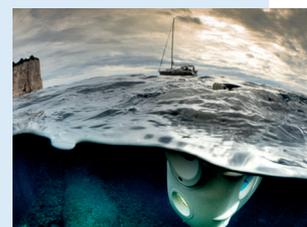
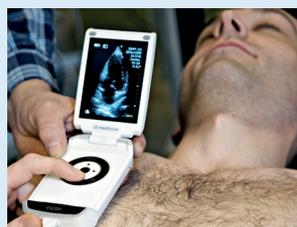


Norwegian stakeholder input on ***Orientations towards the first Strategic Plan for Horizon Europe***



Introduction

On 8 - 9 October 2019, the Norwegian University of Science and Technology (NTNU) and SINTEF, Scandinavia's largest independent research institute, gathered more than 100 top-level representatives from Norwegian private and public sector in Brussels, including CEOs, presidents and vice presidents, to discuss Norwegian contributions to and participation in European research and innovation. Representatives from the European Commission kindly accepted our invitation to join. We were very fortunate to have participants from DG CNECT, DG ENER, DG MARE, DG MOVE, DG RTD, the European Political Strategy Centre and the European Defence Agency, including a Director General, Directors, Heads of Units and Policy Advisors.

We would like to cordially thank the European Commission representatives for spending time with the Norwegian stakeholders, for giving us important insights and information about European research and innovation policies, priorities and programmes.

For two days we discussed Orientations towards the first Strategic Plan for Horizon Europe . The debates were centred on Digitalization, Energy, Health, Mobility and Oceans.

This document presents the conclusions from two intense days of discussions on the challenges facing Europe, key R&I orientations, as well as industrial opportunities and opportunities for society in general in the key areas above.

While the document represents the input developed over two days by the combined set of Norwegian stakeholders, it is ultimately the sole responsibility of NTNU and SINTEF.

We hope that the input will be well received and perceived as useful in the final preparations of the first Strategy Plan for Horizon Europe, and eventually the development of the Horizon Europe Work Programmes.



Anne Borg
Acting Rector NTNU



Alexandra Bech Gjør
CEO SINTEF

Digitalization

Challenges — Digitalization

Digital technologies are the backbone of future competitiveness and better societies. Public and private investment in R&D in digital technologies must be strengthened.

The need for Research and Innovation on Digitalization: Key R&I Topics

The key digital technologies **Artificial Intelligence, Big Data, Internet of Things, Cyber Security and Autonomous Systems** should be prioritized to support digitalization.

In particular, a collective and decisive EU Research and innovation agenda for **Industrial AI** will be instrumental in bringing its benefits to all citizens and businesses. The potential of AI in the public and health sectors needs special attention.

Moreover, advances and capabilities in explainable and trustworthy AI and robotics are crucial.

Research that strengthens our ability to extract the value of data and **share data** in different ecosystems is crucial. Open science and data are important for the advancement of science but are also vital for enterprises. Issues related to **privacy** need to be addressed so we can make use of new and existing data collections, particularly related to health. Devising instruments for data sharing and use that address these issues are vital for European competitiveness. The Next Generation Internet (NGI) initiative, which has as its goal to develop the key technologies, building blocks and infrastructures for the internet of tomorrow must also include future mobile communication systems, i.e. beyond 5G/6G; IoT and sensor networks; and the interplay between these technologies. Incorporating these mobile systems will allow important tasks such as environmental surveillance, especially in the Arctic, as well as monitoring for road safety and maintenance and marine aquaculture, to name just a few.

Digitalization entails a critical dependency on the digital systems. Digitalization and **Cyber Security** are two sides of the same coin. The race to detect and deflect malevolent attacks and safeguard against accidents and natural disasters is ever ongoing and requires significant investment in research, knowledge building and educational capacity.

We need to understand the **effects of these technologies on citizens and on society** at large. In this context, social sciences have an important role to play. Moreover, successful implementation of digital technologies in the public sector and industry will require research in areas related to people, organizations, processes and technology.

Industrial and Societal Opportunities

Key Digital Technologies including efficient electronic components and computer architectures are necessary for development and the environment, and essential to address the UN's SDGs.

Horizon Europe should facilitate projects that **combine leading digital technology and industrial domain competency** to develop innovative and disruptive solutions. Indeed, interplay between the application areas and core digital technology is key.

In order to secure European independence of international supply, research in advanced electronics components and architectures must be supplemented by a focus on high-capacity, high-yield production of state-of-the-art components.

Contact:

Dr. Morten Dalsmo, Executive Vice President, SINTEF Digital, morten.dalsmo@sintef.no
Professor Bjarne Foss, Pro-Rector for Research, NTNU, bjarne.foss@ntnu.no
Professor Torbjørn Svendsen, Director NTNU Digital, torbjorn.svendsen@ntnu.no

Energy

Challenges— Energy

The energy system needs to be decarbonized by 2050. This pertains to the entire energy mix. Remaining emissions will have to be offset by technologies capable of removing carbon emissions. These technologies will also be critical for removing emissions from energy-related sectors such as agriculture, process emissions, as well as non-CO₂ greenhouse gases.

A just and fair transition must be made on nature's terms. Preserving biodiversity and ensuring sustainable ecosystems must be duly considered and respected in policies and technology developments.

Unprecedented scale-up in research, innovation and deployment is needed to reach net zero emission goal for 2050. It will be key to deploy all sustainable solutions by developing new technologies, as well as refining and optimizing current technologies and to follow up this deployment with continued improvement activities. Resource efficiency, secure supplies and production must provide the basis for a thriving European sustainable industry and economy.

The need for Research and Innovation on Energy: Key R&I Topics

Environmental design for all renewable generation solutions. The negative impacts of the energy transition must be minimized. We must also optimize overall European energy efficiency, energy storage possibilities and energy stability regulations across borders. Cross-border energy life cycle environmental costs must also be minimized. Additionally we must study the cross-border use of energy systems as the European hydropower sector.

Market and system design, representing the real physical system, will make the integrated energy system fit a new reality of flexibility, on demand and production services.

Enable the hydrogen economy with clean energy from electrolysis and from natural gas with CCS. Develop the cross-enabling nature of hydrogen and electricity use, in industry, power, heating, transport and other hard-to-abate sectors and energy storage. Clean hydrogen is a fuel that can also be transformed into ammonia, which is a commonly transported chemical that in many cases may be easier to transport than hydrogen.

Strengthen R&I actions towards real storage projects for CO₂. The ability to store CO₂ will be crucial for securing a climate -neutral continent by 2050. Storage capacity will enable strong sector coupling: hydrogen from natural gas with CO₂ separation, decarbonization of energy intensive industry (cement and steel), power generation with near-zero emissions and climate-positive solutions that allow for removing CO₂ from the atmosphere.

Start investing in R&I for climate-positive solutions (CPS). Europe is missing an R&I agenda for these solutions, which remain largely unknown, under-researched and at present suffer from a lack of adequate resources. The ultimate risk here is that we fail to reach the Paris agreement goals. How can we expand resources, develop innovative new solutions and scale them up for the market? One opportunity is to use the ocean for production of biofuels and carbon uptake.

Industrial and Societal Opportunities

Energy and climate are key elements in the European Green Deal. **This development will allow Europe to spearhead innovative new sustainable solutions and underpin green industrial development and growth**
A just transition is key — thus any **European-scale**



solutions must be acceptable — in terms of new solutions, efficient use of resources, land use and large-scale deployment. The role of policies and regulations must follow hand-in-hand with technological developments as well as societal and end-user acceptance. For example, to be able to trial innovative approaches in cities, we need to create regulatory sandboxes to promote piloting of energy innovations. This is to make sure that regulations fit future cities.

Look at scale — for example, how can we make floating wind power a European success story?

We need to invest in R&I for structural funds and the innovation fund to complement MS/AC efforts in this field. **Following up on the SET-Plan implementation groups will be crucial.**

Contact:

Professor Johan Einar Hustad, Director NTNU Energy, johan.e.hustad@ntnu.no

Dr. Inge R. Gran, CEO, SINTEF Energy Research, inge.r.gran@sintef.no

Dr. Nils Røkke, Executive Vice President Sustainability, SINTEF, nils.a.rokke@sintef.no



Health

Challenges — Health

In general, health and care services in Europe today are considered good to excellent. However, citizens' expectations and needs are increasing. In addition, there will be a higher number of older people living with multiple chronic diseases. Without structural change and a more cost-efficient approach, the current European health systems are likely to deteriorate or collapse as a result of a tremendous increase in patient load. Adding to the severity of the situation, innovation in health care is slow and novel diagnostics and treatments usually take too long to be implemented broadly to benefit the population as a whole. The reasons for this are many, including cultural differences, lack of cross sectorial collaboration, ineffective funding systems and regulatory hurdles.

The need for Research and Innovation in Health: Key R&I Topics

To reduce the overwhelming burden on the health care system, we must do more to prevent disease, reduce the number of patients treated ineffectively or unnecessary, and **empower** patients to prevent and manage life with **chronic disease**. To avoid failure of the health system, we must develop and implement better diagnostics and more **personalized** treatment options. To succeed with research, innovation and development of a **health industry** that can support such transformation, **access to individual and population data**, combined from relevant public and private sources, is needed. Methods and regulations for safe data management and handling individual privacy are crucial and **time-critical** requirements. Implementation of successful solutions from studies in “**living labs**” (defined by regions

or even countries) on a larger scale may be a feasible approach. Such “**living labs**” should focus on **chronic diseases** such as **dementia and psychiatric disorders**, and aim at prevention, early detection, efficient and **fair distribution** of health care, and **empowerment** of the population at all levels.

Industrial and Societal Opportunities

If successful, our proposed actions will contribute to a Europe that has access to high quality health-related data on its population. The data will be **possible to share** between countries and information from different sources can easily be combined for analysis to monitor health both at an individual and population level to improve health care. Data will be available for research and innovation, and if combined with community data, support cross-disciplinary collaboration for health interventions. Regulatory and law changes will ensure that data are available in a form that can be used for research, innovation and business development, resulting in **value creation that in the end is returned to the provider of the data**. Active involvement of industry, especially SMEs, in **public – private partnerships** and living laboratories will secure scale up of successful results at a European level.

Contact:

Professor Bjørn Gustafsson, Dean, Faculty of Medicine and Health Sciences, NTNU, bjorn.gustafsson@ntnu.no
Dr. Jon Harald Kaspersen, Research Director, SINTEF Digital, Health Research, jon.h.kaspersen@sintef.no
Dr. Magnus Steigedal, Director NTNU Health, magnus.steigedal@ntnu.no

Mobility

Challenges in the area of Mobility

Mobility is the bloodstream of our society. Moving people and goods on land, at sea and in the air keeps our world ticking, serves well-being and economic efficiency and is an important industry in itself. Despite its importance, Europe is missing an overall vision for its mobility industry. The automobile industry is slowly responding to demands for no emissions, but a clear view on where we see opportunities to take the lead in the whole sector is lacking. Based on what we view as the main challenges, we see opportunities that define R&I challenges and open industrial opportunities, and that can make a real impact.

Zero-emission mobility: Currently, there is a lack of methods to identify climate impacts from the entire transport system and no solution for energy supply and infrastructure for heavy vehicles and longer transport.

Integration: The system suffers from a fragmented transport sector, without multimodality. Systems are not integrated and there is no, sharing or use of available data for organizational cooperation. Nor is mobility included in the planning phase of city development, and user perspectives are seldom included.

Partnerships and knowledge sharing: Some aspects of transport research in the EU are constrained to certain research groups, despite the overall goals of open research.

The need for Research and Innovation on Mobility: Key R&I Topic

Cross-disciplinary research is a prerequisite to achieve transport and mobility objectives, including technology, societal economy, psychology, innovation and industrialization, and organizational

structures, among others.

Cooperative, connected and automated transport: Data analytics and data sharing will allow safer and more efficient mobility, effective terminals and ports, cooperation and communication between vehicles/infrastructure, holistic transport systems optimized on a set of KPIs, control functions in automated transport, and standardization for optimized and effective mobility.

Zero-emission mobility: Particularly for heavy transport vehicles, longer transport and the infrastructure development (ship, rail, trucks, construction, aviation), energy efficiency is needed. Optimization opportunities include implementing autonomy, automation and digitalization (data), door-to-door transport concepts, and optimized use of available transport capacity. We need to implement a circular economy, including methods for calculating the total emissions from transport and the indirect emissions from production of materials for building transport infrastructure.

Mobility for the good life: Mobility should be seen as part of the development of smart cities, including planning mobility that supports the good life for citizens and industry, recognizes user perspectives, with an understanding of the behaviour and needs of transport users.

Maintenance and climate adaption: We need to develop smart uses of existing infrastructure, predictive maintenance, new materials in a circular economy perspective.



Industrial and Societal Opportunities

- Low-emission technologies and services for and by transport
- Safer and more efficient transport services supporting citizens needs
- More liveable cities
- Increased innovation and industrialization to build a global competitive transport industry

Contact:

Professor Olav Bolland, Dean, Faculty of Engineering Science, NTNU, olav.bolland@ntnu.no

Dr. Beate Kvamstad-Lervold, Special Advisor, SINTEF Ocean, Energy and Transport, beate.kvamstad-lervold@sintef.no

Dr. Petter Støa, Vice President Research, SINTEF Energy Research, petter.stoa@sintef.no

Oceans

Challenges — Oceans

Research and innovation are strong contributors to build knowledge and establish measures to secure **ocean health and to unlock the ocean's potential in climate change mitigation through new technologies and the development of circular blue economies**. A scientific approach and methodology need to be adopted when taking and revising decisions. The identification of critical aspects and the acquisition of essential data are crucial to disentangle perceptions from accurate predictions and propose appropriate solutions to challenges faced by our oceans.

The European objectives to develop a sustainable blue economy should be the lighthouse when integrating the contributions from research, industry, public authorities and citizens.

Sustainable and innovative use of the oceans is critical to more sustainable energy production (including Climate Positive Solutions, CPS) and food production. Research in low-carbon maritime transport to achieve safe zero emission mobility is a key element not only for ocean health, but for the health of the entire planet.

The need for Research and Innovation on Oceans, key R&I Activities:

Focus on **sustainable fisheries, aquaculture technologies and the development of harvesting and production of low trophic species** to increase the percentage of food from the oceans and explore the potential of the oceans in their role as a food provider.

Focus on the development of **zero- and low-emission maritime transport** as an integrated part of mobility and urbanization through development of new vessels and fuel concepts.

Focus on the development of **life-cycle assessment methods** adapted for ocean industries.

Focus on new ways for **large-scale biomonitoring, data harvesting and development of analytical technologies and pipelines** to establish knowledge and to understand the oceans' complex natural systems and their response to anthropological pressures. Modern methodologies using molecular tools should be further developed to cope with large-scale situations, multi-disciplinary cooperation and standardized platforms for data exchange and sharing, i.e. refinement of DNA-barcoding and metabarcoding.

Focus on **scientific research on ocean governance** to establish new and effective governance models as a cooperative effort across countries, including models for co-existence and co-use of ocean space, such as in the recognition that pollution impacts are not restricted to ocean properties nor by political barriers. Research will include **new socio-economical models** to understand societal needs and acceptance as well as consumer behaviour. Research & innovation can improve growth without over-exploitation.

Industrial and Societal Opportunities

A focus on the ocean's potential to **strengthen industrial development** through emerging technologies will also advance the understanding of the **ocean's important role in climate mitigation and its use**.

The oceans are not only a resource to harvest and nurture, or an ecosystem to be studied and protected; they are also a cultural construction. Many Europeans have long built their national identities around their links to the sea and bodies of water, a fact that researchers and businesses need to consider. Solutions to the food paradox



and climate change challenges should be explored by **sustainable & effective use of the oceans** for energy, food, feed, and mineral production. This will relieve the strain on land-based activities as well as allow the development of safe and reliable green transport for healthier and sustainable societies.

Enhanced public involvement: use research to enable the promotion of social acceptance towards a zero-emission society and disseminating the importance of healthy oceans for a healthy globe, as well as promoting necessary change in consumer patterns.

Contact:

Professor Ingrid Schjølberg, Dean, Faculty of Information Technology and Electrical Engineering, Director NTNU Oceans, ingrid.schjolberg@ntnu.no
Dr. Vegar Johansen, CEO SINTEF Ocean, Vegar.Johansen@sintef.no

Dr. Bård Wathne Tveiten, Research Director, SINTEF Ocean, BardWathne.Tveiten@sintef.no
Ms. Maria Azucena Gutierrez Gonzalez, Coordinator NTNU Oceans, mariaazucena.gutierrez@ntnu.no

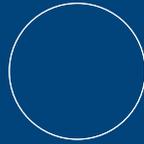
Participants

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Abelia
Aker BioMarine
Aker Solutions
Arbaflame
Norwegian Labour and Welfare Administration
BEUC
Boost.ai
DG CNECT, European Commission
DG ENER, European Commission
DG MARE, European Commission
DG MOVE, European Commission
DG RTD, European Commission
DigitalNorway
DNV GL
EERA – European Energy Research Alliance
Energy Norge
EPSC, European Political Strategy Centre, European Commission
Equinor
European Defence Agency
europeiskpolitikk.no
EVRY NORGE AS
Financial Mechanism Office
Fiskerstrand Holding AS
Norwegian Institute of Public Health
Norwegian Defence Research Establishment (FFI)
Gassnova SF
GIEK (Garantiinstituttet for eksportkreditt)
GlucoSet AS
Grieg Star AS
Hafslund E-CO
Central Norway Regional Health Authority
Hydro
ICT-Norway
Innovation Norway
Norwegian Railway Directorate
JPI Oceans
Kantega AS
Khrono
Kongsberg Defence & Aerospace

Kongsberg Maritime AS
Kongsberg Seatex AS
Norwegian Coastal Administration
Norwegian Food Safety Authority
Mentis Cura AS
Norwegian Ministry of Education and Research
Norwegian Ministry of Foreign Affairs
Norwegian Ministry of Health and Care Services
Mission of Norway to the EU
NHO Brussel
NORCE Norwegian Research Centre AS
Norwegian Research Council
Norwegian Industry
Norsk Tipping
Norway Health Tech
Novartis Norway
Nord-Trøndelag Elektrisitetsverk
Norwegian University of Science and Technology
NTNU
The Norwegian Water Resources and Energy Directorate
Ocean Data Platform Foundation
Norwegian Ministry of Petroleum and Energy
Petoro AS
Petroleum Safety Authorities Norway
Rainpower
The Research Council of Norway
Science Business
SINTEF
Siva SF
St Olavs Hospital
Norwegian Medicines Agency
Norwegian Public Roads Administration
Statkraft
Statnett SF
The Storting
Norwegian Hospital Construction Agency
Telenor Research
Trondheim Municipality
Trøndelag County
Mid-Norway European Office
University of Bergen
University newspaper (Universitetsavisa)
Visolit Norway AS
Yara
ÅKP AS

 NTNU



 SINTEF