research community has put health registers and biobanks among the pillars of future strategic research areas in life science. There is a need to professionalize the capacity among researchers and research support staff for the transition stage between scientific objectives on the one hand and data owners, data storage or legal framework on the one other. This is a key element for planning new innovative research projects and become involved in international collaborations and networks. The integration of comprehensive Norwegian register linkages with biobanks have the potential to provide high quality data and unique innovative research designs by world standards. If sufficiently funded, the NFLC infrastructure will provide a competence hub for Norwegian research environments with important deliverables: 1) speed up the process of moving from research ideas to complex data sets, 2) provide an environment of expertise on optimal and feasible data sources for specific research questions.

Project number: 316591

Title: eInfrastructure for digital, user centric and sustainable digital transformation in urban smart cities

Applicant (partners): IFE (UiO, Østfold University College, Østfoldforskning, OsloMet, Smart Innovation Norway, NILU, Halden kommune, Logiq, ITS Norway, Halden næringsutvikling)

Project Manager: Petter Kvalvik

Short summary:

Our future cities need not only to be smart but also sustainable. Infrastructure that allows to collect data, share, store and analyse data is fundamental to achieve a smart and sustainable city. For this to work, initiatives needs to be citizen centric and ensure trust as well as handling privacy, reliability, equity and security. At the same time, it should be smart in utilise big data to drive toward UN sustainability goals. Currently, we are far from this, much applied research and research-based innovation is needed.

Here, we need to go through a digital transformation to understand how to use digital technology to do more with less effort and get it done quicker, safer, and cheaper. This requires setting up city laboratories that involves all stakeholders: the public sector, academe, businesses and the research institutes. Infrastructure is fundamental to allow for applied research and research-based innovation on large scale architectures and ecosystems that holds extraordinarily amounts of diverse data. This path is well aligned with the Norway's digitalisation strategy for the public sector1 as well as EU's Digital Single Market strategy2 and Research and innovation for the European Green Deal3.

Halden Living Lab (HLL) is our joint large effort to a sustainable smart city. Living Labs are defined as usercentred, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings. HLL will connect with other national and European Living Labs e.g. European Network of Living Labs (ENoLL)4. HLL target the following characteristics and factors of a smart city: (1) people, (2) environment (3) economy, (4) mobility, (5) governance and (6) standard of living. Founding members are Institute for Energy Technology, Halden kommune, Østfold University College, Smart Innovation Norway, Østfoldforskning, eSmart systems, Halden næringsutvikling and Logiq. First new members that joined for this application are UiO, OsloMet, NILU, ITS Norway. More invitations are lined up before the full application is submitted.

The national eInfrastructure shall support multiple living labs, but will be shaped in the context of HLL, to acquire the necessary knowledge required to extend and integrate with other infrastructures and for managing the infrastructure and the data located in heterogeneous sources across the smart city.

Project number: 316593

Title: World of Wild Waters – Virtual lab «WoWW-lab»

Applicant (partners): NTNU (Telenor, Offshore Sim Center)

Project Manager: Oddbjørn Bruland

Short summary:

The digital and physical world are merging. Simulations and presentation of results are materialized in digital twins and through VR and AR tools. This increases the understanding of both problem and the consequence and the ability to communicate with problem owners and decision makers. This is a key objective in the WoWW project, one of nine of NTNU's strategic digital transformation projects. Through gamification of natural and man-made hazards, we facilitate the testing of solutions and

visualization of effects in a digital twin of the built environment. Sensor technology, IoT and AI open new opportunities for monitoring and operating community infrastructure. Visual solutions are required to make this information intuitively understandable. The virtual laboratory will be used for R&D on topics that provide a highly improved basis for planning and operating such infrastructure. It will lay important groundwork for the development of future infrastructure operating centres. NTNU has one of Europe's largest hydraulic laboratories. Physical modelling, digital simulations and digital 3D visualization opens up for cost-efficient opportunities to test a considerable broader range of scenarios than physical models alone offer. A virtual laboratory will help in dissemination of basic research results and documentation to clients and society in general. It will also provide new opportunities in the education sector and will contribute to accelerating the transformation towards and increased interactive and participation-based teaching. Digital twins contain information about the physical world and physical objects and through IOT and sensors connect to the real world in real time. This opens opportunities to test ideas and new development on real data in real time in a virtual, but real world. Additionally, this can be utilized in the development of prototypes for control centres for municipalities. Integration of simulation programs with digital twins facilitates new possibilities for optimizing physical infrastructure. This is highly relevant for instance for Hydropower plants, for testing consequences of changes in the design phase, as well as for contingency planning and exercise in the operational phase. Consultants and contractors have completely transformed their processes into Building Information Modelling (BIM) based on digital twins. To be in the position to lead in the development, through education and research, it is essential and urgent to build labs for visualization and use of digital twins. The combination of physical and virtual laboratory has a great potential for multi-disciplinary use and to be unique in an international context.

Project number: 316598
Title: Smart Buildings Energy and Indoor Air Quality e-infrastructure
Applicant (partners): STIFTELSEN SINTEF (SINTEF Digital, SINTEF Energi, NTNU Ingeniørvitenskap og NTNU Arkitektur og Design)
Project Manager: Karen Byskov Lindberg

Short summary:
SmartBuildingHub will contribute to merging the gap between R&D on energy-efficient & flexible buildings and R&D on Smart Grids. To achieve this, it is crucial to have well organized and interlinked databases consisting of detailed measurements (sub-metering beyond the main meter) with high time resolution (hourly data and even minute data in some cases) of electricity use, heat use, onsite energy generation, occupancy, and indoor climate parameters, as well as electric mobility. Currently, there is no infrastructure in Norway, giving access to researchers and solution developers for deep insight into the energy and indoor climate in buildings. Further, SmartBuildingHub will also contain hardware and software for stationary and portable equipment to conduct detailed sub-metering in selected pilot buildings, to enable detailed analyses of the indoor climate and energy use of buildings. In the e-infrastructure, the data will be organized per building category, e.g., small house, apartment block, office, school, hotel, and geographical location. The business model for SmartBuildingHub consists of two levels of access for external users: free access, with summarized and average annual values to give an overview of the key indicators, and paid access, containing high-resolution values, parameters distributions, and correlations between variables for detail analysis such as planning, sizing, etc. The e-infrastructure of SmartBuildingHub will be linked to the

national e-infrastructure of Sigma2/NORID. For the sensor data collection, SmartBuildingHub will acquire additional edge and sensororiented data storage and processing support.

Project number: 316605
Title: National Infrastructure for AI-Powered Autonomous Cyber-Physical Systems
Applicant (partners): UiA (Gullknap aerial center, MIL, Omron, ABB, NORCE, NTNU, UiT, SIMULAMet, Hydo Energy, RedRock)
Project Manager: Linga Reddy Cenkeramaddi

Short summary:
The primary objective of this Infrastructure proposal NI-AI-CPS is to build the National Infrastructure for Artificial Intelligence (AI) powered Autonomous Cyber-physical Systems (CPS). This infrastructure will enable both ongoing and beyond state-of-the-art research in the directions of inter-connected autonomous systems, mobile walking robots, socio-technical systems such as urban transportation, within the context of smart cities and autonomous precision agricultural systems. This infrastructure includes: large Unmanned Aerial Vehicles (UAVs) and Unmanned Ground Vehicles (UGVs) testbed at Gullknapp aerial Center in Arendal and University of Agder (UiA); 5G network testbed to support research in the communication technologies (mmWave communications with the provision to evolve beyond 5G); autonomous AI-powered collaborating vehicles including connected UAVs, UGVs, autonomous walking robots, communication modules enabling communication among different entities, namely, UAVs to UAVs, UAVs to UGVs and UGVs to UGVs communication modules; smart sensor modules; The research activities and associated use case application will be very diverse, including, among others, vehicle to everything (V2X), driver assisted vehicles mixed with autonomous vehicles (AVs), beyond visible line-of-sight (BVLOS) for Drones, Robot Shed for off-the-shelf robots as well as Makery-made robots, industrial Internet-of-Things (IoT), advanced embedded computing platforms for data processing and AI modules, smart energy systems and management for autonomous cyber-physical systems. The main objectives are:

- to build a connected autonomous vehicles research, development, industrial and educational platform for improved research in autonomous networked systems including UAVs, UGVs, autonomous mobile walking robots and context-aware sensor systems, autonomous agricultural systems, high speed communication systems for connected vehicles which will be highly relevant for Norwegian Industry.
- to build a scalable, reconfigurable, and adaptive IoT using edge computing based distributed infrastructure for reliable and secure transmission of information among autonomous connected vehicles.
- to build a decentralized local processing framework and a federated processing framework where the processing and intelligence is done both in cooperation between local processors and fusion centers.
- to enable the rapid development and testing of modular sensors in autonomous cyber physical infrastructure for autonomous systems. Reduce the timeline of product development and testing of modules for autonomous systems for both researchers and companies to test new modules quickly.
- to facilitate the secure control of complex cyber-physical infrastructure online, facilitate data storage, access for future projects and research in cyber-physical systems with embedded AI modules.

Project number: 316606
Title: Norwegian Travel Industry Monitor: Digital lab for big data analysis of economic development of businesses and destinations
Applicant (partners): USN (Telemark Research Institute Norwegian Tourism Partners)
Project Manager: Kåre Sandvik

Short summary:
The four-year project initiative aims to develop a big data platform that can integrate relevant travel industry data to accomplish the untapped potential for frontier research of factors that affect

sustainable growth and profitability of businesses and destinations in the travel industry. A robust data platform will provide vastly improved "evidence-based" decision support to industry managers and policymakers.

Travel industry data are fragmented and located at public institutions (e.g., SSB, Avinor, UNWTO), commercial actors (e.g., Google, Telenor), and the travel industry businesses themselves (e.g., hotel chains, resorts, airlines, ferry companies, etc.). Sharing data is vital to get a fuller picture of the industry's dynamics and economic ecosystem, and deals with challenges of a technical platform and implementing contracts with data providers that manage risk and mutual benefits. There are several initiatives in other countries that integrate available travel industry-related data for advanced research and better decision making. To stay globally competitive, Norway needs to invest in a new and future-oriented data infrastructure for travel research.

The project consists of the development of a data model framework and roadmap for acquiring and integrating prioritized travel industry data from multiple sources. Accordingly, an agile technology platform will be designed and implemented to store, integrate, and access data for advanced research. The use of data for research will be in place in year 1. Testing functionality and security will be done while incrementally adding more data sources, analytics functionality, and user-friendly access.

Project number: 316608
Title: Norwegian Biobank for Nature (NORBINA)
Applicant (partners): UiO (UiB, NTNU, UiT, NMBU, UiA, NIVA, NIBIO, NVI)
Project Manager: Arild Johnsen

Short summary:
The use of genetic resources is ubiquitous in biological research today, and there is an urgent need to implement the FAIR principles (findable, accessible, interoperable, reusable) to the archiving of biological material used in both Norwegian and international research. So far, the FAIR principles have been adopted to facilitate open access to research results, raw data, metadata, analysis code, software, and scientific publications through various research infrastructures and data repositories. In contrast, the archiving of the physical samples, such as tissues, DNA extracts, whole specimens and environmental samples, have not been structured in the same way. Here, we propose a national infrastructure for archiving non-human biological samples in a distributed biobank, making cryopreserved samples and associated data available for biological research institutions that use biological samples in genetic, genomic and other molecular research, also embracing the One Health perspective and the UN sustainable development goals. The infrastructure will have nodes at each of the four largest university museums (Oslo, Bergen, Trondheim, Tromsø), and each node will serve biology/biodiversity institutions in its region. There will also be affiliated biobank facilities at institutions outside of the university museums. In order to establish the biobank module nationally, there is a need for investing in storage facilities (-80°C freezers and containers with liquid nitrogen), DNA extraction robots, development of a database infrastructure, and personnel. The new infrastructure will complement several existing and planned infrastructures for Norwegian bioresources, DNA sequencing and bioinformatics, and improve their impacts and synergies through a collaborative and interactive network.

Project number: 316613
Title: Robust and fault-tolerant network infrastructure with 5G access (ROBUST5G)
Applicant (partners): SIMULA AS (NTNU, UNINETT, Norwegian Metrology Service)
Project Manager: Haakon Bryhni

Short summary:

As our society becomes increasingly dependent on wireless communication, the need for improving robustness is increasing rapidly. This trend is accelerating with the upcoming adaptation of 5G networks which will become the digital backbone of our mobile, connected society. Current wireless and wired telecom infrastructures are not sufficiently robust compared to the extreme dependency we have to a healthy telecom infrastructure. Operators are under strong pressure to operate their networks at a lowest possible cost and both regulation and automation is needed to improve reliability. Furthermore, new user groups are encouraged to share a common infrastructure to save cost and leverage state of the art technologies. This trend increases the requirements of robustness of the underlying architecture since our society relies not only on critical consumer services like communication services, banking, shopping and logistics, but also applications traditionally served by dedicated networks such as military, emergency (e.g. TETRA) and railroad signalling networks (e.g. GSM-R) which all evaluate 5G as a key part of their network infrastructure in the future. 5G represents very demanding requirements for the cellular operators and the network infrastructure vendors which need new standards and new technologies both at the infrastructure and network management level.

The complexity of configuration and adjustment of telecommunication networks to respond to rapid changes in demand has recently led to the vision of Self-driving networks [1] which measure, analyze and control themselves in an automated manner. Self-driving networks can react to changes in the environment (e.g., demand), while exploiting existing flexibilities to optimize themselves. Furthermore, the advent of large-scale machine learning can also benefit self-driving networks and over time develop to faster reconfiguration and more reliable operation compared to manual configuration by human operators. This method is of particular interest in 5G to ensure rapid reconfiguration in case of failure which requires automated response to demand, changes in geographic load in the network, change in network capacity and loss of connectivity with minimal impact for critical applications.

The infrastructure will be distributed with 5G access nodes in Oslo and Trondheim, interconnected by fast optical links with automatic reconfiguration and edge computing resources. The infrastructure will build on top of the existing 5G infrastructure at SimulaMet, the eX3 supercomputer at Simula and laboratory and network infrastructure available at UNINETT and NTNU.